The Contribution of Early Education to Vulnerable and Resilient Developmental Pathways

Thesis submitted for the degree of

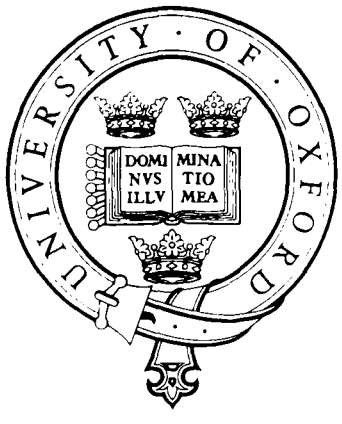
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To my loved ones and friends: My greatest of thanks

ABSTRACT

This study investigates the relationship between early education and cognitive and social development in young British children between the ages of 3-7 years. It is hypothesised that pre-school education might facilitate *resilience* in children's *developmental pathways* that have proved *vulnerable* due to the significant impact of risks. This study aimed to provide a systematic examination of the relationship between cognitive and social development, child or family specific developmental risks, and the structures and processes of early education.

Adopting the methodology of *secondary analysis*, this study re-examined the data of the Effective Provision of Pre-school Education (EPPE) project that followed the developmental progress of nearly 3,000 British young children as they experienced different kinds of early education from 1997 to 2001 and later primary school. Three sets of longitudinal statistical analyses were carried out. First, a new method was developed for measuring the relative weight of different kinds of risks as they predict development. Second, the impact of different kinds of risks upon development during the pre-school period (ages 3-5) was examined to see whether it was lessened by high quality early education. Third, the developmental skills and abilities of children at exit from early education were studied in terms of their prediction of developmental pathways during the first two years of school (ages 5-7).

Results from these three sets of analyses suggested the following: (1) validity of the new method of measuring developmental risks, (2) strong evidence of partial protection of young children's general cognitive ability when examining child level developmental risks and the quality of the processes that take place in programmes of early education, (3) that high quality early education can contribute to resilient developmental pathways during the first two years of school by boosting the vital cognitive and social skills of children at entrance to primary school.

In policy terms, high quality early education programmes have the *potential* to serve as interventions within normal populations. Further, high quality early education programmes also have the *potential* to act as a type of primary prevention in a manner similar to targeted Early Interventions for children already at risk.

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Respice et Prospice

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List of Abbreviations

AIC	Akaike Information Criterion
ANOVA	ANalysis Of VAriance
ASBI	Adaptive Social Behaviour Inventory
BAS	British Ability Scales
BERA	British Educational Research Association
BPS	British Psychological Society
CACE	Central Advisory Council for Education
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CIS	Caregiver Interaction Scale
CSBQ	Child Social Behaviour Questionnaire
CSE	Certificate of Secondary Education
DAS	Developmental Ability Scales
DCSF	Department for Children, Schools, and Families
DfEE	Department for Education and Employment
DfES	Department for Education and Skills
EAL	English an Additional Language
ECEC	Early Childhood Education and Care
ECERS-E	Early Childhood Environmental Rating Scale Extension
ECERS-R	Early Childhood Environmental Rating Scale Revised
ECMERC	Early Childhood Measurement and Evaluation Resource Centre
EFA	Exploratory Factor Analysis
EI	Early Intervention
EM	Expectation Maximisation algorithm
EPA	Educational Priority Area
EPPE	the Effective Provision of Pre-school Education project
EPPSE	the Effective Pre-school, Primary. and Secondary Education project
EYFS	Early Years Foundation Stage
EYTSEN	the Early Years Transition & Special Education Needs project
FIML	Full Information Maximum Likelihood mathematical algorithm
FCCC	the Families, Children, and Child Care project
GCA	General Cognitive Ability
GCSE	General Certificate of Secondary Education

GLM	General Linear Model
GNVQ	General National Vocational Qualification
GxE	Gene *x* Environment interaction
HLE	Home Learning Environment
HLM	Hierarchical Linear Modelling
HNC	Higher National Certificate
HND	Higher National Diploma
IHDP	Infant Health and Development Programme
IMD	Index of Multiple Disadvantage
IQ	Intelligence Quotient
LEA	Local Education Authority
MAR	Missing At Random
MCAR	Missing Completely At Random
MCS	Millennium Cohort Study
MI	Multiple Imputation
MNAR	Missing Not At Random
NFER	National Foundation for Educational Research
NICHD SECC	National Institute for Child Health and Development Study of Early Child Care
NVQ	National Vocational Qualification
QCA	Qualifications and Curriculum Authority
RMSEA	Root Mean Square Error of Approximation
SDQ	Strengths and Difficulties Questionnaire
SEM	Structural Equation Modelling
SEN	Special Educational Needs
SES	Socio-Economic Status
SPSS	Statistical Package for the Social Sciences
TLI	Tucker-Lewis Index
UNESCO	the United Nations Educational, Scientific, and Cultural Organization
WISC	Wechsler Intelligence Scales for Children

INTRODUCTION

Although the new millennium has seen a dramatic increase in the UK provision of early education (Lewis, 2003), our understanding of the range and means of the impacts that can be expected from this complex and rapidly evolving system of programmes and settings remains unclear. Furthermore, the new millennium has also seen the rapid growth of research concerned with children's development and specifically, the resilience of children's development to the impacts of risks (e.g. Masten, 2007). This coaccurance of the growth of the provision of early education together with the expansion of research on resilient development has led to several commentaries calling for studies that are grounded in their unification (e.g. Peisner-Feinberg, 2004; Borge, Rutter, Cote, and Tremblay, 2004). For example, Luthar (2006) called for researchers to examine whether processes within pre-school can foster resilience in development and Schoon (2006) commented that research on resilient development in early childhood was still relatively rare. This thesis seeks to address these issues with a called for (Luthar, 2006) *"systematic exploration"* into whether early education can protect the development of children from the impacts of developmental risks and thereby contribute to vulnerable and resilient developmental pathways.

This introductory chapter outlines the rationale behind the present investigation, describes the investigation itself and the structure of the thesis, presents the research questions, summarises the thesis chapters, and then ends with bullet points summarising the key findings.

Research rationale

If programmes of early education and care (typically *'pre-school'* for those aged 3+; Melhuish, 2004) can mitigate the impacts of developmental risks in young children's lives, then these programmes could be considered a type of early prevention of the detrimental developmental outcomes common to children who experience high levels of risk (Masten & Gewirtz, 2006). Further, although the protective impact of targeted Early Interventions have been well demonstrated (e.g. Ypsilanti/High Scope/Perry Pre-school Study, see Melhuish, 2004; the Abecedarian Project, see Rutter and Rutter, 1993), equivalent evidence is much weaker for universal programmes of pre-school (NICHD, 2000a). This disparity in findings indicates an important gap in research because it is much more usual

for young children to experience a programme of universal pre-school rather than a targetted Early Intervention (Peisner-Feinberg, 2004).

Further to the impacts of risks to development, there is also specificity in these impacts according to their ecological level relative to development (drawing upon research such as Bronfenbrenner, 1979). For example, Conger and colleagues (1992) identified that family processes can have an intermediatory role in the impact of Socio-Economic Status (SES) on the social development of adolescents (see also Conger, Ge, Elder, Lorenz, & Simons, 1994; Linver, Brookes-Gunn, & Kohen, 2002). The impact of the more distal (relative to the child) SES could be partly explained by the more proximal functioning of their family. This intermediatory effect is referred to as a hypothesis of *mediation*[1] and can also be found in other studies examining distal and proximal risks impacting development. For example, Scaramella, Conger, Simons and Whitbeck (1998) studied parenting (distal), child friendships and academic attainment (proximal) as all impact the likelihood of adolescent pregnancy.

The relationship between salient developmental factors has also been informed by the multivariate hypothesis of *moderation.* Moderation is differentiated from mediation in that moderation proposes that the developmental impact of a risk may itself be dependent upon a third factor or process. The hypotheses of moderation and mediation can also be specified simultaneously. For example, Ackerman, Kogos, Youngstrom, Schoff, and Izard (1999) suggested a mediation model of distal SES impacting social development via intermediate impacts to the more proximal parenting. At the same time however, Ackerman and colleagues also examined whether additional child level factors could also lessen (moderate) the mediating impact of parenting. As a result, the study by Ackerman thereby demonstrates the use of a hypothesis of *moderated-mediation* (see Chapter 2, Section 2.4.1) that can also be found in Ackerman, Izard, Schoff, Youngstrom, and Kogos (1999).

The specification of developmental risks has also been explored through a third technique, the construction *cumulative risk indices* to represent the interplay of risks at the same ecological level (e.g. Ackermanm, Schoff, Levison, Youngstrom, & Izard, 1999). Further, the use of cumulative risk indices is quite different to the uses of *mediation* and

[1] See Chapter 2, Section 2.4.1 for more on mediation and moderation.

moderation. Originally developed for use in epidemiological studies (e.g. Lloyd-Jones *et al*., 2004), the use of cumulative indices has since spread to sociological studies (e.g. Elder, 1998) and studies of child development (e.g. Rutter, 1979). Of relevance to this investigation, a cumulative risk index has also been considered by the NICHD (200a) to investigate whether high quality programmes of early education can mitigate the impacts of developmental risk. However, the NICHD eventually decided not to use a cumulative risk index and this a decision that is indicative of recent criticisms made of these measures (e.g. Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001; Burchinal , Roberts, Hooper, & Ziesel, 2000). As a result of these concerns, it is vital for researchers to develop alternative procedures to the measurement of cumulative indices as a necessary means to establish the association between risks occurring at the same ecological level [2].

Referring back to the central focus of this investigation (developmental resilience), the question as to whether pre-school can protect children's development from the impacts of risks continues to be investigated. Moreover, this is despite the previous attempts having been made to draw together research from the fields of developmental psychopathology and early education. For example and considering three instances of recent developmental psychopathological research in particular, Borge, Rutter, Cote and Tremblay (2004) argued that, *"Perhaps, it* [universal pre-school] *could compensate to a degree for marked family adversity"*. Going into greater depth, Luthar (2006) went on to identify that researchers need to go beyond measuring the 'quality' of the *structures* within pre-schools (e.g. carer-to-child ratio, staff qualifications) to consider instead the 'quality' of the *processes* (e.g. staff-child relationships) which are taking place. Also in 2006, Schoon made a broader comment based upon previous research focusing on this age range, *"Most research on resilience has focused on middle childhood and adolescence, while early childhood is a less researched period*".

At roughly the same time as the commentaries by Rutter, Luthar, and Schoon were being made from the perspective of developmental psychopathology concerning whether early education can protect development, similar commentaries were also being made by those strongly concerned with the education of pre-schoolers. For instance, Melhuish (2004) reviewed the developmental impacts of early education and care and was explicit in

[2] The development of such an alternative procedure was subsequently carried out by this investigation (see Chapter Four) in addition to postulating theories of both *mediation* and *moderation*.

articulating the question (although not answering it) that is the focus of this thesis, *"In what ways might early years provision be used for early intervention with children at high risk for developing special needs both intellectual and behavioural?"* Furthermore, Peisner-Feinberg (2004) drew attention to the limited number of previous studies that have examined the impacts of universal early education to development when compared to those that have studied targetted Early Interventions.

Providing an overview of research on whether pre-school can protect development, Peisner-Feinberg (2004) critiqued several previous attempts including that of Burchinal, Peisner-Feinberg, Bryant and Clifford (2000); Hagekull and Bohlin (1995); NICHD (2000a); Peisner-Feinberg and Burchinal (1997); and Peisner-Feinberg and colleagues (2001). Peisner-Feinberg argued that these previous studies had found inconsistent benefits of attending pre-school for the development of high-risk children. Moreover, some previous studies had even concluded that for high quality pre-school, *there had been a complete lack of any identified protective effect.*

Two of the studies that have investigated whether pre-school can protect development have recently made claims as to the novelty of their design (Burchinal, Peisner-Feinberg, Bryant and Clifford, 2000; NICHD 2000a). The study by Burchinal examined the social and cognitive development of over 1000 young children and investigated the impacts of *'background risks'* and the quality of pre-school. Burchinal and colleagues argued that this was first study to have sampled enough children whose development was at-risk to effectively test a risk-moderating hypothesis. However, the authors identified only a single instance of protected development with a single measure of quality that focussed on both the structures and processes in pre-schools (The Early Childhood Environment Rating Scale, ECERS; Harms, Clifford and Cryer, 1998). The language development of young children from ethnic minority backgrounds was partial protected when these children had attended pre-schools of high overall quality. Suggesting reasons for this limited evidence of protection, Burchinal and colleagues proposed that their study had lacked sufficiently detailed information about the families and the quality of the pre-school that each young child had attended.

Perhaps the most important investigation into whether high quality pre-school can protect the development of young children from the effects of risks was that conducted by the

National Institute of Child Health and Human Development (NICHD; 2000a). Not only was the paucity of previous research mentioned as a driving factor behind the study, but so too were the limited nature of the risks that had been previously studied[3]. Despite investigating a smaller sample of young children (943) than the study by Burchinal and colleagues (2000), the NICHD sought to address gaps in the research literature. In particular these gaps were addressed through the investigation of three types of *'Family risk factors'* (psychosocial, socioeconomic, and sociocultural) and by measuring the quality of the *processes* that took place within the studied pre-schools (using the Observational Record of the Caregiving Environment, ORCE; NICHD, 1996). However, like the Burchinal (2000) study, the NICHD found only limited evidence of protection. This was a finding that they referred to as, *"contrary to expectations"* and which was partly attributed to a lack of severe risks in their sample and few pre-schools of high quality.

In summary, despite continuing advancements from research in developmental psychopathology or early years education, there have been few studies bridging these two fields. Furthermore, the attempts that *have* so far been made have been frustratingly lacking in the conclusions that have been drawn (i.e. Peisner-Feinberg, 2004) even going so far as to be contrary to those expected by the researchers themselves (i.e. NICHD, 2000a). It is upon this background of research that this investigation is based and the questions that it asked presented as warranted. This study is primarily concerned with developmental resilience and in particular, whether it can be fostered by high quality early education. As a necessary part of this however, a method of specifying the effects of risks from the same ecological level was also developed. The development of a new method of measuring the combined impact of a set of risks arose from considerable concerns with the common pre-existing method: constructing cumulative risk indices.

This study reanalysed the anonymised longitudinal data collected by the Effective Provision of Pre-School Education project (EPPE). This was a longitudinal English study that began in 1997 with the aim of investigating the effects of pre-school education and care on the development of young children between the ages of 3 and 7. A random sample of 141 programmes of early education was drawn from five geographical regions that were

[3] this was also the study which rejected the use of a cumulative risk index in specifying risk effects

representative of the UK (covering urban, rural and sub-urban areas). The quality of the processes and structures within these programmes of early education were then assessed and the development of a random sample of children was measured after informed consent was obtained from their parents/guardians. The final sample of pre-school attendees who where analysed in this investigation was 2,862 young children (see Sylva *et al.*, 1999). By contrast to the broad scope of the original EPPE investigation, the aim of this research was to discover if high quality early education could 'protect' the development of young children and the potential magnitude of this protection. Further, this study aimed to determine whether the protection offered by high quality pre-school varied across the nature of the risks, the types of quality, and the domain of development that was being protected.

This study is differentiated from EPPE by the novel portrayal of the characteristics of children and families as posing potential risks to child development, and the focus on pre-school quality as being able to mitigate these risks. Whilst the effects of child and family characteristics had been examined in the original study, the application of a theoretical framework derived from the field of development psychopathology had not. Further, there had not been an in-depth systematic examination of the effects of risks acting in combination, or a systematic examination of whether high quality pre-school could protect against risks to foster resilient developmental pathways. It is with this focus and these objectives that this investigation aimed to go beyond the work of the EPPE team to make an original contribution to knowledge. The term 'original' is used deliberately and is based upon EPPE claiming to be the first large-scale British and European study of the longitudinal effects of early education (Sammons, Elliot et al., 2004). Since this investigation builds upon the findings of the earlier EPPE investigation, so the claims to novelty made by EPPE can be carried over. If EPPE was the first large-scale longitudinal European examination into the developmental impact of education, then with a novel focus on the possibility of pre-school promoting resilience, so the scale and breadth of this investigation appears to be novel within a British and European context.

Three concepts that featured in the original EPPE study were here re-analysed with a novel focus centred on the risk-mitigating impacts of pre-school. These three concepts were: 1) the quality of the early education experienced by the EPPE sample of children; 2) cognitive

and social development between the ages of 3-5 (pre-school) and then 5-7 (primary school); 3) the potential risks to development.

Many instruments and methods were used to measure the three concepts that feature in both this and the original EPPE investigations. Primarily and further to the aims of both studies. a single global/overall measure of the quality of early education was assessed alongside 5 indicators of the quality of processes and 7 indicators that assessed structures. The young children who participated in the EPPE investigation also had their cognitive and social abilities measured when they were 36 months of age alongside the recording of 21 potential risks to these skills. Development was again measured when these children were 58 months of age and again at the ends of the first and second years of primary school (until age 7).

The first conceptual area which was investigated was the quality of early education. The measurements taken of early education can be differentiated according to processes, structures, or a combination of the two. Further, all were measured while the children participating in the EPPE study were attending their programmes of early education (an average period of 20 months). A combined measure of the overall/global quality of processes and structures was measured through trained fieldworkers' assessments via the Early Childhood Environmental Rating Scale Revised Edition (ECERS-R; Harms, Clifford and Cryer, 1998). This measure assessed seven distinct aspects of provision and the *overall measure* of quality that was obtained from these was simply the mean of the items that made up this scale.

Five *processes* that took place within pre-schools featured in this investigation and like the overall/global measure (ECERS-R), these were obtained via *fieldworker assessment* using two observational instruments: 1) The Early Childhood Environmental Rating Scale Extension (ECERS-E; Sylva, Siraj-Blatchford and Taggart, 2006), and 2) the Caregiver Interaction Scale (CIS; Arnett, 1989). Like the ECERS-R, the ECERS-E provided a mean score based on a number of subscales which assessed the curricular provision in early literacy, mathematics, science, and diversity. By contrast, the CIS assessed the interactions of caregiving staff with the young children and is comprised of four subscales which were analysed separately. These subscales of the CIS relate to the following descriptions of the staff-child relationship: *Positive; Punitive; Permissive; Detached.*

Together with duration of attendance, seven measures of the quality of the structures within pre-schools were assessed via observation at the same time as the five measures of process quality. The seven structural measures were: The *manager's* highest academic (1) and childcare (2) qualifications; the mean *caregiving-staff* age (3), highest academic (4) and childcare (5) qualifications; the number of care-giving staff (6); and the number of children enrolled at the pre-school (7). Finally, the duration of pre-school attendance was simply the number of months that each child had spent in the pre-school centre whose quality was assessed.

The second conceptual area that featured in both this and the original EPPE investigations was the psychological development of the sample of young children. When the participating children first entered the EPPE study at 36 months, they had their cognitive abilities assessed by trained researchers using the British Ability Scales (BAS; Elliot, NFER-NELSON, Smith and McCulloch, 1996) to return a measure of General Cognitive Ability (GCA). These scales were again used when children left pre-school at mean age 58 months and these again returned a measure of GCA. By contrast to researcher assessed cognitive skills, social and behavioural development was measured at 36 months by pre-school centre workers using the Adaptive Social Behaviour Inventory (ASBI; Hogan, Scott and Bauer, 1992). Five behaviours then emerged from a factor analysis of the items asked by these pre-school centre workers: Co-operation & Conformity; Peer Sociability; Confidence; Antisocial Behaviour; and Worried/Upset Behaviour.

At mean age 58 months, the EPPE team developed the Child Social Behaviour Questionnaire (CSBQ; see Sammons *et al.*, 2003) to measure behaviours that were beginning to emerge in children as they entered primary school. The CSBQ was administered by the children's primary school teachers and was an adaptation of the items from the ASBI assessment battery and incorporated items from the SDQ (see below). Two of the subscales of the CSBQ (self regulation and antisocial/worried behaviour) are here independently examined as being skills that the quality of pre-school can protect in conjunction with an independently examined third developmental ability: young children's GCA. Once in primary school however, the participating EPPE children had this measure of general cognitive ability replaced with measures of educational attainment (primary reading test 1 and maths 6 test in Year 1 and Key Stage 1 tests of reading, writing, and

maths in Year 2). Further, the CSBQ assessments of self-regulation and antisocial/worried behaviour were dropped in favour of behavioural assessments made through the Strengths and Difficulties Questionnaire (SDQ; R. Goodman 1997, 2001).

The final conceptual area measured in this investigation was the risk posed to development from the characteristics of children and their families. Further, this potential risk to development was conceptualised as relative to children or families in accordance with Ecological Systems Theories (e.g. Bronfenbrenner, 1979). In this investigation, 7 measured risks were hypothesised to be related primarily to the *child* whilst 14 were deemed to be more pertinent to the *family*. However, although cumulative indices (e.g. Sameroff, Seifer, Barocas, Zax and Greenspan, 1987) are the traditional means of measuring the combined impact of these risks upon development the traditional means of measuring the effect of these sets of risks impacting development, this method has also been criticised (e.g. Burchinal, Roberts, Hooper, & Zeisel, 2000). As a result, an alternative to cumulative indices was development by this investigation that was based upon Confirmatory Factor Analyses (CFA) using formative measurement (see Kleine, 2006). This CFA procedure returned combined measures of child and family level risks that were based upon separate risks being allowed to vary in their separate contributions to each of their specific ecological levels.

Structure of the thesis

Building upon the findings of previous research, this thesis investigated whether high quality programmes of pre-school could protect the cognitive and social development of a broadly representative sample of young British children. Designed to address the limitations of similar previous research, this investigation consisted of a secondary analysis of nearly 3,000 families with young children and sought to provide a body of research evidence concerning risks, development, and pre-school for parents, policy makers, and researchers to both draw and build upon into the future.

Research questions

The research questions addressed by this study were focussed upon early years education and its potential to lessen the effects of developmental risks:

1) Can high quality programmes of early education mitigate the impact of risks to promote resilience in the social and cognitive development of young children at school entry (at age 5)?

   a) *How do these effects impact subsequent vulnerable and resilient developmental pathways between ages 5 and 7?*

2) Through what means might early education achieve such effects?

   a) *Can early education that is of high quality supplement the care and education provided by families?*

   b) *Can early education that is of high quality increase children's school readiness?*

Overview of thesis

This thesis addresses the above research questions across six chapters that provide (in order): 1) A guide to relevant previous research from the fields of child development and early education. 2) A detailed account of this study, its research questions, and the methods that it employed. 3, 4, and 5) The results of the statistical analyses that were conducted to answer the research questions. 6) A discussion of the findings that are indicated by the results in light of the methods used by this study and the earlier research.

Chapter One reviews and critical appraises research that has generated knowledge about the theoretical concepts that were the focus of this investigation. This first chapter is divided into two sections with the first focusing on vulnerability and resilience in the developmental pathways of young children. In particular, the first section of the literature review of Chapter One introduces and reviews the developmental concepts and research that frame this work. This first section of Chapter One presents definitions of key terms (developmental risk, combined cumulative risk, resilience, protection, vulnerability), and introduces the models of child development that are subsequently drawn upon throughout the rest of the investigation[4].

The second part of Chapter One considers the contribution of early education to vulnerable and resilient developmental pathways and this consideration begins with an account of how modern British early education has have been shaped by research on resilient development.

[4] from measurement in Chapter Two, the analyses of Chapters Three through Five, and with reference to in Chapter Six

The second section of Chapter One considers relevant pre-existing literature in proposing that for early education to make any contribution to developmental pathways this will depend upon the *quality* of the care and education that is provided. Based upon this initial theoretical foundation, programmes of early education are introduced alongside theories that offer explanations of their impacts upon young children's development and how these intersect with the ideas of developmental resilience. These discussions suggest that high-quality programmes of early education might contribute to resilient developmental pathways through the promotion of school readiness which would complement familial care and stimulation. Further, this chapter has already considered how previous research on this topic has returned findings that are inconclusive. This sparsity of specific research is surprising given the amount of research that has been conducted over the last 50+ years into both young children's resilience to developmental risks (with four waves of research; Masten, 2007) and the developmental impacts specific to programmes of early education (with three waves of research; Melhuish, 2004).

Chapter Two goes on to describe this investigation and the original EPPE research along with the research questions, methods, and the underlying rationale that underpinned both. These discussions are followed up with a description of the sample and a demonstration that the studied young children, families, and pre-schools were broadly representative of the British population at that time. Following on, the measures that were used in this study and the means of their assessment and then outlined in greater detail than they have been so far described in this chapter. An in-depth description of the measures is given due to the design of this investigation (secondary analyses) necessitating both a sound understanding of the measures reanalysed and the limitations inherent to their validity and/or reliability. The final part of Chapter Two then considers the statistical analyses that were used in this study and presents justifications for the techniques used. In particular, the analyses used throughout Chapters Three, Four, and Five were shaped by considerations originating from the research literature on developmental resilience, and by the data and design of the original EPPE study. For example, previous investigations into developmental resilience prompted this study to develop novel measures of the combined impacts of risks and to differentiate risks according to their ecological level.

Considering the analyses outlined and justified in Chapter Two in even greater detail, important determinants of the structure of the analyses were the design of the EPPE study

and earlier research into child development. The design of the EPPE study necessitated the need to control for the effects of nesting children within pre-schools, and the need to impute missing data. By contrast, earlier research into child development necessitated the analyses *explicitly* modelling development rather than just the modelling of developmental skills. An attempt to explicitly model development was achieved through statistical modelling that took into account two effects: a) children's development when they first entered the EPPE study; b) the impacts that risks might already have had upon children's development prior to entering pre-school. In designing a series of analyses that were based upon both the EPPE design and considerations of developmental research, aggregated Structural Equation Models (SEM) were specified to test a series of hypotheses concerning pre-school and *risk-moderation.* A series of analyses were conducted in which each of the thirteen measures of quality was independently examined to determine whether it could significantly moderate the effects of each of the combined risks as they impacted each measure of development that was assessed at entry to school (GCA, self regulation, antisocial/worried behaviour). In addition, children's duration of attendance at pre-school was also tested alongside the measures of quality, both as a moderator of risks and also as a moderator of any of quality effect. As a result, when testing the hypotheses of pre-school quality and risk-moderation, three multiplicative statistical interaction terms were used: 1) *quality x risk;* 2) *duration x risk;* and 3) *(quality x duration) x risk.*

Chapters Three, Four, and Five present the empirical results of the analyses and the results of each of these chapters builds upon and extends those before. Although the results of Chapter Five address the research questions of this investigation, the validity of the analyses conducted in this chapter would have been severely limited without the analyses conducted in Chapters Three and Four. Chapter Three consists of a simple exploration of the data and features examinations of the direct *bivariate* relationships between each of the three sets of measures central to this investigation (development, risks, pre-school quality). The purpose of Chapter Three was to determine the validity of the assumptions which lay behind the subsequent SEM of the latter chapters. The uni- and bivariate relationships that feature in Chapter Three are then subsequently analysed in greater (*multivariate*) depth in Chapters Four and Five. However, the results that are presented in Chapter Three serve to explain the modelling choices that followed rather than for providing reliable results for the conclusions of Chapter Six to be based upon. The lack of reliable results from this first results chapter comes from the relationships that are examined failing to control for the

influences of other variables or even the characteristics of the sample itself (i.e. the nesting of children within pre-schools). As such, the relationships that are revealed in Chapter Three merely provided an initial picture of those that the subsequent SEM built upon in Chapters Four and Five.

Chapter Four is the first of the inferential results chapters and focuses on developmental risks. It documents the devising of a new method for the measurement of their combined impact upon development. For validation, the newly developed measure is compared and contrasted to its most widely used alternative, with results favouring the approach taken here. Confirmatory Factor Analysis (CFA) using formative measurement was used to generate a measure of combined risk that: a) did not require data to be discarded via the dichotomisation of otherwise continuous risks, and b) allowed the contribution of each risk to vary in its indication of the combined measure. This analysis develops the work of Kleine (2006) and was based upon criticisms that have been levelled at the most commonly used *pre-existing* method for the measurement of the combined impact of risks (cumulative indices; e.g. Burchinal, Roberts, Hooper, & Zeisel, 2000). The predictive validity of the CFA approach was demonstrated in the first section of Chapter Four by comparing its impact on development against the impact of the Cumulative Index that was developed by the EPPE project (their, "Index of Multiple Disadvantage"). The comparison of these two risks measures was accomplished through SEMs that estimated the impacts of both upon children's cognitive and social skills from entry (at mean age 36 months) to exit of pre-school (at mean age 58 months).

The exploratory analyses of the first section of Chapter Four is then extended in the second section by conducting comparative analyses that focussed on dividing combined risks according to their ecological level (child or familial). These analyses were designed to build upon the results of the first section of this chapter by demonstrating the *relative importance* of modelling ecological levels (e.g. Bronfenbrenner, 1979) when estimating the combined impact of developmental risks. As in the first part of Chapter Four, the predictive validity of the division of risks by ecological level was demonstrated by comparing the developmental impacts of a single factor solution (ignoring ecological levels) to that of a two factor solution (modelling child and family level risks separately). Chapter Four concludes by restating the rationale that lay behind the analyses, summarising the results, and revealing the conclusions that may be reliably drawn. The

validity of the methods demonstrated in Chapter Four is central to the subsequent analyses conduced in Chapter Five and the discussions in Chapter Six.

The first section of Chapter Five extends upon the newly developed method for measuring combined risk that was generated in Chapter Four to address the key questions. To reiterate, these key questions concerned whether the quality of pre-school could lessen (*moderate*) the impacts of these combined risks so as to evidence protected development. Chapter Five reports on each measured quality of pre-school having its direct and risk-moderating impact estimated upon the three measures of development that were assessed at entry to school and within the context of each of the two ecological levels of risk. A unique set of five cumulative SEMs was then estimated for each combination of risk, developmental skill, and quality of pre-school. These sets of models began with the simplest patterns of relationships before moving on to those more complex. These five cumulative SEM analyses examined: 1) only direct effects on development; 2) direct effects plus a *risk x quality* interaction; 3) direct effects plus a *risk x duration* interaction; 4) direct effects plus a *quality x duration* interaction; and 5) direct effects plus a 3-way interaction between *risk, quality, and duration.*

The second section of Chapter Five goes on to demonstrate how the three developmental abilities at age 5 were of crucial importance for the development of young children over the next two years, a period of development that ends with Key Stage 1 assessments. This set of analyses builds upon those that precede it (Chapters Three, Four, and the first section of Chapter Five) by conducting a new analysis that uniquely and *simultaneously* examines *both* cognitive *and* social/behavioural developmental pathways and their influence upon one another. This analysis extends earlier findings by demonstrating the long terms effects of risks acting in combination and the additional importance that comes from mitigating these through high quality pre-school. As a result, it is really Chapter Five which most directly addresses the title of this thesis. By contrast, Chapters Three and Four provide preliminary analyses which support the answering of the research questions that takes place in Chapter Five. Taken together, the analysis conducted in the two sections of the final results chapter examines the impacts of domain-specific developmental risks (Section 5.1) and the mitigation of these impacts due to high quality early education (Section 5.1). The impacts of risks and the possibility of their mitigation are then shown to shape

subsequent developmental pathways during the first phase of primary school (Sections 5.1 and 5.2).

Drawing together the findings of the three preceding results chapters, Chapter Six discusses the conclusions that can be drawn from the empirical results and offers possible theoretical explanations. The conclusions are then used to answer the formal research questions and consideration is given to possible limitations and areas for future research. Various characteristics of pre-school (processes, structures) were found to partially mitigate the combined impacts of developmental risks and so protect developmental skills and abilities. Further, the developmental skills and abilities that pre-school quality was found to partially protect (GCA, self regulation, lack of anti-social behaviour) were also shown to be crucial for subsequent developmental pathways during the first two years of primary school. As such, an argument is made that it might be possible for programmes of early education to serve as interventions within normal populations by serving as a type of *primary prevention*. At the same time however, this study did not aim to provide a *definitive* account of if and how early education can protect the development of young children so as to contribute to resilience in developmental pathways. Rather, preceding research on the topics of this investigation prompted a thorough initial "*systematic exploration*" (Luthar, 2006) for future researchers to extend and build upon.

Key findings

The novel key contributions to the literature stemming from this investigation were:

1) Concerning the role of pre-school quality as a protective factor:

- This investigation identified many more instances of significantly protected development than similar previous research (notably, Burchinal *et al.*, 2000; NICHD 2000a).
- The quality of early education was much more likely to partially protect:
    - Against the combined impacts of child level rather than family level risks.
    - When programmes of early education offered particularly high quality processes rather than structures.
    - The cognitive rather than the social development of young children.
- The difference by developmental domain of the partial protection offered by high quality early education also extends to the role of duration - the protection of

social/behavioural development was much more dependent upon children having experienced high quality for a longer period.

- Notably, the overall quality of early education was found to partially protect the overall cognitive development of young children against the impacts of (an SES analogous) family level combined risk.
    - As such, high quality early education may be able to partially combat the effects of social inequalities in a similar manner to Early Interventions such as Sure Start (though not necessarily to the same extent).
- Finally, high quality pre-school was found to be able to partially supplement the care education provided by families.
    - Although poor home learning environments were found to be the most important family level risk to the cognitive and social development of young children, high quality pre-school could partially lessen the developmental impacts of this.

2) Concerning developmental processes shaping future development:

- Young children's GCA, self regulation, and anti-social behaviour at exit from early education (~mean age 58 months) were found to be significantly related to measures of cognitive and social development taken at the end of the first and second years of primary school.
    - However, stronger effects were noted *within* developmental domains rather than *in between* (e.g. GCA and subsequent reading ability).
    - Furthermore, cognitive abilities at exit from early education had a bigger impact upon subsequent social development during the next 2 years than did social skills upon subsequent cognitive development
- Developmental pathways during the first 2 years of primary school (Key Stage 1) were concluded to be vulnerable due to two findings: 1) These pathways were significantly related to young children's GCA, self regulation, and anti-social behaviour at exit from early education. 2) These same three developmental skills were also significantly impeded by the impacts of combined risks.
- The implied vulnerability in developmental pathways was also evidenced to be partly mitigated due to high quality early education. This was because early education was found to lessen the impacts of combined developmental risks upon

GCA, self regulation, and anti-social behaviour when children exited these programmes.

- As such, high quality early education can be concluded to contribute to resilient developmental pathways during the first two years of primary school by boosting the important (yet also risk-impacted) cognitive and social skills at exit from pre-school.
- High quality early education can not only increase children's school readiness, but can also *differentially increase* school readiness by lessening the impacts of risks to key developmental skills at entry to school.

3) Concerning the modelling of cumulative risk:

- Constructing a cumulative risk index does not always produce a measure of greatest predictive power when estimating the combined impact of risks to young children's development.
- Instead, individual risks can contribute very differently from one another to an estimation of their combined impact. In turn, the modelling of this variation amongst risks can systematically increase the size of their combined impact.
- Further, modelling the combined impact of risks from the same ecological level (e.g. gender and family income specific to separate child and family levels) can also lead to systematic increases in their impacts upon development.

1. LITERATURE REVIEW

Developmental resilience may be defined as the process of an individual's positive adaptation to developmental risk and vulnerability; it is often facilitated and aided by beneficial effects referred to as 'protection'. Furthermore these integral components of resilience (risks, vulnerabilities, and protection) originate from a variety of developmental systems and sources, and vary in their proximal/distal relevance to the individual. This thesis explores whether one relatively distal factor, attendance in programmes of early education, can protect the development of young children against the impacts of proximal and distal risks to facilitate not only developmental resilience, but also resilience in future 'developmental pathways' (Bowlby, 1988). Key themes that emerge from and are explored in this investigation include: the accumulation of risks, the importance of the quality of early education, and the differences between:

1. Distal and proximal cumulative developmental risks
2. The quality of structures and processes within early education
3. The impacts to young children's cognitive and social development that are specific not only to types of risk, but also to various types of quality

This chapter consists of a critical appraisal of previous research germane to the concepts, constructs, and relationships that were investigated in this thesis. It begins with a discussion of the central concepts that underpin this work and how these ideas are conceptualised within the context of young children's development. Based upon this theoretical foundation, programmes of early education are then introduced alongside the theories explaining their impacts upon young children's development and how these intersect with the ideas of developmental risk and resilience. These discussions suggest that high-quality programmes of early education might make contributions to the vulnerable and resilient developmental pathways of young children by complementing familial care and stimulation via the promotion of school readiness. Previous research that has investigated this topic has returned findings that can be best described as inconclusive. This sparsity of specific research is surprising given the amount of research that has been conducted over the last 50+ years into both young children's resilience to developmental risks (with four waves of research; Masten, 2007) and the developmental impacts specific to programmes of early education (with three waves of research; Melhuish, 2004).

1.1 Vulnerability and resilience in the developmental pathways of young children

1.1.1 Defining key terms

The key terms used throughout this investigation emerged from the work of scholars such as Rutter, Garmezy, and Werner who used the terms, vulnerability, resilience, risk, and protection to describe development in a manner that was very different to the preceding pioneering developmental theorists such as Freud, Piaget, Kohlberg, and Erikson who all posited theories of development emphasising developmental stages and a predictable movement of individuals through these as they aged (Rutter & Rutter, 1993). Rutter and Rutter (*ibid*) point out that such approaches are overly reductionist as they posit fixed end-points of human development which do, *"not fit with what we know of socio-emotional development"* and which have proven limited in three further ways:

1. *"...no one theory constitutes anything like a complete explanation of developmental processes"*
2. *"Most theories seems to ignore children's social life despite the fact that personal relationships are such a crucial part of our heritage as social beings"*
3. *"...each of the 'big' theories has been shown to be wrong, or at least seriously lacking in some of the concepts that are central to the theory."* (Rutter & Rutter, 1993)

In response, the ideas of developmental risk, resilience, protection, and vulnerability have come to increasingly dominate the discourse of human development (perhaps most commonly encountered within the growing field of 'developmental psychopathology'[5]). Furthermore, as these ideas have expanded into ever widening areas of research (e.g. Masten, 2007; the 2009 Annual Meeting of the American Educational Research Association[6]; the Sure Start Programme in the United Kingdom[7]) so the definitions of these terms have begun to become less and less concrete. Although they have not yet becoming *"floating signifiers"* (Chandler, 2001) continuing attempts have been, and continue to be made to clarify, restate, or

[5] *"..an interdisciplinary approach for the study of human functioning..."* that is concerned with, *"the origins and time course of a given disorder, its varying manifestations with development, its precursors and sequelae, and its relation to non-disordered patterns of development"* (Schoon, 2006)
[6] See Gadsden, Davis, & Artiles, (2009)
[7] See Section 1.2.1

reinterpret their original definitions (e.g. Luthar, 2006; Masten & Gewirtz, 2006; Rutter, 2008; Schoon, 2006).

Within the field of research that is perhaps most concerned with processes involved in developmental risk and resilience, *'developmental psychopathology'*, studies of vulnerable and resilient developmental pathways have been commonly grounded in the interplay of individual characteristics within wider ecologies (see Masten & Shaffer, 2006; Rutter & Sroufe, 2000). Perhaps the most influential set of theories drawn upon in conceptualising this interplay are 'ecological system theories' (particularly the work of Bronfenbrenner, 1979) which view these as taking place within a nested structure where the child is ensconced within his or her environment (see Gorman-Smith & Tolan, 2003; Hetherington & Parke, 2003).

However despite the relatively common theoretical foundations, there has also been a lack of consistency in the terminology used to describe the concepts central to studies of vulnerable and resilient developmental pathways (see Luthar, Cicchetti, & Becker, 2000a). As a consequence, this literature review first defines the terms that it uses before then moving on to discuss the relationships that have been posited to exist between them, the supporting research evidence, and the validity of both. Schoon (2006) provides evidence of this inconsistency by describing one such disagreement. Whilst some authors argue that protection and vulnerability are opposing concepts, for others, a protective factor is instead the opposite of a significant developmental risk (rather than a vulnerability).

Further to the point of inconsistent definitions, and of particular concern to this investigation, are the variable definitions that have been implicitly and explicitly applied to the term," vulnerability" such that many studies commonly use this term inconsistently. For example, in the examples cited above from Schoon (2006), is vulnerability the opposite of protection or not? 'Vulnerability' is a term that can be found to be used both as a synonym for 'at-risk'[8] but also as a susceptibility to the effects of developmental risks themselves such that 'vulnerability' comes to imply a

[8] For example, *"...improve the lives of vulnerable children and families"* (p.xix Cicchetti, 2003) [as a*ttributive* adjective]

'susceptibility to risks'[9]. It is due to this lack of clarity that the term 'vulnerability' has been avoided in these opening discussions in favour of more the precise terms, 'at-risk', and/or 'susceptibility' (see Section 1.1.1) where appropriate.

Given the ambiguity of the term 'vulnerability' as it has been used in studies of risk and resilience, what can therefore be understood from the phrase, "vulnerable developmental pathways" in the title of this thesis? Well, given that 'vulnerable' has been used as both a synonym of "at-risk" as well as "susceptible", this thesis made the decision to examine both. First, "vulnerable developmental pathways" can refer to a period of development that has been identified as being of high likelihood to be sub-optimal due to the significant impacts of the combined influences of distal and proximal factors[10] that are referred to as "risks". Second, "vulnerable developmental pathways" can also refer to a period of development that is probabilistically *susceptible* to the future direct impacts of developmental 'risks' themselves. Both meanings are investigated in this thesis and further details can be found in Chapter 2, Section 2.1.1.

The following sub-sections of this chapter present, define and outline the hypothesised relationships between five concepts that form the foundation of this investigation: developmental risk, combined cumulative risk, resilience (to risks), protection (from risks), and susceptibility (to risks). Figure 1.1 presents a brief overview of these terms and defines the relationships between them that are accepted in this work based on the preceding research literature. Risk has been argued (e.g. Luthar, 2003) as referring to developmentally detrimental individual characteristics (Bynner, 2001) and/or environments (also, 'adversity'; Werner, 1996). Conversely, a lack of *risk-inferring* characteristics/environments implies that there is a favourable probabilistic likelihood that a child should reach a level of development thought to be appropriate for their age. In other words, there is a strong probability that they should display *competence* in their development (Masten & Powell, 2003). However this ideal situation, that children be exposed to no risks/adversities, or should otherwise prove invulnerable to their effects, is also highly unlikely (e.g. Masten & Coatsworth,

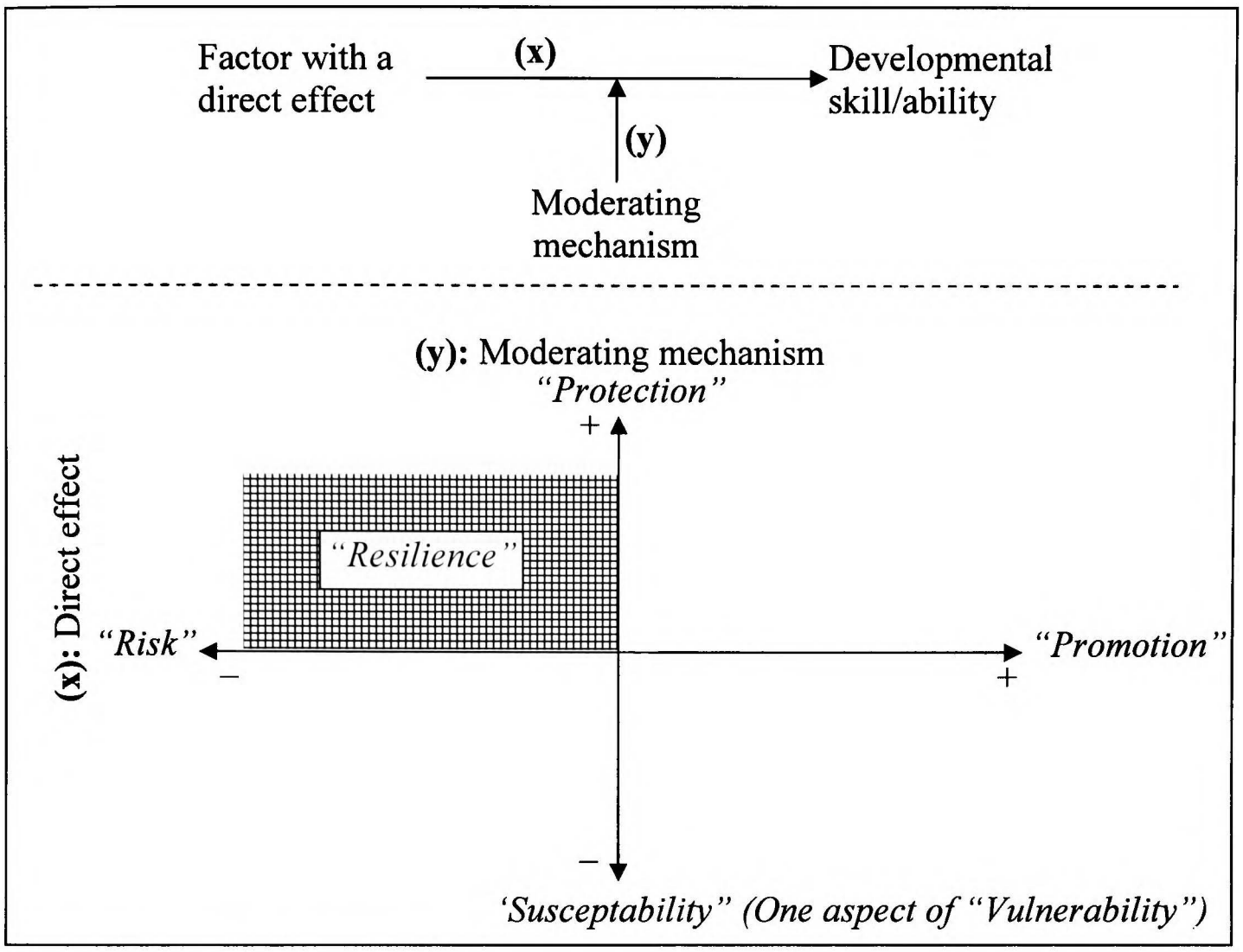
[9] For example, *"...genes operate though making people more vulnerable to environmental stressors"* (p.19 Rutter & Rutter, 1993) [as *predicate* adjective]
[10] Risks differentiated by their ecological level (Bronfenbrenner, 1986) relative to the child (Yates, Egeland, & Sroufe, 2003)

1998). The clear reality of children's development is that they are exposed to a *combination* of influences, both beneficial as well as detrimental, during what is commonly referred to as '*ontogenesis*' (Cicchetti & Rogosch, 1996).

However, in spite of this understanding of the balance of factors both positive and negative and their relationships to one another, the exact impacts of an individual's characteristics and encountered environments upon their development has also been argued as unique and specific (Masten et al., 1999)[11]. Whether a developmentally salient factor has an effect that can be evaluated as beneficial or detrimental will always be a subjective judgement made by an culturally-bound observer[12] that varies according to the age of both individuals, the onset of the factor's impact[13] (Egeland, Carlson, & Sroufe, 1993), and the duration of this effect (Schoon et al., 2002). Referring to the title of this thesis, such concepts and relationships suggest that every child displays some degree of *resilience* to risks throughout their development[14], or in other words, will display some form of competence despite processes constituting adversity (Garmezy, Masten, & Tellegen, 1984) or *vulnerabilities/susceptibilities* (see Section 1.1.1). Finally, the mechanisms that underlie this accepted definition of developmental resilience have been historically termed, '*promotive*' when broadly beneficial (Sameroff, Gutman, & Peck, 2003) and, *'protective'* when acting to counter[15] the effects of adversity and risk (Rutter, 1987).

[11] With the emphasis on *individuality* and *specificity* differentiating more recent theories of development from those preceding (e.g. Piaget, 1926)
[12] See Section 1.1.1 for more on the inherent subjectivity of these judgements
[13] Note: the *impact*, not the *factor*. For example, the impact of some genetic factors become active later (like Huntington's), or impacts that can change between beneficial/benign/detrimental over ontogenesis
[14] Resilience thereby becoming akin to, *"Ordinary Magic"* (Masten, 2001)
[15] Alternative synonyms also encountered are: mitigate; moderate; ameliorate

Figure 1.1 Defining the impacts of factors and processes involved in development: Differentiation of direct and moderating effects



Developmental risk

Risk: *"Elevated probability of undesirable outcome in the future"*

Risk Factor: "*Measurable attributes of people, their relationships, or contexts associated with risk"* (Masten & Gewirtz, 2006)

For researchers investigating the development of children, risk factors have been defined as, "*Personal and environmental factors that adversely affect growth and development*" (Johnson & Waldfogel, 2002). Combined with the definitions above, these examples provide a consistent conceptualisation that researchers such as Cicchetti (2003) have drawn upon when making the argument that risk implies development within the context of a significant *adversity* such as poverty (Masten & Coatsworth, 1995, 1998; Masten & Shaffer, 2006; McLoyd, 1998; Repetti, Taylor, & Seeman, 2002). In turn, this association makes the ideas of developmental risks and developmental risk factors fairly ubiquitous to any study of human development. Furthermore, the difference between 'risk' as a factor and 'risk' as a process is central to the argument made by Rutter and Rutter (1993) that the effects of risks can be

extended back to the relationships that are shared between risk factors and their subsequent processes. Subsequently, several key questions are postulated by Rutter and Rutter (*ibid*) as underlying any identification of developmental risk and its impacts upon development: How indicative are risk indicators of the risk processes that produce the developmental sequelae, and just how much does the measurement of a risk factor inform us as to the processes and mechanisms by which its significant effects come about?

The idea that adversities such as poverty pose a 'risk' to development is discussed by Sameroff, Gutman, and Peck (2003) who stressed the difference between risks and causes: risks (i.e. adversities such as poverty) are fundamentally probabilistic in nature whilst causes are deterministic. Schoon (2006) later elaborated upon what is meant by the term 'risk' within studies of resilience by referring back to its origins in epidemiological research. Risk, *"comprises genetic, biological, psychological, environmental, and socio-economic factors with an increased probability of maladjustment"* (Schoon, *ibid*). This emphasis on probability is important as it implies that any statistical relationship found between "risk factors" and outcomes are inherently *non-causal*; that finding a statistically significant relationship between two measures (i.e. a risk and a developmental outcome) reveals nothing about the true underlying causal relationships. Thus, multiple individuals may both display the same characteristic or experience the same situation, but the characteristic or situation need not constitute a consistent risk nor does the means by which such a factor poses a developmental risk have be consistent either. This specificity of the impacts of risks to individuals has become a hall-mark of developmental psychopathological research more generally and features prominently in the exploration of other developmental processes such as protection and resilience (discussed below). Referring back to adversities such as poverty, Schoon (2006) provides an example,

> *"A child raised by working-class parents will not necessarily experience poor quality care-giving or scarcity of material resources"*. (Schoon, 2006)

This person-specificity of the impacts of risks has also been extended to different domains of development such as that for psychological development in particular, the impacts of risks to cognitive and social/behavioural skills are qualitatively different. This is based upon the observation that whilst there is validity to viewing the

development of cognitive skills as a linear progression, the same can not be said for social/behavioural development. Rutter and Rutter (1993) highlight two examples of why extending the traditional view of development as a linear progression is inappropriate for social skills and behaviour. First, what happens if a person loses their sense of self-esteem as a result of personal loss? Second, what would the maturational end point be for a continual progression of social skills and behaviours? From points such as these, it becomes easier to understand why it is necessary for the impacts of risks to development to be contextualised. Not only do cognitive and social skills qualitatively differ, but any period has the potential to contain *both* the progress *and* retreat of these latter mentioned developmental skills.

The earlier quotes from Schoon (2006) also highlight another important issue in the conceptualisation of developmental risks and the nature of their effects: 'risks' are also intrinsic to all systems that have impacts upon the life of an individual. Drawing upon ecological systems theories (most notably Bronfenbrenner, 1986), the categorisation of risk factors by these systems recognises fundamental differences between the proximity of risks to an individual and thus also impacts the complexity of the underlying causal *risk processes.*

Whilst an encountered adversity such as poverty can be considered a relatively distal source of developmental risk, a genetic disorder such as Down's syndrome would obviously be more proximal and yet the effects of both can be manifest in developmental outcomes and, for example, in diagnoses of Special Educational Needs (e.g. Durlack, 1995; Florian, Rouse, Black-Hawkins, & Jull, 2004). However, the most distal of influences on an individual's development is the passing of time itself (Bronfenbrenner's '*Chronosystem*') which encompasses all of the systems, factors, and process whose effects can be considered more proximal. The integration of the passing of time makes ecological systems theories inherently developmental in scope and thus extremely relevant to any discussion of developmental risks. They provide a framework by which researchers have conceptualised developmental risks as originating from multiple systems and processes (e.g. the family, Masten & Shaffer, 2006; Repetti, Taylor, & Seeman, 2002), and that these systems and processes (and thereby also risks) interact over time and can be nested within one another (Cicchetti

& Curtis, 2007). For example, *"genetic effects accumulate over time whereas environmental effects show this tendency to a lesser degree"* (Rutter & Rutter, 1993).

The portrayal of developmental risks as person-specific yet located at various distances from an individual's life (and also their control) and which vary over time also carries with it a further implication. Just as risks, their relationships, impacts, and underlying causal processes vary over time, so too will an individual's responses to these; they are not a passive recipient to the impacts of risks. Furthermore, because the balance of significant factors that influence development varies according to the developmental stage and/or chronological age of an individual (e.g. upon cognitive ability, Rutter & Rutter, 1993), so the identification of significant risks to skills and abilities is also developmental age specific (Bell, 1986; Loeber, 1990). Not only are the impacts of risks going to vary according to internal biological milestones such as the development of the immune system (at around 6 months) or puberty/menarche, but the impacts that earlier risks have upon development may also influence the response of individuals to later encountered risks[16].

From the understanding that the impacts of risks to an individual's development will vary over-time in both their underlying processes and manifest effects, researchers have come to believe that the effects of social, environmental, biological, and genetic factors are understood not to act separately, but in combination with one another (Rutter et al., 1997). Indeed, this is a conceptualisation that has been applied to factors with effects deleterious (Luthar, Cicchetti, & Becker, 2000b), as well as, 'promoting' and, 'protecting' (Rutter, 1987). Differentiating latter twentieth century studies of human development from those preceding; this understanding has been the basis of many influential longitudinal studies of human development over the past 30 years. Such investigations have included: the Isle of Wight Studies (Rutter, 1976), the Rochester Longitudinal Study (Sameroff, Seifer, Baldwin, & Baldwin, 1993), the Kauai longitudinal study (Werner, 1993, 1996), Project Competence (Garmezy, Masten, & Tellegen, 1984) and research by the National Institute of Child Health and Human Development (NICHD; see Fearon & Belsky, 2004). What has proved common across all of these investigations has been not only the concept of a

[16] *"...it is exceedingly uncommon for early and late experiences to be independent of one another. One reason is that people's behaviour shapes their environment... a second reason is that early experiences tend to determine later experiences."* (Rutter & Rutter, 1993)

combined risk that affects development, but also the time-sensitive strategy for the measurement of this through the construction of cumulative risk indices.

Combined cumulative risk

Based on the original work of Rutter (1979) and Sameroff, Seifer, Barocas, Zax, and Greenspan (1987), cumulative risk indices are created through the summation of dichotomised risk factors that are theorised to affect ontogenesis, a procedure outlined by G. W. Evans (2003). The origin of these measurement models is described by Sameroff, Gutman, and Peck (2003): epidemiological research revealed that it was the *combinations* of risk factors, rather than individual risk factors *per se,* that were significantly contributing to the onset of heart disease (for example see Lloyd-Jones et al., 2004). The concept of an accumulating and overarching risk was gradually extended from the field of medicine into other areas of research and eventually into investigations of child development where it was postulated that people encounter a combined risk to their development that is formed from the *volume/amount* of risks in their lives rather than from any *individual* risk or *type/category* of risk alone (Sameroff & Cole, 2003). For example, Sameroff, Seifer, Barocas, Zax, and Greenspan (*ibid*) found that from a set of ten environmental variables, (including maternal mental health) no *individual* measure was, on its own, a significant determinant of lower than expected cognitive development in children.

By way of testing the validity of cumulative risk indices and to compare and contrast alternative approaches for assessing the impact of risks to development, Burchinal, Roberts, Hooper, and Zeisel (2000) investigated the impact of family based social risks on young children's cognitive development between the ages of 1 and 4 years of age. Their sample consisted of 87 African American children in full time community based child care who had started between the ages of 1 and 11 months of age (mean = 5.4 months). Using 9 individual risk factors, the authors tested 3 statistical approaches (including a cumulative risk) that had used to previously investigate how proximal risks (e.g. birth weight; Brooks-Gunn, Klebanov, Liaw, & Spiker, 1993) and distal risks (e.g. poverty; Garmezy, 1991) act together when affecting children's development: multiple regressions, exploratory factor analyses, and cumulative indices.

The first of the approaches used by Burchinal, Roberts, Hooper, and Zeisel (2000), the traditional multiple regression, establishes the impact of risks upon development by modelling the separate effects of individual risks so that they can be compared (Sameroff & Seifer, 1983). Unfortunately, the frequent presence of multicollinearity in these analyses obscures relationships between individual risks and developmental outcomes and occured in the analyses of Burchinal *et al.* The second approach, exploratory factor analysis, overcame the problems associated with multiple regressions and shared many of the advantages of cumulative risk indices (the third approach). This included greater predictive power of cognitive development when assessed at 1, 2, 3, and 4 years of age. Nevertheless, like cumulative risk indices and multiple regressions, factor analysis also had disadvantages: Burchinal and colleagues noted that exploratory factor analysis uses an empirical rather than conceptual basis for data reduction. Consequently, such an approach limits the external validity of any findings returned from its use and can result in the extraction of several factors when only *one* is desired for the representation of a single combined cumulative risk. The authors concluded that,

> *"...both the risk-factor approach and the risk-index approach appear to provide viable methods for relating social risk to developmental patterns."*
> (Burchinal, Roberts, Hooper, & Zeisel, 2000)

Concerning criticisms of cumulative indices, these relate to their emphasis on *volume/amount,* one that implies that there exists some sort of *interaction* that occurs between individual risks (Schoon, 2006). Furthermore, *'interaction'* is a term that holds multiple meanings but here refers to individual factors modifying the effects of others as they coincide in impacting development (Hinshaw, 2002). However, the idea that an accumulation strategy can represent this form of *interaction* depends upon two considerations. Firstly, the term 'interaction' can be a synonym not only for this example of a *moderation* effect (Wu & Zumbo, 2007) but also for risks simply *"working together"* (Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001). Secondly, a cumulative index is an attempt to represent an individuals' life history (see Schoon, 2006) comprised of causal chains of effects over time (see Rutter & Silberg, 2002). Considerations such as these led Kraemer, Stice, Kazdin, Offord, and Kupfer (2001) to claim that too little attention had been paid to the development of measurement tools for the purpose of assessing risk and that for cumulative indices,

> *"Accumulating risk factors and either counting or scoring them does little to increase the understanding of etiologic processes..."*
> (Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001)

In addition to the criticisms made of the ability of *accumulation* to represent interactions between risks, cumulative indices make assumptions concerning how a conceived *combined* risk may be operationalised. Primarily, cumulative indices dichotomise individual measures of risk, a procedure that has faced criticism as dichotomisation incurs substantial loss of information that can lead to dubious statistical relationships (MacCallum, Zhang, Preacher, & Rucker, 2002). However, such uncertainty concerning the impact of dichotomisation upon statistical relationships is dependent upon the exact procedure followed and the circumstances in which it is used. For example, although methods that use *arbitrary* cut-offs have been criticised (e.g. median splits; MacCallum, Zhang, Preacher, and Rucker, 2002), those that do not have also been acknowledged as useful (e.g. the 'extreme groups approach'; Preacher, Rucker, MacCallum, & Nicewander, 2005) or even necessary (e.g. dichotomising a moderator that is hypothesised to have a step-⌜ function; Baron & Kenny, 1986).

As well as the potential problems that have been associated with dichotomisation, the summation of dichotomous measures further assumes that distal and proximal factors (relative to an individual in question) may be summed together with equal weight (Luthar, 1993). Such an assumption is one identified by Lee (2007) as being the opposite to that of the traditional multiple regression where each risk would be viewed as having a unique and separate impact. Finally, if an accumulation strategy is used to identify a sub-sample of individuals whose development is deemed to be especially at risk then this constitutes an 'extreme groups approach'; the same procedure that although being noted as useful to developmental studies has also been criticised (Preacher, Rucker, MacCallum, & Nicewander, 2005).

These many criticisms that have been levelled at risk accumulating cumulative indices are also indicative of the wider state of research investigating developmental risks, their impacts, and whether these can be mitigated. Whilst significant progress has been made in the field with research just entering its 'fourth wave' (e.g. Masten, 2007), there still exists a discourse concerning the fundamental definitions and

relationships which underpin this. Luthar (2006) provides two quotes pertinent to this, not only are there, *"increasing concerns about the rigour of methods used in this body of work"*, but also, *"the literature on resilience reflected considerable confusion around pivotal constructs and definitions."* It is to this most central of constructs that discussion now turns.

Resilience

Resilience: *"Positive patterns of adaptation in the context of risk or adversity"*
(Masten & Gewirtz, 2006)

Research investigating individual risks, their accumulation, and the possibility of resilience to them, arose from the observation that some individuals who were exposed to incontrovertible levels of adversity nevertheless displayed adaptive subsequent development (Yates, Egeland, & Sroufe, 2003). Contributing to the rise of developmental psychopathology and a more integrated science of human development, the study of resilience can be traced back to the 1970s and the works of Michael Rutter (see Luthar, Cicchetti, & Becker, 2000a), Emmy Werner (see Rutter & Sroufe, 2000), and Norman Garmezy (see Luthar, 2006). Although used with a variety of definitions (Luthar, Cicchetti, & Becker, 2000a), the term 'resilience' has been broadly accepted as inextricably linked to risk, such that resilience is a response of overcoming rather than succumbing to, the impacts of risks that are encountered in one's life (see Rutter, 1987). Twenty years later, this conceptualisation remains broadly adhered to with authors such as Cicchetti (2003) arguing that resilience refers to processes in development that result in positive adaptation despite significant levels of adversity.

The concept of developmental resilience has however, also been conceived as an everyday phenomena (Sameroff, 2005) in which individuals display some degree of *resilience* to the unavoidable risks they encounter in their development (Garmezy, Masten, & Tellegen, 1984). Within this perspective, resilience has been viewed as originating from the actions of ordinary adaptive responses (Masten, 2001). Furthermore, Masten elaborates that this *"ordinary magic"* indicates a direction for those policies and practices (e.g. education) that attempt to enhance the development of children deemed to be at risk. Conversely and concerning social policy, Reynolds and Ou (2003) haave reported that research examining risk and resilience has proven

of particular appeal to those who seek to enhance the well being of individuals through social programmes. For the UK in particular, such educational policies and programs have included: the Sure Start Program (see DfES, 2003) and the *Childcare Act* 2006 (see Lindsey & McAuliffe, 2006).

Due to the fundamental association between the concepts of developmental resilience (as it is defined here) and developmental risk (see Figure 1.1), the issues that surround this contencious term (see Section 1.1.1) extend into discussions of resilience. These primarily take the form of two caveats which must be kept in mind by researchers who are investigating these ideas. First, like development itself and the existence of significant risks to it, *resilience is person and context dependent* (Schoon, 2006). Although this may seem a minor point which logically follows from the application of the concept of resilience to development and developmental risks, it also has important additional consequences, foremost of which is the notion that resilience is a judgement which is subjective both to the values and opinions of individuals as well as to the society in which it is made[17]. As such, a developmental outcome in one societal context (such as tendency towards violence) might be considered adaptive by one observer in one context, but also equally maladaptive by either the same individual in a different context, or alternatively, a wholly different pairing of observer and context altogether.

The second caveat to be borne in mind by researchers investigating resilience and which has its origins in the notions of developmental risk is that: *resilience is a process not an individual trait* (Egeland, Carlson, & Sroufe, 1993; Luthar, 2003; Luthar, Cicchetti, & Becker, 2000a). Claiming otherwise, that resilience is a trait implies a deterministic relationship between individuals and their development (e.g., the, *"seductive notion of infant determinism"* (J. Kagan, 1998; cited in Bernard, 2004). For example, "Child X didn't succeed because they were not resilient enough". Not only does this ignore the inherent probabilistic, observer, and culture subjective relationships that are fundamental to the impacts of risks to development, it also hazards *"blaming the individual"* (Schoon, 2006) and ignoring the importance of the conceptual interaction between the individual and the environments in which they

[17] For example, Rutter and Madge (1976) comment that, *"...in certain subcultures there are behaviours which are normal in that setting although not in the broader community."*

live (those emphasised by ecological systems theories). Furthermore, the criteria that are used to identify 'average' developmental achievements are themselves observer and culture subjective and this is a limitation that is common to any study of human development and not just those that focus on risk and resilience[18].

Finally, although Schoon (2006) maintains the definition of resilience as an observer-subjective process over time that involves successful adaptation despite significant adversity, the paper by Masten et al., (1999) illustrates three specific ways in which this broad definition of resilience has been used:

> *"1.) a positive outcome despite the experience of adversity*
>
> *2.) continued positive or effect functioning in adverse circumstances*
>
> *3.) recovery after a significant trauma"* (Masten et al., 1999)

Importantly, these terms are not presented as mutually exclusive and common within them are the same differences in term-usage that were previously identified as present in 'vulnerable' earlier in the Introduction to this chapter (see Section 1.1.1). Like this earlier term, 'resilience' can be encountered both as a *state-clarifier* (i.e. 'resilient development') and as a *relationship-clarifier* between an individual and a salient developmental effect (i.e. 'resilient to the impacts of...'). Whilst the first two above quoted instances use 'resilience' as a relationship-clarifier (*"outcome"* despite *"adversity"; "positive functioning"* in *"adverse circumstances"*), the third quoted instance uses 'resilience' to clarify an absolute state of development (*"recovery"*). However, regardless of whether resilience is used to describe the outcome of a relationship, or to describe the relationship itself, the literature on developmental resilience has consistently argued that resilience should always involve a developmental outcome that is exposed to developmental risk (e.g. Masten et al., 1999; Rutter, 2008). From this starting point, resilience is then inferred (rather directly measured) on the basis of an adaptive level of development (even if this is only to 'normative' levels'; Masten, 2001) that is facilitated by moderating effects referred to as 'protection'.

[18] A classic example would be the findings of Nunes, Schliemann, and Carraher (1993) concerning context dependent mathematical ability. Some Brazilian children were found to exhibit a much higher level of mental arithmetic when it came to 'real life' financial transactions rather than in the more abstract setting of the classroom.

Protection

> Protective Factors: "*Measurable attributes of individuals, their relationships, or contexts particularly associated with positive outcomes or development in the context of risk or adversity*" (Masten & Gewirtz, 2006)

Understood to underlie the process of resilience are two mechanisms that have been termed '*promotive*' when broadly beneficial (Sameroff, Gutman, & Peck, 2003) and '*protective*' when countering the effects of adversity and risk (Rose, Holmbeck, Coakley, & Franks, 2004). In particular, Rutter (1987) argued that protection refers not to a universal and directly observable factor, but rather to a *process* or mechanism through which the detrimental developmental impacts associated with experiencing risks are mitigated to result in resilience. This point was then furthered by Rutter and Rutter (1993) who compared protection to catalysts and note that the primary role of protection is to, "*...enhance resistance to risk factors*" rather than to have a direct effect on development. As such, A. France and Utting (2005) point out that with this definition, protection becomes something other than the opposite of a risk (that being 'promotion') and that less research evidence has been obtained about these effects rather than those associated with developmental risks (Farrington, 2000). This particular conceptualisation of protection and resilience as *processes* rather than *factors* complicates the respective identification of both (see Luthar, Cicchetti, & Becker, 2000a, 2000b): they rely upon being indirectly inferred rather than directly measured (see below).

As with the identification of developmental risks and resilience, 'protection' is dependent upon the context in which its effects are observed to take place, and the context in which the observation is made (Little, Ashford, Morpeth, & Smith, 2005). So for example, two observers from different cultures can observe a series of factors in a third culture influencing an individual's development. Not only does the culture and context in which the factors operate influence any conclusion of protection, but so too do the cultures of the observers. A. France and Utting (2005) cite a real world example as family size, whilst a larger family size has been identified as posing a risk to child development due an increased likelihood of familial poverty and less parental attention, families can also be a source of protection as they foster nurturing

environments. Rutter and Rutter (1993) comment upon this contextualisation and note that:

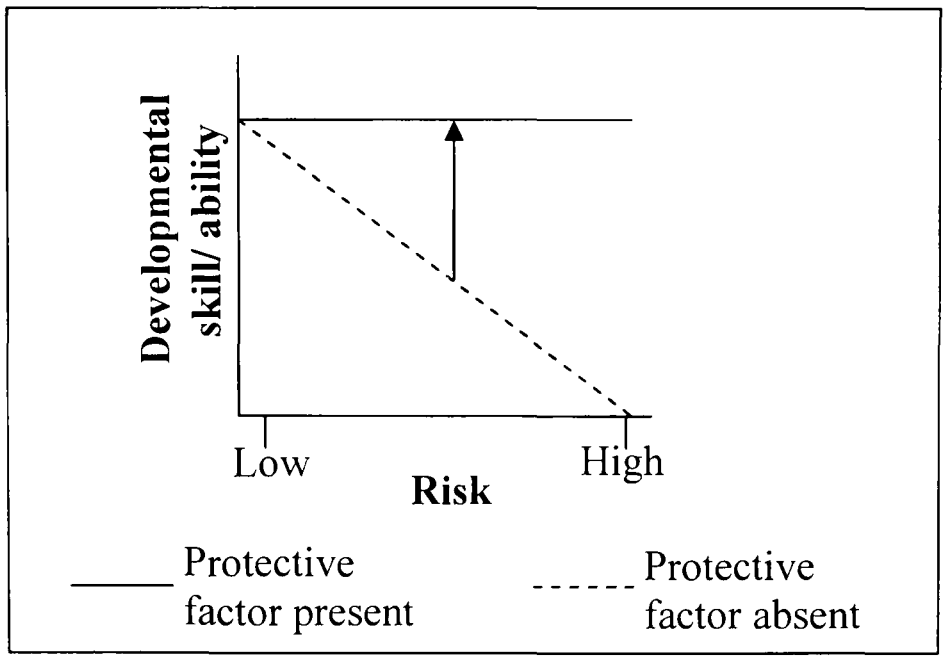
> 1) *"If social interventions are to be beneficial overall, it is necessary to understand the social system as a whole and not just the bit that you want to alter"*
>
> 2) *"The broader environment, including the structure and organisation of society, plays a role in shaping personal experiences"*
>
> (Rutter & Rutter, 1993)

Furthermore, Rutter and Rutter (1993) highlight the importance of *contextual- timing* (again tying in with ecological systems theories and concepts such as the '*Chronosystem*') and note that although both good and bad experiences impact development, the future consequences of either may turn out to be protective. A clear classical example of this would be the sickle-cell gene type conferring partial protection to individuals against malaria (Aidoo *et al.*, 2002). Although in the short term or in a non-malaria exposed context this gene type is undoubtedly deleterious in its effects, in contexts where exposure to malaria is more common it can prove not only protective but even evolutionarily advantageous (Allison, 1954). Such context dependency in the identification of protection led authors such as Rutter and Rutter (*ibid*) to conclude that research needs to focus less on protective factors and more on the mechanisms through which protection operates[19].

Referring back to the issue of detecting instances of protection/buffering effects within *"variable-focused"* studies of resilience, researchers often identify factors that may moderate the effects of risks upon outcomes (Masten & Powell, 2003). Should evidence of a significant moderation be found, this is taken to imply that a protective process has been found within the context of the risks in that investigation. Despite an individual experiencing a degree of adversity that would normally constitute a detriment to their development, it would instead be concluded that a protective factor had been found that mitigated the impact of this risk leading to a higher than otherwise expected level of development (see Figure 1.2).

[19] Thus side stepping the issues of context-dependency and subjective judgement when it comes to identifying factors that are supposed to confer developmental protection.

Figure 1.2 Identifying an ideal instance of 'protection' in studies of resilience



However, making use of the concepts of risk, resilience, and protection in real world interventions is not so straightforward. For example, Melhuish (2004) outlines a 'prevention paradox' that exists when trying to protect the development of young children from the effects of developmental risks which differentiates between risks coming from different ecological levels. Whilst the incidence rate of sub-optimal development (such as learning difficulties or behaviour problems) is commonly observed in disadvantaged communities (i.e. high family level risk), the *absolute* number of cases is actually larger in the general population (due to the simultaneous effects of other risks as well such as those that are biological or genetic). This impacts traditional prevention programmes because they commonly aim to protect development against the effects of family based social risks even though the total impact of all risks is greater and more widely manifest in the general population as a whole. This example serves to highlight the complex challenges that exist when it comes to protecting the development of young children; there are non-independent systematic risks which vary in their ease of detection, their ease of mitigation/protection against, and the cost-effectiveness of programmes that are put forward for doing so[20].

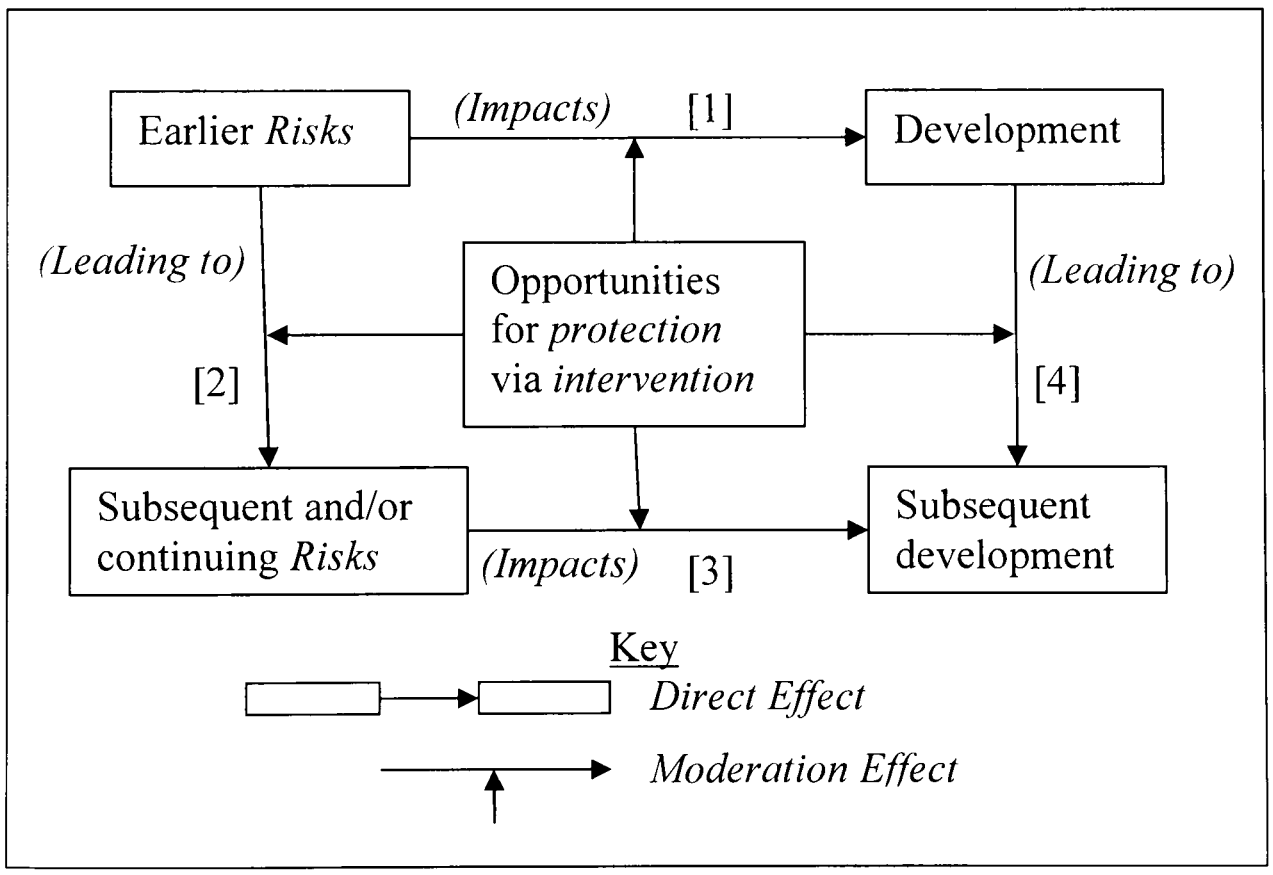
Going into more detail, Schoon (2006) identifies three ecological levels that research has identified as being protective of development: individual attributes such as *"early academic resilience";* characteristics of families such as a developmentally

[20] Section 1.2 elaborates upon attempts made by programmes of Early Education

"supportive family environment"; and aspects of the wider social context such as the *"characteristics of the school environment"*. Together, these are noted as forming a *"triarchic framework of resilience"* as each has been repeatedly demonstrated to be strongly and reliably associated with resilience across a variety of studies and contexts (Luthar, Cicchetti, & Becker, 2000a). Finally, Figure 1.3 presents a graphical overview of the opportunities that exist for protective processes to facilitate development according to the theories and research that have been outlined so far. Over time, protective interventions can moderate/mitigate:

1. the concurrent impacts of risks upon development
2. the continuation of risks and chains of risks over time
3. the impacts of latter encountered risks upon latter development
4. the strong association amongst developmental skills over time

Figure 1.3 The relationship between developmental risks, their impacts upon development, and the opportunities for protection via intervention



Susceptibility

> Vulnerability: *"Susceptibility to a specified negative outcome in the context of risk or adversity"* (Masten & Gewirtz, 2006)

Moving from beneficial risk-moderations to moderations that are deleterious and given the dual-usage of the term 'vulnerability' in the risk and resilience literature (as noted in Section 1.1.1), this thesis uses 'susceptibility' as a replacement synonym of vulnerability. As such, a *'susceptibility'* to the impacts of risks (see Figure 1.1) is understood to be an effect, factor, or process that *increases* the impact of an effect (development risk if negative)on a outcome such that development is significantly *less* than one would expect to find given the risk alone within an average member of a target sample or population. As such, a susceptibility factor (more commonly a 'vulnerability factor' using the definition above) is commonly defined as having the opposing effect to one that is labelled 'protective' (Schoon, 2006). Continuing the running theme of developmental processes that has been emphasised so far and which is commonly encountered in the literature investigating risks and resilience, Luthar and Brown (2007) provide evidence of the centrality of both 'protection' and 'susceptibility' to the concept that is central to this thesis, both are defined as *"processes implicated in resilience"*.

Serving as an introduction to perhaps the most easily understood risk-enhancing susceptibility are genes and their variation whose effects on psychological functioning are commented upon by Rutter and Rutter (1993),

> *"The strength of the effect varies somewhat according to the particular psychological characteristic being considered but, overall, it seems that genetic factors account for some 30-60 per cent of the variation between individuals in the general population"* (Rutter & Rutter, 1993)

Although this quoted range is large enough that it initially suggests invulnerability to some of the relationships between developmental risks and latter developmental sequelae, Rutter and Rutter (1993) also dismiss this notion on the basis of two research-grounded observations. First, *"some genes operate mainly though their effect on susceptibility to environmental influences"* (i.e. Gene *x* Environment interactions[21]), and second, *"...genes are likely to be important in determining*

[21] 'GxE'. For examples see Cicchetti and Valentino (2006), and Rutter and Silberg (2002).

people's exposure to risk environments". The first of these observations postulates an argument for genes altering a physical response to environmental situations (such as encounters with family level risks), whilst the second makes the argument that genes can also be partially responsible in facilitating the exposure of development to the effects of family level risks. For example, the disposition of a child may elicit certain types of parenting behaviours (Bates, Pettit, Dodge, & Ridge, 1998; Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000; Stifter & Bono, 1998) which can then have effects on the same child's development that have been documented as covering the entire range from promoting to detrimental[22] (e.g. Cauce, Stewart, Rodriguez, Cochran, & Ginzler, 2003; Steinberg, Lamborn, Dornbusch, & Darling, 1992).

Cicchetti and Valentino (2006) elaborate upon the relationships that have been found to exist between genetic susceptibilities and environmental risks to development by repeating the emphasis on ecological systems theories[23] which has proved so common to studies of resilience. 'GxE' susceptibility by risk interactions are well explained by these models as they stress the bi-directionality and non-independence of developmentally salient factors and effects. In other words, it is the mutual relationships that are shared between factors that occur across proximal and distal ecological levels (relative to the individual in question) that influence developmental progress and future trajectories rather than any individual factor or effect operating alone. Furthermore, the origin of these genetic susceptibilities to environmental risks have themselves been identified as the result of earlier GxE interactions such as same-sex parental experience of malnutrition during their years of middle childhood (i.e. *"epigenetic transmission"* (Pembrey et al., 2006).

Another extremely important issue regarding the relationship of risks with susceptibilities concerns effects over time and mutual impacts upon development. Because developmental skills and abilities are so strongly associated with future development, so a developmental skill can simultaneously be both an *outcome* that is impacted by risk *x* susceptibility/protection interactions and yet also, a strong *risk* for future development as well. It is this dual conceptualisation of development as

[22] I.e. risk inferring
[23] E.g. Bronfenbrenner (1979, 1986)

partially a product of interacting salient effects *and yet also a* strong predictor of future events that can be seen to underlie the dual usage of the term 'vulnerability' which has been noted in this chapter (see Section 1.1.1). Risk *x* vulnerability[24] interactions are frequently hypothesised to impact development which in turn is then hypothesised to both hinder and constitute a vulnerability[25] in subsequent future development. Such longitudinal effects and mutual risk-development relationships over time is where discussion now turns with firstly an appreciation of young children's adaptations to developmental risks and secondly, the evidence for and means by which these risks can be transmitted intergenerationally.

1.1.2 Young children's adaptations to developmental risks

Because it is common to encounter developmental resilience defined as a positive adaptation of an individual under the context of significant risk (e.g. Rutter & Madge, 1976; Schoon, 2006), an examination of the means by which this adaptation comes to pass provides a very basic conceptual framework for understanding the features and processes that it is necessary for programmes of early education to have in order for them to be effective in protecting development. More to the point, Schoon (2006) also notes that,

> *"Development* [itself] *constitutes a patterning of adaptation across time."*
> (Schoon, 2006)

However, the representation of child development as an interplay of characteristics with ecologies (i.e. adaptation) is complicated by the observation that different children display different adaptations when exposed to the same risk (Rutter, 2006). Rutter (1987) provides two examples, being a girl or having an easy temperament reduces the short and long term developmental effects of exposure to adversity. Moreover, this differing pattern of reaction is also found for children who have been deemed resilient; although they have overcome adversity, some resilient children display greater levels of internal distress than others (Masten, 1997). Offering an explanation for this, Rutter and Rutter (1993) note variations in children's responses to experiences of abuse or neglect, bereavement, unemployment and other major life experiences and then describe how these are driven by behavioural tendencies

[24] As a*ttributive* adjective
[25] As *predicate* adjective

originating from earlier operating genetic and environmental effects (e.g. those 'protective' and 'susceptible' as discussed earlier).

Findings concerning differential patterns of adaptation (such as those above) demonstrate the 'equifinality' and 'multifinality' (see below) that is present in not only in children's adaptation, but also in the ecologies that impact their development (see Cicchetti & Rogosch, 2002 for a detailed discussion) and this similarity illustrates the interplay that exists between these concepts. Acting upon young children's development are child-specific environmental influences which have effects that are altered by child-specific reactions/adaptations (e.g. Kerr, Lopez, Olson, & Sameroff, 2004). In particular, these relationships have featured prominently in studies of psychosocial stressors that focus on the adaptation of the individual to their environments (see Cicchetti, 2003; P. Evans, Hucklebridge, & Clow, 2000) and this is an issue which is returned to later in this thesis (see Chapter 6).

Given that there have been several attempts to conceptualise resilience within theoretical frameworks and models which emphasise adaptation (see Luthar, Cicchetti, & Becker, 2000a; Yates, Egeland, & Sroufe, 2003), it is worth examining these models as it is common to encounter the same broad conceptualisation of development within them as is encountered in explanations of resilience more widely. Two pertinent example are the Organizational Model of Development (Sroufe, 1979), and Schoon's (2006) *"developmental-contextual systems model of adaptation across the life course"*, which although developed nearly 30 years apart, nonetheless offer a similar representation of development which unifies the developmental concepts and relationships that have been discussed so far[26].

Turning first to the Organizational Model of Development (Sroufe, 1979), this *"increasingly popular"* (Yates, Egeland, & Sroufe, 2003) theoretical framework presents human growth (both physiological and psychological) as a continual process of adaptation to both current and previous experiences. Sroufe's model suggests that successful adaptation in the past promotes successful adaptation in the future; a process that is influenced by the ecologies in which individuals are nested. Within

[26] As in Figures 1.1, 1.2, and 1.3

this conceptualisation, 'adaptation' is used to refer to the means by which an individual deals with developmentally salient events (such as starting school in the case of young children). In other words, the physical and social environments in which individuals live serve to shape their future development, whilst development in kind also partially influences the nature of encounters with future environments (Germain & Gitterman, 1996).

The "*developmental-contextual systems model of adaptation across the life course*" is a conceptual model developed by Schoon (2006) in response to the pre-existing literature on resilience and applied to the developmental impacts of socio-economic deprivation (i.e. high family level risk). Schoon's model is grounded in both the classical developmental psychology model put forward by Bronfenbrenner (1986) that emphasises ecologies of development, and in sociology driven 'life-course theory' (e.g. Elder, 1998). Combining both, the model proposes an ongoing interacting set of contexts which frame a person's life and which have bi-directional relationships not only with the individual over time, but also between themselves. Mirroring Sroufe's (1979) theory, salient proximal and distal environments are conceived as both emerging from and also shaping an individual as time passes (via 'adaptation' as defined above) within a context of a continually changing wider society.

Within such a broadly yet consistently conceived heuristic framework as that of Sroufe (1979) and Schoon (2006), the concepts of and relationships between risk, resilience, protection, and susceptibility (vulnerability) can be easily understood. Risks are negative probabilistic relationships for future development and adaptation, protective factors/relationships reduce the impacts of risks, susceptibilities increase these, and resilience is a final resultant process whereby an individual is exposed to significant cumulative risks and yet does not manifest an adaptive response that is commonly associated with it (Yates, Egeland, & Sroufe, 2003).

Leading on from the theories of Schoon (2006), Sroufe (1979), and Bronfenbrenner (1986) are two further clarifying terms which are specific to the differing observed relationships noted as existing between environments and individuals and which are of relevance to this work: multifinality and equifinality. '*Multifinality*' refers to different patterns of adaptations specific to each individual in response to any given

experience (e.g. a risk), whilst '*equifinality*' refers to different patterns of environments and adaptations that end up leading to the same outcome (e.g. a successful adaptation). Finally when both these ideas and the conceptual frameworks in which they are applied are extended across multiple human lifetimes, there then emerges a theory for the intergenerational transmission of risk itself and an explanation of cycles of disadvantage. It is to such theory that discussion now turns.

1.1.3 The intergenerational transmission of developmental risks

Clarke (2006) and Deacon (2003) both stress how the intergenerational transmission of family based social risks, via 'Cycles of Disadvantage' (see Rutter & Madge, 1976), has a long research history that has stressed the nesting of individuals and their risks within families, and families within wider communities (again highlighting ecological systems theories). Furthermore, with explicit emphasis on the passage of time and the existence of relationships across this, it is common for studies of the intergenerational transmission of risks to pay especial heed to cumulative effects (pertinent to developmental risks), individual's adaptations (pertinent to protection and susceptibility), and instances of multi- and equi-finality (pertinent to resilience).

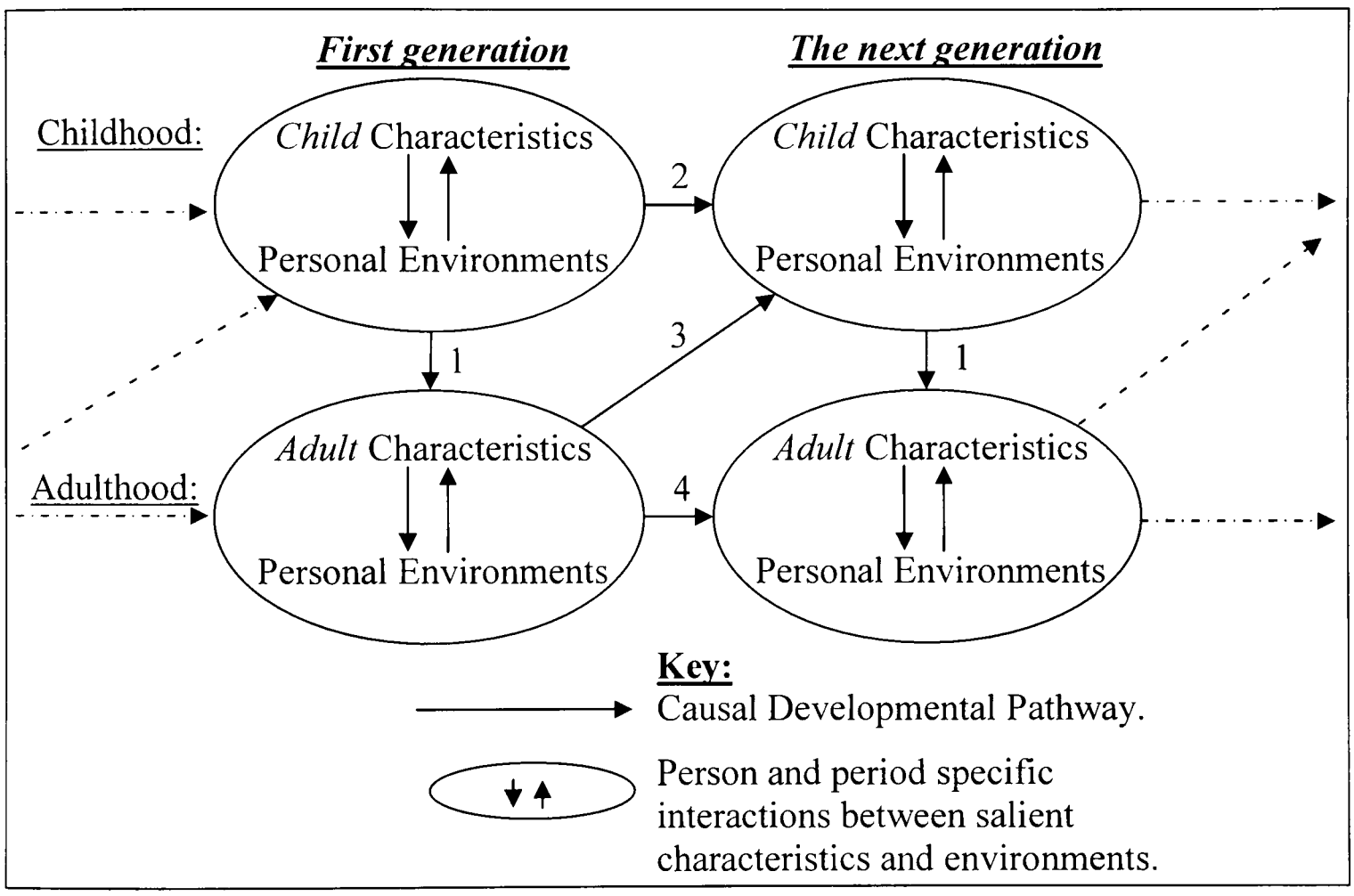
More generally though, some of the most important effects to be identified in studies of child development are those which have been found to act across generations (see Figure 1.4 below). The adversity (*the risks*) and susceptibilities (*vulnerabilities*) of one generation have been found to be passed on, often facilitated by family processes (e.g. parenting; Saltaris et al., 2004) and structures such as warmth of mother-child interactions and the physical condition of the home (Brooks-Gunn, 2000). Furthermore, similar mechanisms to those that shape children's development have also been found to underlie these intergenerational effects. In both cases, mechanisms of transmission have been found that focus on both the *individual*[27] as well as on the wider *environment*[28] in which they develop.

Figure 1.4 expands upon the idea that individuals interact with their environments by including the progression of time in this relationship. The arrows labelled 1-4 represent these *developmental pathways* that have been found to operate through

[27] E.g. the aforementioned '*epigenetic transmission*' (see Pembrey et al., 2006)
[28] E.g. the aforememntioned *'cycles of disadvantage'* (Rutter & Madge, 1976).

biological, psychological, and sociological mechanisms (see below). Rather than development being at risk due to the interaction of individual's characteristics with their environment, development is instead at risk due to the *continuing* interaction of these processes with one another *over time*. As an example, consider the similarity of the childhood experiences of two generations (path 2); this is partially dependant upon (*mediated*[29] by) the adulthood experiences of the preceding generation (paths 1 then 3; see Hops, Davis, Leve, & Sheeber, 2003).

Figure 1.4 The intergenerational transfer of risk: Mediation through the interplay of characteristics with environments (adapted from Serbin & Karp, 2004)



From this understanding it can be seen that underlying the transmission of risk between the generations are mechanisms which mirror those of within-generation risk effects themselves and that although these mechanisms each operate at a different ecological level, these also interact with one another. For example, Pembrey (2002, 2006) found detrimental effects on children's development originating from changes in the gene expression of parents and grandparents who smoked or endured periods of food scarcity during their childhood slow growth periods (path 2 in Figure 1.4). However, this *biological* mechanism ('*characteristic*') was also facilitated by the

[29] For more on *mediation*, see Chapter 2 Section 2.4

social mechanism (*'context'*) of cycles of disadvantage (Rutter & Madge, 1976). Disadvantage has been found to lead to both an increased likelihood of an earlier onset of smoking (O'Loughlin, Paradis, Renaud, & Gomez, 1998) as well as poorer nutrition during childhood (D. Wood, 2003).

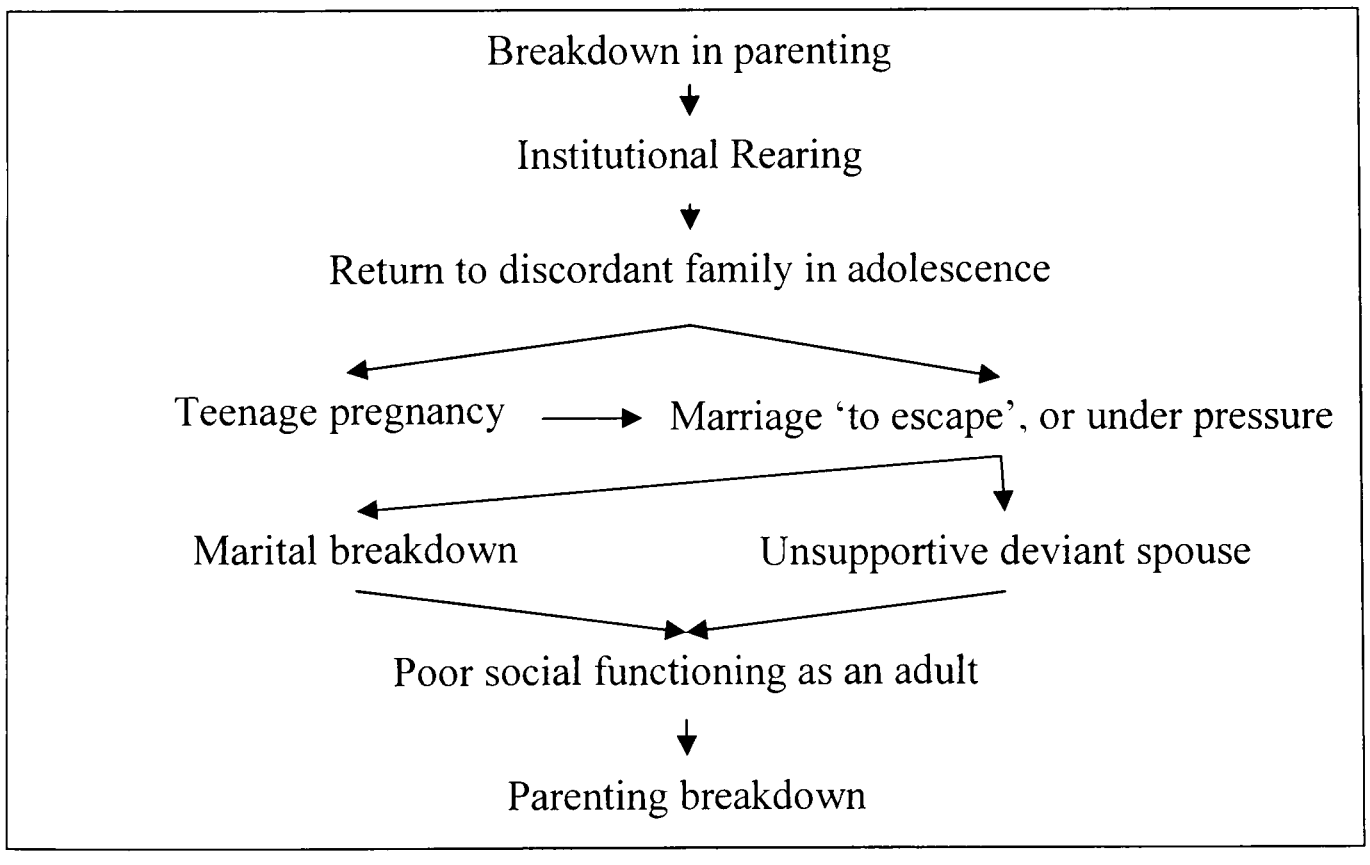
The association between social and biological mechanisms of risk transference implies that social disadvantage and the poverty with which it is associated constitutes a very serious risk not only because of its own intergenerational transmission (e.g. through *"cultures of poverty"*, Ortiz & Briggs, 2003), but also because it can facilitate a chain reaction (Rutter & Rutter, 1993) involving co-occurring biological mechanisms. The work of Walsh (2002) serves as an example illustrating just how pervasive and detrimental the effects of poverty and social disadvantage can be. Poverty was found to have detrimental effects on children, their parents, and on the interactions of children with their parents (thereby the entire family unit). Furthermore, these are effects that have been found to be magnified by persistent poverty (e.g. D. Wood, 2003). Consequently and because poverty impacts the entire family unit, it can also be seen to impact each of the intergenerational pathways that are illustrated in Figure 1.4 (paths 2-4). Such pervasive effects have led poverty (construed here as a family level combined risk) to be regarded by some authors as *"the greatest risk factor of all"* (Schorr, 1988), both for its impact on children's development but also for the subsequent development of the next generation of children as well.

At the same time however, the very existence of intergenerational continuities of developmental risk has also been widely debated and has even resulted in authors such as Kauffman and Zigler (1989) dismissing such effects and claiming that, *"...the time has come for the intergenerational myth to be placed aside"* a comment that was refuted by Belsky (1993) and is discussed in detail in Belsky and Jaffee (2006). The seminal book by Rutter and Madge (1976) offers some explanation as to the continuation of this debate: because risks and their effects occur as chain reactions over time, so identifying the persistence of one particular *risk factor* (such as poor parenting) is complicated. In this instance, the real source of intergenerational risk might not lie in parenting, but in consistent social environments or even common political structures that exist over multiple generations. Furthermore, Rutter and

Madge (*ibid*) also comment that although intergenerational transmission has often been demonstrated, the exceptions are many[30] (repeated in Schoon, 2006) even given a background of extreme poverty.

Turning to a *"classic"* (Belsky & Jaffee, 2006) real-world example of the intergenerational transmission of risk (and fitting with the theoretical model presented in Figure 1.4). Figure I.5 illustrates the chain of effects that were found to underlie an intergenerational transmission of parenting breakdown[31]. An experience of extremely poor parenting during childhood (such that a child was taken into care) was found to lead to subsequent poor social functioning as an adult (path 1 in Figure 1.4), then poor social interactions and decision making, and finally to a breakdown in these individual's own parenting (path 3 in Figure 1.4). Thus poor parenting was observer across consecutive generations of adults (path 4 in Figure 1.4) which was facilitated (*mediated*) by chains of interactions between individuals with their environments and their own children.

Figure 1.5 Simplified model of intergenerational transmission of parenting breakdown (from Rutter & Rutter, 1993)



[30] Hence forming the basis for a study of resilience
[31] Taken from the report of the work of Quinton and Rutter (1988) in Rutter and Rutter (1993)

However, many of the studies of intergenerational transmission of risk such as that of the cycle of parental maltreatment of children, are based upon the historical self reports of participants which Belsky and Jaffee (2006) suggest may not always be accurate. Whilst the validity of the accounts of severe traumas and stressors is relatively self-evident, this cannot be said of more general parenting practices. So it is that much of the literature on intergenerational continuities has been of limited validity since the methodology has often been weak due to retrospective participant reports (hence the continuing debate mentioned above). Conjecturing on the reality of underlying causal mechanisms, Belsky and Jaffee (*ibid*) distinguish between subsequent parenting behaviours that were learnt either *explicitly* during childhood (e.g. through psychological *modelling*[32] or *reinforcement*[33]), or *implicitly* through altered parenting styles (e.g. attitudes and/or values). Although parent-child attachment theory (Bowlby, 1969) is proposed as offering a theoretical basis by which these mechanisms operate, Belsky and Jaffee (*ibid*) also stress that the exact processes driving variations in the continuity of parenting and its internalisation remain, as yet, unknown.

1.2 The contribution of early education to the vulnerable and resilience developmental pathways of young children

Moving on from the discussion of developmental risk, resilience, protection, and vulnerability, one of the many factors that has been conjectured to have an impact upon all of these are programmes of early education (e.g. Borge, Rutter, Cote, & Tremblay, 2004) and discussion now turns to these programmes and their effects. The first point to make however is that the evidence surrounding both have come from two distinct areas of research: that concerning typical programmes of community based child care and education, and that concerning special programmes of Early Intervention (EI) for 'at-risk' children (Peisner-Feinberg, 2004). However, because this investigation aimed to investigate how the former of these (commonly referred to as 'child care' and/or 'pre-school'; see below) impacted upon the relationships shared between developmental risks and young children's developmental pathways, so the subsequent discussion considers research evidence from both areas. Furthermore, the following sections of this literature review highlight the sparsity of the previous

[32] As in classical Social Learning Theory (Bandura, 1977)
[33] As in classical Operant Conditioning (e.g. B.F. Skinner, 1963)

research that has aimed to investigate this issue and this serves both to support the aims of this thesis and the simultaneous consideration of both sets of research findings. As Peisner-Feinberg (2004) commented,

> *Whereas several studies have explored the longitudinal effects of early intervention programmes, few have examined the effects of children attending community child care programs as they make the transition from pre-school to elementary school."* (Peisner-Feinberg, 2004)

The differences between the effects associated with programmes of EI and those of early education and care are however far from trivial. Whilst the long term effects of EI have been demonstrated on both children's cognitive and social development, and have been strongly linked to intensive (high duration and frequency of attendance) high quality experiences, these programmes do not reflect the pre-school experiences of the majority of children. As such, the usefulness of their findings for accurately informing us about the likely effects of programmes of child care and education is therefore limited. Peisner-Feinberg (2004) again provides a historic overview of the attempts that have so far been made to draw together these separate fields of inquiry under a focus on developmental risk and reports the few studies that have so far been carried out with this as an explicit objective. Citing research by Burchinal, Peisner-Feinberg, Bryant, and Clifford (2000); Hagekull and Bohlin (1995); the NICHD (2000a); Peisner-Feinberg and Burchinal (1997); and Peisner-Feinberg *et al.*, (2001), Peisner-Feinberg (2004) identified that research has shown inconsistencies in any benefits that have been associated with pre-school attendance on the development of high risk children, with some studies even identifying no protective effects (NICHD, 1998, 2000b). Another example is the paper by Borge, Rutter, Cote, and Tremblay (2004) who put forward the claim that early education and care can act as a factor that can be both *protective* and also *risk-enhancing* (i.e. 'susceptible' see Section 1.1 and Figure 1.1) of the developmental impacts associated with developmental risks.

Although earlier attempts to bring together the research on developmental risk and early education have proven inconsistent in their findings, when one appreciates that these have been conducted over four waves of research into developmental risk and resilience (Masten, 2007) and three waves of research into early education and child care (Melhuish, 2004; Sammons, Sylva et al., 2002), this is perhaps less surprising.

Both fields have seen dramatic recent increases in their generation of theory and knowledge which investigations aiming to integrate and build upon have had to negotiate (e.g. changing definitions[34]). Providing just one example of perhaps the most important consistency that has been found across these studies is found in the paper by Borge, Rutter, Cote, and Tremblay (2004). They argued that the nature of any effect associated with early education upon development and its relationship to developmental risk was related to the *'quality'* of the programme of early education, i.e. whether this is deemed to be high or low (insofar as this is possible).

Another important issue that is encountered when reading the following passages is one commented upon by Melhuish (2004): within Britain it has proved common for different terminology to be used to describe the provision of group-based programmes of early years child care and education. For under threes, provision is usually referred to as *"childcare"* whilst for the over threes (and under fives), the term is usually *"pre-school"*. Furthermore, another repeating theme found through this section of the thesis (and subsequently returned to in Chapter 6) is that of early education for an entire population, and targeted early education as intervention to protect the development of children exposed to the risk that is inherent to social disadvantage. With this in mind, the following sections present firstly an introduction and history of early education in Britain; secondly the possibility of, and means by which, programmes of early education might protect development; thirdly the role that the quality of these programmes might have upon young children's cognitive and social development; and fourthly and finally, an in-depth exploration of findings relevant to this that were found by the largest European study to investigate the effects of British early education and care: the Effective Provision of Pre-school Education project (EPPE).

1.2.1 Introduction to, and history of, early education in Britain

Whether it is entitled *nursery education*, *day care*, *child-care*, *early years services*, *the foundation stage/phase,* or *early education* (Sylva et al., 1999), the origin of today's system of British early education lies in a back and forth interchange of ideas

[34] E.g. *developmental vulnerability* and *developmental resilience* as discussed earlier in Section 1.1

during the past century (and beyond) between researchers in various countries[35] but especially the USA (e.g. the *"War on Poverty"*) and the UK (e.g. the early ideas of McMillan, 1919; see Smith, 2008) with differential take-up of the concept by countries around the world. By the mid-twentieth century, Britain was lagging behind its European neighbours such as France and Belgium[36] (Jackson, 1993; Lewis, 2003; Randall, 1995). Although Robinson (1998) also noted that significant progress had been made in the amount and quality of provision offered in the UK since the 1960s, this was also described as not having been equally available to all families. The historical account of E. Wood (2007) describes how the progress of British early education and care was associated with the combating of the impacts of developmental risks via protection:

> *"From being at the margins of government policy in the first half of the twentieth century, early childhood is now central to policy visions and aspirations towards improving the quality* [see Section 1.2.3] *of education and care, tackling social exclusion* [i.e. family based social risks], *promoting early intervention* [i.e. protecting development from the effects of risks], *and enhancing life chances* [i.e. developmental pathways] *for children and their families..."* (E. Wood, 2007)

Thus combating the effects of what can be termed 'family level risk' (i.e. poverty, adversity, or social disadvantage) was always a central objective of historical Early Intervention programmes and in the USA in particular, was especially notable in the early days of the Head Start Early Intervention programme that was founded in the 1960s (the significance of which remains despite an early negative evaluation by the Coleman report in 1966). Furthermore, Robinson (1998) notes that the broader educational policy prevalent in the USA during the 1960's and 70's was one concerned with equality of educational opportunity for all, the notion of 'social justice', and in particular a desire to reduce socio-economic group differences in 5 and 6 year old children's motivations, attitudes, knowledge, and skills.

[35] For example, Kwon (2002) names Jean-Jacques Rousseau, Friedrich Fröbel, Robert Owen, and Susan Isaacs as early pioneers.
[36] Which Randall (1995) argues is a result of a non-interventionist political ideology stemming from a historical precedence in Britain that favoured liberal state policies. See also Lewis (2003).

Bringing the discussion back into the context of British early education, after the 1967 Plowden Report (CACE[37], 1967) and its simultaneous promotion of nursery schools alongside a critical stance on full-time placement for under-threes and of full time working mothers (as highlighted in N. Browne, 1996; Jackson, 1993[38]), the British view of the role of early education for the under fives slowly aligned itself with that of the USA[39]. However, even with this being the case, A. France and Utting (2005) maintain that an integration of the fields of educational research with that of developmental risk and resilience did not take place in the UK until the 1990s. By way of support, N. Browne (1996) comments that British State involvement in early education[40] (evidenced in the 1968 Seebohm Report on the organisation of local authority services and the 1974 Finer Report on one-parent families; Randall, 1995) was triggered by children being labelled as *"in need"*, a comment that echoes Robinson's account of the State promotion of early years education in the USA throughout the 1960s and 70s to counter the effects of poverty. However the small increase in state funded provision that this led to was swiftly countered by one of Margaret Thatcher's first acts as Prime Minister: the relieving of the responsibility for local authorities to provide nursery education (Jackson, 1993).

This period of time also saw repeated changes in the terminology that was used to describe those whose development might now be described as 'at high risk'. Once these children might have been described as 'backward', then, 'culturally deprived', and then most recently, 'disadvantaged' (Robinson, 1998). Regardless of the terminology that was in use or the country in which policies of early education and care were being enacted (N. Browne, 1996), S. L. Kagan and Zigler (1987) reiterate caveats from both the USA (citing Edward Zigler) and Britain (citing Barbara Tizard) that stress that there are inherent limitations to the combating of poverty/disadvantage which could be expected from a compensatory effect of early years education. Furthermore, this is a view which is still found, with some scholars remaining highly sceptical of any protective effect (e.g. Belsky, 2001).

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[37] Central Advisory Council for Education

[38] *"...it is generally undesirable, except to prevent a greater evil, to separate mother and child for a whole day in nursery... it is no business of the education service to encourage these* [working mothers]." (CACE., 1967)

[39] See Clarke (2006) for details.

[40] *"Then nursery-infant"* (E. Wood, 2007).

In addition to the historical emphasis on the combating of the effects of poverty, the mid-twentieth century also saw a quieter, but still present appreciation in Britain that high quality early care and education might also be able to mitigate the developmental effects of non-poverty related developmental risk as well. E. Wood (2007) notes the comments made by Whitbread (1972) that children from middle-class families can also experience poor parenting that is characterised by insufficient intellectual stimulation and which can leave children, *"emotionally crippled"*. This emphasis on the possibility of early education to mitigate more than just the effects of poverty (then the policy-drivers of early education and care in Britain) was also mirrored in the concurrent policies of European nations which were more concerned with individual child-focused issues in development (e.g. 'personal risks') such as that concerning demography and gender equality (see Smith, 2008).

The issue of labels for programmes of child care and education prior to primary school has historical origins which carry with them important ramifications for their effects on children's development. N. Browne (1996) identifies dual and parallel programmes referred to as *"pre-schools"* which emphasised skills, knowledge, and attitudes (Robinson, 1998), and *"child care"* such as playgroups[41] which emphasise various kinds of play (Lewis, 2003; Robinson, 1998). Within Britain, this duality can be traced back to 1918 and the administration of *"day-care provision"* by the Ministry of Health and *"nursery education"* by the Ministry of Education (Randall, 1995). As such, by the mid 1990's there was a plethora of provision types within Britain with each offering a different combinations of care and education, briefly called, *"educare"* (Randall, *ibid*) and which was unique in Europe. N. Browne (*ibid*) describes seven types that could be found in Britain at that time:

1. *Nursery schools and classes run by LEA*. Staffed by trained nursery teachers and nurses and providing full or part time education for 3-5 year olds (catering for ~26% of children)
2. *Private nursery schools.* Comparable in service to LEA nursery schools but no necessity for staff to be trained to the same level (catering for ~3.5% of children)

[41] Emerging in Britain during the 1960s (Browne, 1996)

3. *Reception Classes.* Catering for 4 year olds in primary schools. Free but no necessity for teachers to have been trained to deal with very young children and with an often poor staff-child ratio that was not as good as that in nursery schools (catering for ~47% of 4 year olds)
4. *Local authority/private day nurseries.* Similar to Nursery schools, except the age ranges of children was wider: from a few months of age to 5 years. Local Authority day nurseries were administered/run by the local Social Services [*percentage not given by N. Browne*].
5. *Combined nursery centres.* Jointly run by local Social Services and the corresponding LEA. Were relatively new at the time (mid-1990s) and combined two previously disparate strands of care or education. They were the forerunner of today's Children's Centres [*percentage not given by N. Browne*].
6. *Registered childminders.* Often privately funded though occasionally paid for by Social Services (targeted at high risk families), registered individuals were and are allowed to care for up to 3 children in their own home (catering for ~10% of children).
7. *Playgroups.* Aimed to provide education through play for 2-4 year olds (thus very much of the 'care' approach). Majority are non-profit and staffed by relatively untrained works/parent helpers (catering for ~60% of children).

This unique state of provision of programmes of early education and care eventually led Britain to develop the recent Children's Centres as a new integrated approach to care with education which was based on 'joined up thinking'[42] and which were inspired by Ball's recommendation in 1994 that the British Government should,

> *"Immediately prepare legislation to create by 1999 a statutory responsibility for the provision of free, high quality, half-day* ***pre-school*** *education for all children from the age of three, in an integrated context of extended* ***day-care****."* (Ball, 1994; emphasis added)

[42] As evidenced in the new terminology of, *"Early Childhood Education and Care (ECEC)"* (Bertram & Pascal, 1999)

To link Children's Centres with the combating of developmental risks via protection to result in resilience and similar to their forerunners 'Family Centres' (see Jackson, 1993), these most recent programmes of early care and education are often found in deprived high risk neighbourhoods or communities (Sylva & Pugh, 2005; E. Wood, 2007)[43] in what may be considered as a form of community based primary prevention (Smith, 2008). In turn, this is a dramatic change within Britain as in the the 1980s research showed that children and families *"with severe problems"* such that they could possibly benefit most from the very highest quality programmes of early education and care possible (see Section 1.2.3) were also the least likely to get it (Ferri, 1981; in Jackson, 1993).

Moving on to the present day, Britain's current Early Years Foundation Stage (EYFS) statutory framework and the previous curriculum (QCA & DfEE, 2000) has as one of its goals, *"equality of opportunity"* (DCSF, 2008) which demonstrates how the combating of risks through combined early years education and care is now an objective of the current British Government. Existing as one part of a trio of new millennium policies[44] all of which were enacted by the current British Government to promote child-centred early education (see Smith, 2008; E. Wood, 2007), the equality of opportunity that is aimed for is intended to be achieved through achieving equality in six domains of young children's development (E. Wood, 2007): Language and literacy; Mathematical development; Knowledge and understanding of the world; Creative development; Physical development; and Personal, social, and emotional education. Finally, it is to such 'opportunity equalising' (i.e. mitigation of the impacts of developmental risks) and the means by which this might be accomplished in programmes of early education that this literature review now turns.

1.2.2 Can early education *protect* the development of young children:

Given that research has shown and government policies assume that programmes of early education can support beneficial psychological processes in children then it is a relatively small step to propose that such programmes may therefore also be able to alter the trajectory of developmental pathways from ones resulting in future

[43] Which can be seen as a re-labelling of the Educational Priority Areas (EPA) that arose from the Plowden Report (Smith, 2008)

[44] The others being the Sure Start Programme, *"Every Child Matters"* (DfES, 2004); and, *"Birth to Three Matters"* (DfES & Sure Start, 2002)

vulnerability to ones resulting in resilience. A. France and Utting (2005) argue that just such a proposition has been put forward as the basis of a *"risk and protection-focussed prevention paradigm"* that emerged in Britain and the USA in the 1990s and which was based upon the notion that cumulative indices of risk (see Section 1.1.1) operate both across and within multiple ecological levels of young children's development (drawing upon work by Bynner, 2001; Farrington, 2000; Rutter, 1980).

First and foremost though, this thesis shares its perception of programmes of early education with that espoused by Chryssanthopoulou, Turner-Cobb, Lucas, and Jessop (2005): both conceive early education to be an environment that facilitates social interactions and which thereby creates the possibility of fostering resilience in development. In their discussion of the benefits of early education upon children's response to psychosocial stressors, Chryssanthopoulou *et al.*, (*ibid*) propose that early education has been often overlooked as being able to *protect* development from the impacts associated with these. Moreover, they report that although early education can have potentially negative effects (echoing the caveats stated above such as that of Belsky, 2001), it can also encourage children's development, including via the mitigation of effects that are associated with familial adversity (see A. Goodman & Sianesi, 2005). Marshall (2004) supports this view in arguing that such amelioration is only possible because programmes of early education are social environments consisting of nested structures of social interactions ensconced within child focussed ecologies.

Since programmes of early education are hypothesised to be environments creating the social interactions that are theorised to underlie developmental resilience, it is important for this investigation to differentiate programmes of early education and care from Early Interventions (EI). Here, a programme of early education alludes to a centre-based programme that is most commonly referred to as *'pre-school'* (i.e. not childminders, *au pairs*, or extended family care). Because so many different types of provision exist within Britain though, this definition also refers to the six most common types of provision that were offered during the 1990s (due to the timing of the data that is subsequently analysed): *playgroups*, local authority and private *day nurseries*, *nursery schools*, *nursery classes*, and *combined centres* (Sylva et al., 1999). However, whether programmes of early education have beneficial or detrimental

effects on children's development (as in the earlier example of Borge, Rutter, Cote, & Tremblay, 2004) depends upon the '*quality*' of the provision which is often differentiated according to 'structures' and 'processes' (Currie, 2001). Whilst 'structural quality' refers to centre characteristics such as staff:child ratio, it is 'process quality' that has commonly distinguished the impacts of early education (see Section 1.2.3). This association has been found not only in British programmes of early education (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004) but also in programmes in other countries (e.g. the USA; see NICHD, 2003a).

The possibility that programmes of early education can protect the development of children from the impacts of risks and the extent of this belief in current policy and research is evidenced by presentations to the British government's 1998 cross-departmental Comprehensive Spending Review (see Oliver, Smith, & Barker, 1998) of the research findings from the risk and resilience literature. These were put forward as the research basis forming a rationale for the provision of State-funded high quality early education to protect the development of young children. Going into more detail, Clarke (2006) reports just how explicitly both theory and findings from the literature concerning developmental risks, resilience, and protection were put forward to the ministerial steering group and civil servants. They were introduced to the ideas of *'distal'* (e.g. poverty) and *'proximal'* developmental risks (e.g. low birthweight), the difficultly of unpacking distinct independent effects that are associated with individual risks over and above the effects of others, the need for a holistic view of developmental risk (e.g. cumulative indices)[45], and finally how developmental protection lies in the quality of relationships that are shared between children and their carers[46], the topic which is examined here.

Perhaps unsurprisingly given the depth of the research evidence presented, the 1998 Comprehensive Spending Review of the British government eventually led to the Sure Start programme of early education (see below) which was explicitly grounded in the research investigating developmental risk and resilience (e.g. that presented in Section 1.1). Clarke (2006) details the aims of this programme which serves to provide

[45] All of which was discussed earlier in this literature review
[46] Explicitly stated as parents, but it's a small step to extend this to other caregivers such as those in pre-schools.

evidence of just how widely it is now acknowledged by British policy makers and researchers that high quality early education can protect the development of young children,

> *"The stated aim of Sure Start is to ensure that children from poor families arrive at school ready to 'flourish'. This is seen to be affected both by the quality of parenting and by access to high quality pre-school services which offer children experiences that are valuable in their own right and that compensate for parental and environmental inadequacies."* (Clarke, 2006)

However, the case of British Sure Start also serves to exemplify the difference between programmes of Early Intervention and those of early education and care. Although Sure Start was based upon the American EI 'Head Start' which was targeted at the poorest families of pre-school children, Sure Start did not do this (A. France & Utting, 2005). Instead and to avoid stigmatising families, Sure Start centres were located in geographically deprived neighbourhoods but did not target specifically poor children, as does Head Start. Whether this move from a programme of EI to one of community based care and education will lessen the effectiveness of the programme to mitigate the effects of risks is open to debate. For example, the presence of 'sleeper effects' (i.e. those operating though chain reactions as discussed in Section 1.1) in Head Start meant that the full impact of the EI programme was not known until the children were in their late teens (A. France & Utting, 2005). Furthermore, programmes of early education and care must also never be viewed as a panacea for the effects of developmental risks. As Brooks-Gunn (2000) commented in relation to the developmental risk of poverty and the mitigating impacts of Early Interventions such as Head Start,

> *"...if policy makers believe that offering early childhood intervention for two years (or even three) will permanently and totally reduce SES disparities in children's achievement, they may be engaged in magical thinking."* (Brooks-Gunn, 2000)

To interrupt the intergenerational transmission of risk?

Moving on to consider the possibility of even longer term protective effects coming from programmes of early education and care, Clarke (2006) identified that since 1999, the idea of an intergenerational transmission of a family based social risk that is

born out of childhood poverty[47] has become explicit in the minds of the current British Government; it is no longer solely an issue investigated and discussed amongst researchers. Furthermore, the combating of such intergenerational transmission is also noted to have been tackled through,

> *"...interventions that aim to change parenting practices in poor families and to provide poor children with high quality early education, in order to counteract the effects of their poor social and physical environment and produce a better future generation of adults."* (Clarke, 2006)

As such, the notion of education being employed as a form of primary EI for the combating of the intergenerational transmission of risk can hardly be considered a new idea. However, what is new is the recent re-conceptualisation of the ideas of developmental risks, their origins, forms, and transmission (see Section 1.1.3), and this progression/accumulation of ideas has in turn led to new theories of intervention. This is perhaps most evident in the changing nature of pre-school care and education which, in Britain at least, has moved from mainly private and voluntary based systems of *ad-hoc* and distinct care and education (see Section 1.2.1), into more cohesive and state funded programmes such as Sure Start (see DfES, 2004) and Children's Centres (see Smith, 2008).

Within Britain, the largest and most recent early education based attempt to interrupt the intergenerational transmission of family based social risk (i.e. poverty/ disadvantage) has come from the Sure Start programme (see Clarke, 2006; Glass, 1999). Based on a 1997 review that focussed on the family and community policies that would be needed to counter the effects of cycles of disadvantage operating on young children younger than eight, this was soon changed to the under fours due to problems in service provision and because an early 'intervention' was judged to offer the greatest potential (Clarke, 2006). Based upon a series of seminars given by scholars versed in the risk and resilience literature (see Section 1.2.1), an inter-generational (child and parental) community based programme of early intervention and family support was drawn up[48] to, *"help break the cycle of social exclusion"* (Glass, 1999). The content of the seminars that were given in this review

[47] i.e. A *"cycle of disadvantage"* (Rutter & Madge, 1976)
[48] Based on the notion of 'social justice' through 'social investment' and based upon ecological systems theory such as the classic work of Bronfenbrenner (1979, 1986)

demonstrates just how close the association has become between matters of developmental risk and resilience, their intergenerational transmission, and the role of early education in this. Clarke (2006) cites the content of the seminars as including:

> *"1.) The factors that contribute to the risk of social exclusion*
>
> *2.) The effectiveness of Early Interventions*
>
> *3.) Suggestions for possible action in the UK"* (Clarke, 2006)

Rolled out in 1999, by the end of 2004, 524 local Sure Start programmes were in operation and aimed to reach a third of all children aged under four who were living in poverty in an effort to promote their physical and psychological development (both cognitive and social) across both the short and long terms (see Section I.2.3 for examples of the underlying evidence base). However, as from 2006, local Sure Start programmes had since begun to be integrated into Children's Centres, much like the Neighbourhood Nurseries Initiative, another pre-school based initiative that was designed to tackle the impact of disadvantage on young children's development (Sylva & Pugh, 2005). The consequence of these mergers has been the simplification of the previously offered separate services into a single locally and family based (parent and child) provision of care and education during the pre-school period.

Referring back to the possibility that developmental pathways can be altered, this has also been investigated both within and between generations of children (e.g. Serbin & Karp, 2004) and whilst positive long lasting effects on development have been found, these have proven somewhat irregular when investigating early education (e.g. Peisner-Feinberg et al., 2001). However, those effects that have been found suggest indirect effects (e.g. chain reactions) that might last across generations (e.g. partially mitigating the effects of poverty; Raut & Heckman, 2005). Again though, early education needs to be distinguished from Early Interventions as each has different effects which originate from their differing purposes (i.e. *supplementation* of family care vs. *intervention* in family care; see Curtis & Nelson, 2003).

Early Interventions recognise that to shift developmental trajectories from future vulnerability (maladaptation) to resilience (adaptation), active engagement with the processes that produce the initial maladaptation must take place (see Masten & Coatsworth, 1998). To this end, effective interventions have been found to target not

only the child, but also their families so as to elicit beneficial changes that will last once the intervention has finished (see Figure 1.6, and Votruba-Drzal, Coley, & Chase-Lansdale, 2004). Such is not the case with early education. Since it is not usually targeted at vulnerable groups of children and is commonly rolled out on a much larger scale (meaning less resource per child), programmes of early education and care, unlike Early Interventions, have typically focused on children individually rather than on entire family units (see Henrich & Blackman-Jones, 2006).

Figure 1.6 Comparing the impacts of Early Interventions and early education in the intergenerational transmission of risk (adapted from Serbin & Karp, 2004)

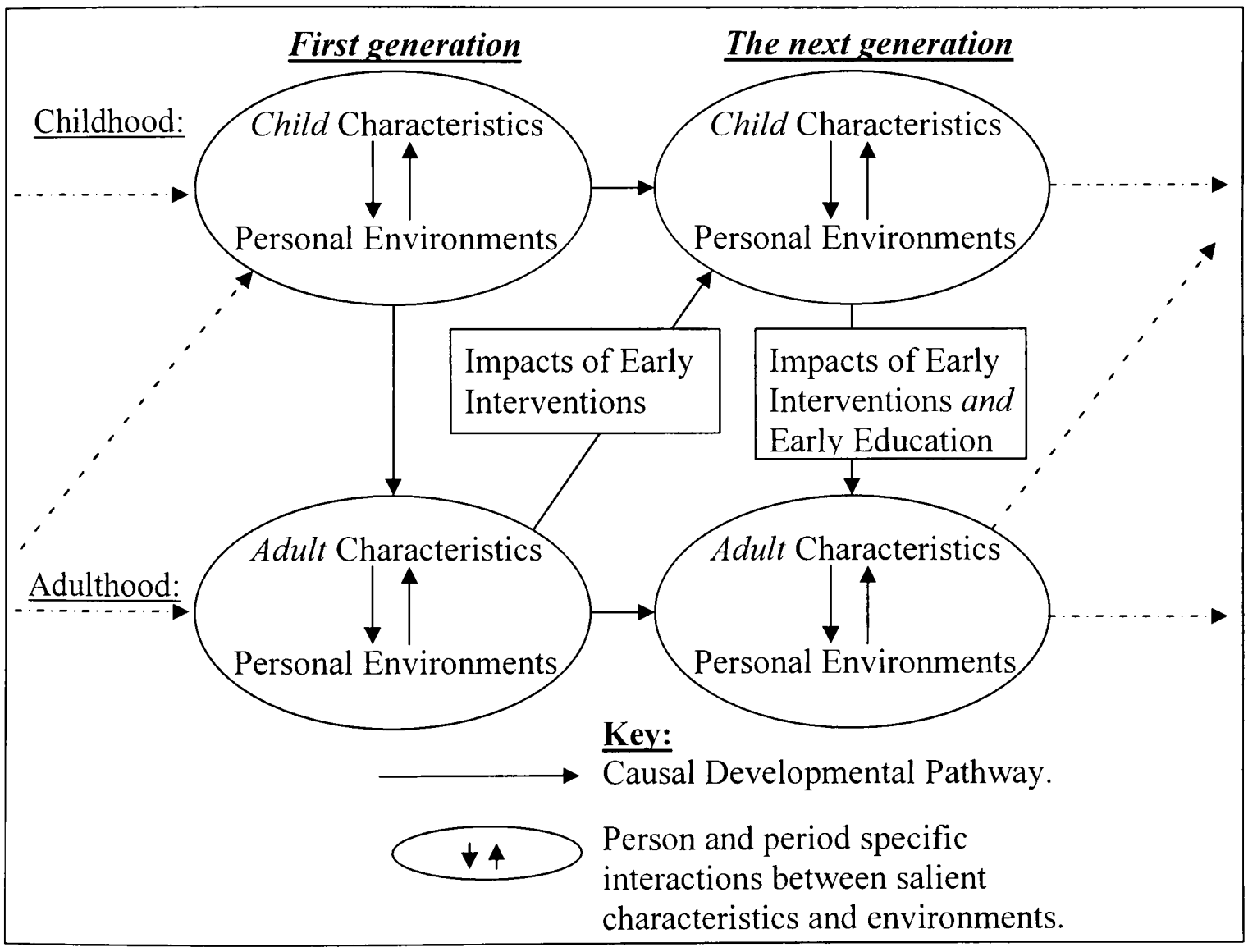
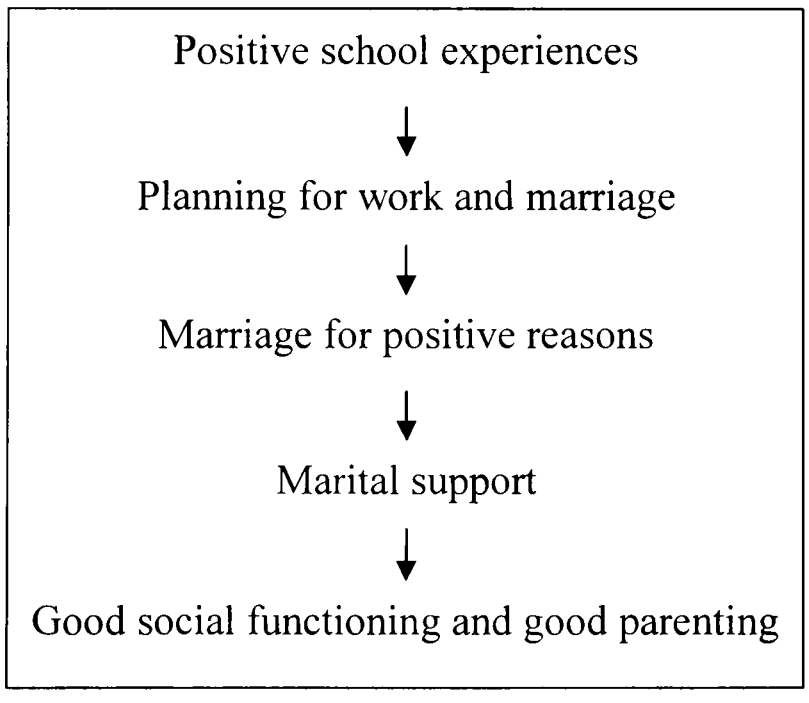


Figure 1.6 illustrates the differences that can be found between typical programmes of Early Intervention and early education as they each impact development pathways both within and between generations. The lack of direct intervention by programmes of early education means that if they are to alter developmental trajectories from future vulnerability to resilience, they will be much more likely to do so through a process of *indirect amelioration* rather than one of *direct alteration* of the processes that led to the vulnerability in the first place (i.e. the risks). Consequently, it seems

reasonable to expect that the effects of early education are likely to be smaller in magnitude than those that can be expected of targeted EI (see J. Hill, Waldfogel, & Brookes-Gunn, 2002).

Finally, Figure 1.7 presents a real-world example of how education has been found to be able to interrupt the intergenerational transmission of the breakdown of parenting for institutionally raised girls (Quinton & Rutter, 1988). Whilst Figure 1.5 documented the mediating mechanisms whereby the risk of parenting breakdown was transmitted from mother to daughter, Figure 1.7 illustrates the beneficial chain of reactions that were found to contribute to this transmission of risk being broken (see Rutter & Rutter, 1993). Of relevance to this discussion, the finding that positive school experiences can prompt positive chain reactions demonstrates the possibility of education transforming developmental pathways from ones of future vulnerability to ones of resilience.

Figure 1.7 Simplified diagram of adaptive chain reaction within institution-reared women (from Rutter & Rutter, 1993)



To vulnerable and resilient developmental pathways?

Given the extensive history of research that has been conducted in the USA, Britain, and the wider world that has consistently demonstrated that Early Interventions offer the possibility of interrupting the inter-generational transmission of risk, one might presume that there was an accurate and complete understanding of the contributions that can be offered by programmes of high quality early education and care.

Unfortunately however, this is not the case. Research that has examined early education and its effects has been heavily limited according to its country of origin and timing. Moreover, our understanding of both these early years programmes and their effects upon young children's development have also progressed since the decade of Head Start, the Perry/High Scope project, and the Plowden Report: that of the 1960s.

Just as the idea of developmental resilience grew out of earlier pre-existing notions of developmental risk and protection to exist alongside and replace neither, so too have more recent attempts to investigate both programmes of early education and their effects upon development (e.g. Section 1.2.3 and the findings of the EPPE project, see Section 1.2.4). What remains relatively un-investigated in the rapidly advancing ideas of developmental risk and resilience when considered in partnership with modern forms of universal pre-school care and education though is a substantial body of research that examines both. In her synthesis of five decades of research (again stretching back to the 1960s), Luthar (2006) expounds upon these issues and the current state of this joint research,

> *"Researchers* [who] *have expanded their definitions of quality need to go beyond indices such as the caregiver-to-child ratio, physical space, and materials to stimulate learning, to consider also the emotional quality of the caregiving children receive. It will be important to systematically explore the protective effects of such variables in early child care as the caregiver's personality characteristics, the sensitivity, warmth, and consistency in caregiving, and the quality of the relationship developed."* (Luthar, 2006)

Luthar's (2006) comments are particularly salient when the definitions of pre-school quality as defined by Ball (1994)[49] are considered. Whilst Ball defined high quality care and education as primarily concerning structures (see Section 1.2.3), Luthar (*ibid*) can be seen to be calling for a more intensive investigation into the effects associated with relationships and process qualities.

[49] And which have been used as the foundation for the efforts of the British government to increase State funded provision

Recent investigations into the effects of attendance at pre-school upon young children's development have attempted to 'unpack' previously identified overall effects (e.g. Belsky et al., 2007; Pluess & Belsky, 2008). Simultaneously, recent advances in the investigation of risk and resilience in child development, termed *"the fourth wave"* (Masten, 2007), have focused on multilevel dynamics such as those that exist between child development and educational provision. Furthermore, authors such as Luthar and Brown (2007) have noted that within this latest wave of research there is a need for,

> *"...translational efforts that will bring critical components of successful parenting interventions to caregivers in child-care settings..."*
> (Luthar & Brown, 2007)

So in uniting these two areas of research, it is not surprising that attempts have been made to investigate whether pre-school provision and primarily its *quality* (again see Luthar and Brown, 2007), can protect young children's development from the impacts of risks. However and to date, the research that has investigated this topic has reached only limited conclusions (e.g. Burchinal, Peisner-Feinberg, Bryant, & Clifford, 2000; NICHD, 2000a) of which the NICHD (2000a) note as being, "*Contrary to expectations*". It was upon this basis that this study re-examined the issues of pre-school provision and protected child development in a secondary analysis that made use of relatively novel methods and previously untried analytic tools (see Chapter 2).

The contribution of pre-school provision to resilience in young children's development was outlined by Yates, Egeland, and Sroufe (2003) who suggested that educational milieus may serve as a community level protective resource when they included nurturing and attentive adult-child relationships. Furthermore, Luthar Cicchetti, and Becker (2000a) argued that for those children who develop in the context of multiple adversities and risks, positive experiences within an educational setting may be of especially great importance. Indeed, UNESCO (2006) has even gone so far as to claim that it is possible for early education to alter the *trajectory* of children's development from vulnerability to resilience by complementing the care and education children receive from their families and the wider community.

To determine whether pre-school can protect young children's development against the effects of risks, the NICHD (2000a) found that the majority of this type of research had focused on interventions rather than programmes of early education and care. Moreover, it was also argued that relatively few attempts (to that date) had been made to examine the relationships that exist between different types of risk and the different qualities of pre-school provision. To address these gaps in the research, the NICHD (*ibid*) investigated caregiver-child relationships and overarching *familial* risks to these children's development. Although they found only limited evidence of protected development, this finding was partially attributed to the sampling procedures that were employed: they returned a limited number of children who were in high quality care and yet had development that was also measured to be at high risk.

Another very recent attempt to examine whether pre-school could protect young children's cognitive abilities was conducted in an investigation by Burchinal, Peisner-Feinberg, Bryant, and Clifford (2000). Argued by the authors to be perhaps the first study to have sampled enough children whose development was at-risk to effectively test a moderating hypothesis, a secondary analysis was carried out on a sample of over 1000 young children. Their study postulated that the relationship between the quality of pre-school and young children's developmental outcomes would vary across differing types of risks including: child gender, ethnicity, family poverty, and parental values. Using the Early Childhood Environment Rating Scale (ECERS; Harms & Clifford, 1980), the authors reported only a single case of significant protection: high quality pre-school was concluded to have protected the language development of children from ethnic minority backgrounds. In listing the possible reasons for this limited evidence of protection, the lack of extensive information about families and a more detailed measurement of pre-school quality were put forward as possible explanations.

1.2.3 Impacts of early education to young children's development: *the role of quality*

Summing up the developmental effects of early education and care, (N. Browne, 1996) reports that despite reservations about compensatory effects, high quality provision has a detectable effect on not just the IQ scores of young children (i.e. their

cognitive development) but also on their social skills such as self-esteem and motivation. For the countering of risks, N. Browne (*ibid*) also notes that high quality early education can be especially beneficial for those experiencing the greatest levels of poverty and economic disadvantage (i.e. family level risk). Furthermore, such findings are mirrored in modern British Early Interventions, (e.g. Sure Start; see A. France & Utting, 2005) whose theoretical foundations lie in the 1960s USA Head Start and Perry/High Scope pre-school programmes. These programmes demonstrated that when high quality provision was combined with home visits, this led to a partial mitigation of the effects of poverty upon young children's development (Clarke, 2006)[50]. However and despite this evidence, even by the mid-1990s the availability of high quality early care and education was very patchy in Britain with N. Browne (*ibid*) comparing two English counties at the time. Whilst Gloucestershire offered no local authority funded nursery education in 1992, in the same year the London Borough of Hillingdon offered 50% of 3 and 4 year olds places funded by the Local Authority (see also Jackson, 1993).

Perhaps the most important underlying reason for such regional disparities in the mid-1990s provision of early education and care is that high quality early education is relatively costly (Statham, 1990). As of 1996, the relative costs of 10 sessions a week of higher-quality[51] *nursery school* early education was estimated at £1,505 whereas for the usually lower quality *playgroup* care, this figure was only £420 N. Browne (*ibid*). The importance, yet also high cost, of high quality early education and care in Britain by the mid 1990s was discussed by Randall (1995). Traced back to Section 19 of the 1989 Children's Act, the growing concern with the both quality and quantity of programmes of early education and care led to a balancing act between these two features. On one hand, Randall (*ibid*) describes an ever growing body of research literature on the importance of quality but on the other, provision also needs to be cheap enough to be affordable (and thereby accessible) to all, and especially so for poor families whose children were hypothesised to have the most to gain.

[50] Clarke (2006) summarises an often cited finding from the Perry/High Scope project: that for every $1 invested, society was saved $7 later. However, this repeats the earlier idea of early intervention as social investment rather than as social justice.

[51] *"...playgroups cannot match nurseries educationally because of their lack of purpose-built accommodation, low levels of public funding, lack of trained nursery teachers and the relatively low level of training."* (N. Browne, 1996)

The focus on the *quality* of the provision that is offered in modern British programmes of early education and care can be most clearly observed in the title of the 1990 Rumbold Report (Rumbold, 1990), *"Starting with Quality"* (see Kwon, 2002). Further, Jackson (1993) observed that the Rumbold recommended that this quality should be comparable to that which is offered in primary schools. Moving on to consider the Start Right Report four years later, Ball (1994) defined *high quality* provision in the early education of 3 and 4 year olds as including:

1. An appropriate early learning curriculum
2. The selection, training, and continuity of caregiving staff
3. A high ratio of caregivers to children
4. Buildings and equipment of appropriate design for early learning
5. A partnership role for parents

In turn, it was these areas of quality that were partially realised by the British government at the beginning of the new millennium when they introduced the Foundation Stage, its associated Curricular Guidance (QCA & DfEE, 2000), and independent and public OfSted[52] inspections of the quality of the provision of the government funded free nursery education places (see Sylva & Pugh, 2005).

Looking back in time though, even during the 1970s there was an emphasis and importance placed not only on the quality of the provision that was offered but also to what 'quality' should actually refer in the context of British early education and care. For example, Jerome Bruner's Oxford Pre-school Research Project (see Bruner, 1980) compared nurseries, pre-schools, and playgroups and concluded that better staff training and qualifications, together with superior facilities and equipment was not in itself sufficient to aid young children's learning (Jackson, 1993). Thus, it has been long understood that it is this '*quality*' which determines the developmental impacts of programmes of early education and care (e.g. Magnuson, Meyers, Ruhm, & Waldfogel, 2004; Stipek et al., 1998). Although it remains hotly debated within the field of early years educational research (e.g. Sylva et al., 1999), 'quality' commonly refers to the 'structures' and 'processes' which define and differentiate programmes (Currie, 2001). Melhuish (2004) provides definitions of the aspects of quality that are commonly associated with each of these and notes that legislation has typically

[52] Office for Standards in Education

concentrated on structural quality as it is easier of the two to both inspect and control (see also Dahlberg, Moss, & Pence, 1999):

> **Process** – *"refers to the characteristics of the child's experience, e.g. interactions with others, learning experiences, variety in stimulation, responsiveness in environment"*
>
> **Structural** – *"aspects of environment that are fixed, e.g. accommodation, group size, adult-child ratio, training of staff, management structure."*

The following sub-sections of this chapter now consider the relationships that have been found between structural and process qualities and different domains of young children's development. The associations between both these types of quality (especially process) and the development of young children in particular has been commonly identified by studies originating both from Britain (e.g. Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004) as well as internationally (e.g. NICHD, 2003a). Of particular concern for this investigation and the following sub-sections of this chapter is whether high pre-school quality can protect the development of young children that are thought to be 'at-risk'. This is especially salient given the dramatic expansion that has been seen in British programmes of early education and care since 1997 (see DfES, 2006).

There are two common themes that can be found repeated in the following discussions. First, the research evidence concerning the effects of programmes of early education and care has proved inconsistent, partly due to differential impacts upon development that can be observed for those who begin programmes before the age of three[53] and those who enter at age three and later[54]. Second, the subsequently presented research combines the separate fields of enquiry concerning developmental psychology and early years education and although these have proven extremely well matched, Dahlberg, Moss and Pence (1999) note that both fields have faced criticism for being overly positivistic, simplifying, and normalising in their traditional views on the development of young children. For example, E. Wood (2007) reflects upon the Piaget inspired 'Developmentalist' perspective in early education that was the

[53] Typically, *"childcare"*; (Melhuish, 2004)
[54] Typically, *"pre-school"*; (Melhuish, 2004)

dominant discourse for researchers investigating early education through the 1960s. E. Wood (*ibid*) comments that the concepts of human learning and development were incorrectly used interchangeably during this period and that this eventually led to the development of erroneous curriculum content.

Impacts on pre-school period cognitive development

Starting with the impacts of structural and process qualities upon the cognitive development of young children, (Smith, 2008) cites the USA's 'War on Poverty' and the establishment of Head Start during the 1960s as being the period of recent history that saw intense research activity focussed on whether education could influence children's cognitive development (see also Fawcett, 2000). Moreover and relevant to this thesis, Head Start involved investigating whether high quality early education could ameliorate the developmental effects associated with being raised in poverty (in other words, promoting developmental resilience to family level risks). Although the findings of this EI suggested enhanced cognitive development through improved process qualities and emphasised direct instruction/teaching, this has since been cautioned against on the basis of the High/Scope project which emphasised children's play (Fawcett, 2000) and traditional pre-school curricula (Schweinhart & Weikart, 1997).

Studying the comparative effects of family, childminder, and nursery care in a sample of 243 mothers and 32 day nurseries in the Greater London area during the late 1980s, the 'Day Care Project', was at the time the most comprehensive British study of the effects of childcare quality on the development of children who initially received this care before the age of three (see Melhuish, 2006). With the initial contact and baseline assessment taking place when the children were between 4 and 5 months old, the study identified that impacts of nursery care (i.e. early education and care) upon young children's subsequent cognitive development depended upon the process quality of the provision that they received. Controlling for the effects of prior development and parental SES and when compared to home and childminder care, attendance at nursery had quality dependent effects on language development that were first noticed at 18 months of age and which continued until age 6 (see Melhuish, 2006 for details). Melhuish (*ibid*) also goes on to note that the findings of the Day

Care Project were drawn upon by the aforementioned 1989 Children's Act which continues to control childcare provision and regulation in Britain to this day.

At the absolute and non-programme comparison level though, Melhuish (2004) summarises the effects on development that research has found to be associated with programmes of early education and care for the under-threes. For children under three whose home environments do not place their future development at risk, high quality childcare has been found to have no strong effects upon cognitive development. However and in contrast, very low quality childcare has been found to be significantly associated with lower levels of subsequent cognitive attainment. In addition, for children over three, high quality early education and care (i.e. pre-school) has been repeatedly associated with enhanced educational and social development regardless of the level of risk that children are exposed to. It is this combination of at best, no negative effect of enrolment for the under threes together with universal benefits for those enrolled over this age that can be seen to underlie much of the seemingly contradictory reports in the media (e.g. Frean, 2008; Randerson, 2008).

Fortunately, the research concerning the effects of early education and care upon the development of young children from disadvantaged backgrounds (i.e. high family level risk) has been more consistent (again, see Melhuish, 2004). Both *childcare* for the under threes and *pre-school* for the over threes has been associated with subsequent improvements in these children's cognitive, language and social development, but only when these programmes have been of high quality (see also Belsky & Steinberg, 1978). Further, Melhuish (*ibid*) also reports that long term effects on developmental pathways have not been found to operate through enhanced cognitive skills but rather through more social skills such as children's confidence.

Moving on to consider Early Interventions and beginning with the famous Ypsilanti/High Scope/Perry Pre-school Study that began in the USA during the early 1960s, this programme consisted of half-day, 5 day-a-week centre based care accompanied by 90 minute weekly home visits that began when children were aged three. Of the children who were selected due to manifesting the negative effects of

social and personal risks[55] upon their cognitive development (IQ scores being less than 90), 123 were studied longitudinally into adulthood. Utilising a Random Control Trial (RCT) methodology Melhuish (2004) reports that the pre-school intervention emphasised an educational curriculum (i.e. process quality) delivered by highly trained staff (i.e. structural quality). As one might hope to find from an intervention that was aimed at children with risks effects manifesting in their cognitive development, there were long term benefits in educational achievement. Further, by age 27, the greater history of engagement with the education system that this led to throughout the children's school careers had facilitated benefits in other areas of the children's lives as well including: reduced drug-use, teenage pregnancy, unemployment, crime, and welfare dependency (see also Rutter & Rutter, 1993).

Similar to the High Scope study and intervention, the Abecedarian project was another early years centre-based intervention conducted in the USA that utilised an RCT design which was aimed at children whose development was affected by risks that can be considered both social (i.e. poverty) and personal (i.e. ethnicity). However unlike High Scope, the Abecedarian project was also targeted at children whose development was at risk due to their mothers' demonstrating significantly low IQ and because of this, the project can therefore also be seen as an intervention designed to explicitly target the intergeneration transmission of developmental risk (see Section 1.2.2). Recruited at age 3 months, 111 children were randomly divided between intervention and control groups that featured no childcare but did include other support from social services. With the project demonstrating a high ratio of highly qualified staff to children (i.e. structural quality), long term effects were found upon not only cognitive development and education achievement at age 21 (producing a mean difference of 8 IQ points, Rutter & Rutter, 1993), but also upon behaviour/social development as well.

Following on from the short term effects on cognitive development that were found in the Head Start project that began in the 1960s, a more explicit and specific attempt to conduct an intergenerational intervention programme other than the Abecedarian project was the 1990s Head Start extension: *Early Head Start* (Melhuish, 2004).

[55] Respectively, deprivation and ethnic minority status

Serving children who were aged between birth and three (as opposed to 3 and onwards) and maintaining Head Start's targeting of disadvantaged families (i.e. high family level risk). Early Head Start was another intervention that adopted an RCT design in contrast to the quasi-experimental design that was used in Head Start. Melhuish (2004) notes that in the years since its beginning in 1995, Early Head Start had grown to include over 700 programmes and has catered for over 62,000 children.

Whilst modest effect sizes were found to be associated between attendance at Early Head Start and on measures of young children's cognitive, language, and social/behavioural development, these effects were also found to vary according to the level of developmental risk the children were exposed to. In particular, Melhuish (2004) reports that developmental effects were largest for children of African-American families[56] and for families with a moderate number of family level social risks (3 out of 5[57]). Of particular relevance to this thesis though were the differing origins of the strongest effects that were found to be associated with the programme impacting child development and parenting. Whilst parenting was most influenced by home visits, child development was most aided by high quality centre based early education. When combined with the long term beneficial 'sleeper' effects that were found with the original Head Start programme, these results provide a powerful example of the risk-mitigating protective effects that might be possible from high-quality programmes of early years care and education (given that it is similar in nature to these early interventions).

In determining the mechanisms by which programmes of early education and care might have their effects, Melhuish (2004) stresses that it is interactions that are shared between children and care-giving staff (i.e. 'process quality') that are of central importance and cites the research of Clarke-Stewart (1987), McCartney (1984), and the NICHD (1999) in support of this argument. Further and of great relevance to this investigation, Melhuish (*ibid*) also provides a reminder of the relative effect sizes that can be expected when research studies compare the effects of family factors (i.e. family level risks) impacting development against those associated with programmes

[56] With ethnic-minority status serving as a common indicator of developmental risk in many early years interventions conducted in the USA including: High Scope/Perry, Abecedarian, and Head Start.
[57] Cumulative Indices (see Section 1.1.1) are used here.

of early education: The NICHD (*ibid*) were reported to have found that early education offered effects that were only around half the size of those that were associated with family factors. Although this suggests that any protective risk-moderation coming from programmes of early education and care might only be partial, this comparison also failed to control for the simultaneous impacts associated with genetic variations (i.e. more proximal 'personal risks') that are implicit within family factors[58]. As such, the question of whether programmes of high quality early education and care and protect the cognitive development of young children remains open for investigation, as do questions concerning the magnitude and commonality/breadth of any such effect.

Finally, the proposition that high quality early education can act to protect the development of young children from the effects of salient risks has also had to deal with research findings indicating the contrary. Perhaps the most well known of these are those coming from the study of Tizard and Hughes (1984). These authors found that there were fewer complex exchanges of language between carer givers and young children within programmes of early education and care (i.e. interactional process quality) than between these same children and their low SES parents at home[59]. Although these findings seem to suggest that early education might not be able to buffer language development from the effects of salient risks, Rutter and Rutter (1993) have also criticised this study in three important ways. First, severely socially disadvantaged (high family level risk) children were excluded from the study. Second, recordings of home conversations were constructed so that mothers were able to give their full attention. Third, it is a fallacious assumption to assume that just because different types of language are used within homes and programmes of early education and care, that this is necessarily a risk for future language development.

Impacts on pre-school period social/behavioural development

The impact associated with programmes of early education and care upon young children's social development (and the importance of programme quality in this) has,

[58] Again for example, referring to effects such as epigenetic variations in the expression of genetic factors that are influenced by experiences that were encountered by a child's same sex parent when they were a child (Pembrey, 2002; Pembrey et al., 2006)
[59] Who in turn used less complex exchanges then high SES mothers and their children

albeit unintentionally, maintained the debate[60] surrounding whether pre-school can act as a source of risk to young children's development that originated in the work of Bowlby (on mother-child attachment; Bowlby, 1951) and that was so influential during the 1960s (e.g. the 1969 British Plowden Report) and which was subsequently determined to have been exaggerated by Rutter (1981). Whilst the beneficial effects of *high quality* pre-school upon children's cognitive development has been widely accepted (see above and Fawcett, 2000), there has also been less consensus over its impacts upon social/behavioural development (e.g. Belsky, 1988, 2001; Love *et al.*, 2003). Melhuish (2006) offers an explanation for this continued disagreement: it is again[61] the age at which children enter these programmes that, together with the quality of provision, differentiates a subsequent positive from negative impact. Citing research by the NICHD (2004)[62] and EPPE (see below, Section 1.2.4), Melhuish (*ibid*) argues that those negative effects that have been found to be associated with early education and care upon social behavioural development are only found when examining very long durations of attendance at these programmes during infancy (age 0-1).

The National Institute for Child Health and Development Study of Early Child Care (NICHD SECC) is a longitudinal American investigation of over 1,000 children who were recruited from various locations around the USA at birth (see NICHD, 2005). Explicating upon whether or not early education and care can (or even does) have a negative effect upon the development of young children, Melhuish (2004) reports that the NICHD found no direct effect that was associated with programme quality, amount, nor type of provision. It was only under certain specific combinations of conditions encountered within both the home and early education that the negative effects that have been previously purported became apparent. Offering an alternative explanation to that of Melhuish (*ibid*), these combined conditions consisted of:

- Poor quality care at home
- Poor quality programme of early education and care
- More than 10 hours a week in this programme

[60] As evidenced for example in continuing stories published by the media such as those cited in Section 1.2.3

[61] As this was also mentioned above (Section 1.2.3) in relation to cognitive development

[62] Which was partially prompted by Belsky's (1988) maintenance of the negative effects that pre-school can have on young children's social development.

Although the NICHD SECC found that children who had entered high frequency continual childcare at a young age went on to display problem behaviour over and above the effects of high quality pre-school, Pluess and Belsky (2008) claim such quality effects may have been underestimated by not taking into account moderation effects (e.g. those illustrated in Figure 1.1). Pluess and Belsky (*ibid*) then offer another explanation as to why it is that pre-school attendance has been found to have differing effects upon young children's social/behavioural development. The authors reanalysed findings from the NICHD SECC and concluded that young children who had difficult temperaments as an infant went on to demonstrate an increased *susceptibility*[63] to the effects on social development that were associated with programme quality whether this be high (and thereby beneficial/promoting) or low (thereby becoming a developmental risk)[64]. However, within the Pluess and Belsky study (*ibid*), infant temperament only acted to moderate quality effects, not the effects associated with type nor the duration that children had spent in attendance. Thus, the contribution of the Pluess and Belsky study to the debate over whether or not high quality early years provision can prove beneficial to young children's social/ behavioural development becomes of even greater value. If the moderation effect had been equally apparent across type and quantity effects, then one would have expected to have seen a similar prior debate concerning these effects upon social/behavioural development.

Returning to the central issue of whether the quality of programmes of early education and care can protect against the impacts of developmental risks, the overview of research conducted by Belsky (2001) provides an example of how the risk posed by early education and care to social development can itself be moderated by its own quality. Although a high duration and frequency of attendance during infancy (i.e. under one) was found to have a negative impact upon children's subsequent social/behavioural development, several studies were also presented which demonstrated how this relationship has been found to be attenuated (moderated/protected) by a *higher quality* of the care and education (e.g. Howes, Smith, & Galinsky, 1995; Howes & Stewart, 1987). This example is especially

[63] As used in this thesis; see Section 1.1.1
[64] Infant temperament is therefore a *vulnerability/susceptibility* factor (see Section 1.1.1).

important to this thesis because it breaks the implicit assumption that a developmentally salient factor has to offer *either* a direct *or* a moderating effect (see Figure 1.1). Furthermore, there also exists the possibility that for children whose development is at high risk, a very early enrolment in a high quality programme of early education and care may have long lasting and promoting (i.e. the opposite effect of a risk) impacts upon future social development with Andersson (1989, 1992) even identifying such effects first upon school adjustment at age 8, and then upon social competence at age 13.

The importance of the protective role played by quality was also identified in the Head Start Early Intervention where quality was found to promote school readiness and thus partially protect children's future developmental trajectories against the effects of poverty (i.e. family level risks; see Zigler & Styfco, 2004). School readiness was benefited through high quality parenting intervention, pre-school care and education, and support services. When high quality support was offered, children were reported as being *"better able to meet the expectancies of school"* and this was evidenced in improved school attendance (obviously a behavioural outcome). In other words, the effect of quality promoted a behavioural change which then brought about higher than expected subsequent attainment in education (Barnett, 1995; Consortium for Longitudinal Studies, 1983). Melhuish (2004) expands upon this by reviewing the relevant research literature and concluding that for programmes of early education and care to offer long term protection they must protect and promote social skills and motivation. In turn, these are then associated with lower levels of subsequent special education and school failure, and higher educational achievement. Thus, the long term protection of development, be it in the cognitive or social domain, seems to strongly depend upon an initial protection of social skills to facilitate school readiness.

Continuing impacts of high quality early education

The two previous sub-sections of this chapter have revealed promoting, protective, and at times risk inferring impacts on social and cognitive development that originate from programmes of early education and care (e.g. Tsitiridou-Evangelou, 2001). Furthermore, these discussions ended by suggesting a partly mediating relationship between the quality of these programmes, long term cognitive/educational outcomes,

and intermediate social/behavioural skills. As such, consideration is now given to research that has explored such a pattern of relationships and in particular, how the behaviour of children can influence their subsequent attainment in education. For example, the Rutter review of 1985 (Rutter, 1985) concluded that it is not what children were taught at pre-school, but rather children showing changes in attitudes to learning and self esteem which can have long term benefits to their educational attainment (Sylva, 2000). This is supported by behavioural theories such as the Theory of Planned Behaviour (Ajzen, 1991) which argue that changes in behaviour come from changing attitudes and beliefs.

The importance of social skills for latter development and the promotion of these by caregivers in programmes of early education and care was evidenced by Norwich and Kent (2002), and Siraj-Blatchford (2001). First, Norwich and Kent stressed the importance of social/behavioural development for young children who were identified as having Special Educational Needs (SEN) which serves as a marker for future cognitive development being at risk. Second, Siraj-Blatchford noted that early childhood workers seek to develop both the verbal and non-verbal social skills of young children who are exposed to high family level risk because the development of these skills are paramount for children to successfully interact with others. Considering the mitigation of developmental risks more explicitly, Early Interventions such as Head Start have also viewed improved social skills as vital for the subsequent educational attainment of those whose development is at risk (see Guralnick, 1990; Zigler & Trickett, 1978). Within Head Start, this was done to prepare children to engage in the behaviour of schooling because young children whose development is at risk frequently fail to engage in the learning process by being disruptive in class (Mandel, 1997). As such, the preparation of children from socially disadvantaged backgrounds for compulsory schooling not only benefits and protects their future development but also has the possibility of indirectly doing the same for their future classmates.

In discussing the developmental skills that pre-school must foster and protect in order for it to have continuing impacts on subsequent educational attainment, Brooks-Gunn (2000) suggests five developmental skills that have emerged as central for future success at school from her reading of the relevant preceding literature: Cognitive

growth and learning, self-regulation, trusting and loving relationships with parents, cooperation with and empathy towards peers. and physical health. Perhaps unsurprisingly, these skills closely match those that are stressed by the 'equality of opportunity' that is aimed for by the Curriculum Guidance for the Foundation Stage (QCA & DfEE, 2000) and strongly emphasise the importance of both cognitive and social skills for successful future development.

However, the mediating pathway of pre-school quality promoting and protecting social skills to bring about continued later impacts in educational attainment must not be viewed as an all encompassing explanation of the means by which programmes of early education and care can facilitate long term resilience in development. Merely going to pre-school is also viewed as potentially benefiting children's later educational attainment by governments who are investing in the early years (e.g. Chazan. 2000) and is central to the social model of integrated SEN provision (e.g. Wolfendale & Robinson, 2006). Furthermore, the effects of high quality pre-school must not be over emphasised with researchers such as Caughy, Dipietro, and Strobino (1994) reporting that although high quality programmes of early education and care could benefit the educational attainment of disadvantaged children (specifically reading), greater attainment could have been expected if the same children had received interventions such as Head Start.

Despite the inherent limitations of the protective developmental effects that can be expected of programmes of early education and care when compared to Early Interventions, Feldman (2004) was keen to stress the relative rarity of these latter programmes and that it might be possible for high quality pre-school provision to fill the gap in the provision of high quality ameliorative care that this rarity leads to. Because a good learning environment in pre-school can partly substitute for a poor learning environment at home (see Sammons, Taggart et al., 2002), so high quality pre-school might improve social skills and thereby also the latter educational attainment of children who come from socially disadvantaged backgrounds (Desai, Chase-Lansdale, & Michael, 1989). In addition, if high quality programmes of early education and care are to do this, then the means by which these Early Interventions have their long term effects on development must also be understood. To this end, Guralnick (2004) emphasises the *intensity* of an intervention as being the central

factor which predicts future developmental trajectories of disadvantaged children and notes three components of intensity:

1. Longer hours per week of attendance
2. Longer duration of attendance
3. More offered support

If these three criteria are met then research such as Campbell and Ramey (1994) has shown that Early Interventions (and therefore perhaps high quality early education and care) can promote gains in cognition that last on into secondary school. Furthermore, the more disadvantage that a child faces, the more they can potentially benefit from an intensive intervention (Guralnick, 2004). By comparison, less intensive interventions may serve to only reduce the effects of less severe risks to future development and educational attainment (e.g. Achenbach, Howell, Aoki, & Rauh, 1993) and it is these less intensive intervention effects that high quality pre-school might be able to proxy. Finally and returning to the initial argument made at the beginning of this section, Melhuish (2004) cites Rutter (1985) in his review of the long term effects of early education and notes that,

> *"The long term educational benefits stem not from what children are specifically taught but from effects on children's attitudes to learning, their self esteem and on their task orientation."* (Melhuish, 2004)

1.2.4 The Effective Provision of Pre-school Education Project

Providing the data which is reanalysed in this investigation, the Effective Provision of Pre-school Education (EPPE) was, "*...one of the few studies (the only one in the UK) to demonstrate the role of pre-school education as an effective means of early intervention...*" (Sammons, Taggart *et al.*, 2002). Furthermore, the EPPE project identified pre-school[65] to have a beneficial impact on the development of children that was at risk due to social disadvantage by partially combating the 'cycles' (see Section 1.1.3) that led to this through improving children's start to school (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004; Sylva & Pugh, 2005). These effects were achieved by high quality programmes of early education and care being able to

[65] *"Pre-school"* referring to programmes of early education and care for those aged between 3 and 5

offer environments that were similar to those of Early Interventions [66] and Sammons, Sylva *et al.*, (2004a) explicate: Because the number of children whose development was identified as being at risk during pre-school fell from one in three to one in five (by entry to primary school), early education and care was therefore envisaged to have offered an unintended but effective intervention for the reduction of SEN, especially amongst those children whose development was exposed to relatively high levels of family level risk.

By way of a brief history of the project (see Chapter 2, Section 2.2 for more details), the EPPE design emerged from the Rumbold (1990) and the 'Start Right' (Ball, 1994) reports which noted the potential of pre-school to influence long term educational attainment, but also noted the lack of evidence from larger scale research (see Sylva, 1994). The EPPE project was designed in response and became the first *large* British research project that examined the effectiveness of programmes of early education and care. Moreover, it was also the first to *accurately* compare the developmental effects of varying types of programmes though multi-level statistical analysis thanks to its large sample size (see Goldstein, 1987). In doing so, EPPE used a longitudinal research design (starting from 1997) to examine the development and educational attainment of 2,800+ children as they started pre-school and was originally ended with their age 7 Key Stage 1 assessments[67]. Looking back, Sylva and Pugh (2005) report that both the British state policy and practice in regard to the provision of high quality programmes of early education and care have since been influenced by the findings of this major project. In particular, the EPPE project was designed to investigate three broad areas:

1) The effects of sessional and full day pre-school education and care on children in the age range 3 – 5
2) The 'structural' (e.g. staffing profiles) and 'process' characteristics (e.g. interaction styles) of more effective pre-school centres
3) The contribution of child and family characteristics to children's development

Leading on from this and with reference to the issues of risk mitigation that are the focus of this investigation, Sylva and Pugh (2005) note joint yet separate contributions

[66] But not the same as, nor as a substitute for…
[67] Although the project has since been extended to follow the children through Secondary School

were found by the EPPE project to be made by the structural (staff qualifications) and process (staff-child interactions) qualities of pre-schools upon young children's developmental progress. Furthermore, the EPPE team also identified (again, see Sylva & Pugh, *ibid*) that although proximal measures (e.g. family SES) posed a risk to young children's cognitive and social development, these were secondary in importance to those risks that were more proximal to the child (e.g. the *quality* of their home learning environment). These findings support the proposition that high quality programmes of early education and care might be able to mitigate the impacts of developmental risks and support the more in-depth examination of these issues that is conducted here. The objectives and methods used in this investigation are returned to (see Chapter 2) after the research findings of the EPPE project are first considered.

Impacts on pre-school period cognitive development

EPPE found that different aspects of quality demonstrated differing relationships to the cognitive gains which underlay preparedness for school. Overall, the EPPE project found that attending an effective pre-school (having higher quality) would lead to (on average) four months additional progress in the average child's cognitive development when compared to the development of a similar child in an ineffective (lower quality) pre-school (Melhuish, 2006). Furthermore, the association between the quality of the provision and this enhancement of cognitive development was a finding that was also mirrored in young children's social development (see below). Breaking down the quality effects upon cognitive development, measures of quality concerning both processes and structures evidenced impacts. In addition to an effect associated with overall quality there were also separate effects associated with the quality of the curricula provision, interactions of staff with children, and two measures of structural quality.

Considering first the *overall quality* of the pre-schools that children attended (as assessed by the ECERS-R[68]; Harms, Clifford, & Cryer, 1998), this was found to broadly impact young children's cognitive development, although boys were only benefited by attending pre-schools that were of *very* high quality. In particular, differences were noted in several areas of cognitive development including: early

[68] The Early Childhood Environmental Rating Scale Revised; see Section 2.3.2

number concepts, pattern construction, and pre-reading abilities. Of particular relevance to this study though was that overall quality was also found to be especially beneficial to the pre-reading skills of those children whose cognitive development was at risk of requiring subsequent SEN (Sammons, Taggart et al., 2002).

As with the overall quality of the pre-schools that the sampled children attended, broad benefits to cognition were also identified as related to the *quality of the educational provision* (as assessed by the ECERS-E[69]; Sylva, Siraj-Blatchford, & Taggart, 2006). In particular, differences were noted across several areas of cognitive development that were related to: pre-reading, early number concepts, and non-verbal reasoning (rather than the above pattern construction). Again, children whose development was negatively affected by significant distal (family SES) and proximal (male gender) risks also had their cognitive skills particularly benefited from higher quality and more educational early education and care (Sammons, Taggart et al., 2002).

The benefits to cognitive skills that were noted as coming from the above process qualities was also not limited to variations on the original ECERS observational measurement tool (see sections 2.3.2.3 and 2.3.2.4 for more on this). The *quality of the staff-child interactions* (as assessed by the CIS[70]; Arnett, 1989) also proved similarly related to cognitive gains. In particular, *'Positive Relationships'* were related to pre-reading whilst *'Detachment'*, *'Permissiveness'*, and *'Punitiveness'* were related to detriments in not only pre-reading but also in early number concepts as well. Furthermore and again in reference to children whose future development was at risk of requiring SEN (Sammons, Taggart et al., 2002), the quality of the interactions that were shared between children and caregiving staff in pre-school was also found to be especially beneficial and in this case, proved so by again offering a boost to early number concepts.

Finally, these main effects of process quality were also repeated within two areas of structural quality: staff-child ratio and there being a higher proportion of qualified

[69] The Early Childhood Environmental Rating Scale Extension; see Section 2.3.2
[70] The Caregiver Interaction Scale; see Section 2.3.2

teachers as carers (*staff qualifications*)[71] with benefits noted on the same cognitive skills as discussed above. However, although these effects were found over and above those of family SES this does not suggest that pre-school quality can have a 'protecting effect' as this is defined here. As such and considering the overall impacts that were found upon cognitive skills, the combination of extensive main and yet limited moderation effects indicates both the extent of the previous EPPE findings and yet also suggests that with a more detailed examination, pre-school qualities might be able to more formally offer protection to young children's cognitive development.

Impacts on pre-school period social/behavioural development

Comparing the main effects that the qualities of the attended pre-schools had upon young children's cognitive and social development, similar results concerning social skills were found to those that concerned cognition (see above and Sammons et al., 2003). In other words, beneficial effects to social/behavioural development were found to be associated with several measures of the process and structural qualities and the frequency of these matched those reported above (Section 1.2.4). For process qualities, the most frequent, significant, and the largest main effects upon social/behavioural skills were found to be associated with the staff-child interactions (CIS), then the overall quality (ECERS-R), and none for the quality of the educational curriculum (ECERS-E). By contrast and yet also partially mirroring the cognitive effects already discussed, the only area of structural quality to exhibit such effects was that of the proportion of staff who were very highly trained (*qualified teacher*). Taken together though, these relationships provide an insight into the average main *promoting* effects that could have been expected from the quality of British programmes of early education circa 1997. However and by themselves, these effects also do not indicate whether qualities were able to mitigate the relationships between developmental risks and developmental outcomes.

Referring back (see Section 1.2.3) to the negative effects that early education and care have been found to have upon young children's social development in other studies (e.g. Belsky & Rovine, 1988), the EPPE project also investigated this possibility and found mixed results (Sammons et al., 2003). Although a longer duration of early

[71] See Section 2.3.2 for more details

education and care was significantly related to anti-social/worried behaviour at entry to reception[72] (see Melhuish, 2004), this effect was also lessened by the overall quality of the early education (ECERS-R)[73]. Further, this negative impact of duration was only identified when examining behaviour at entry to reception. When examining value-added, *"social behavioural developmental gains"* (Sammons et al., 2003) over this period, the duration effect was no longer significant. This disparity in results is not only indicative of the inherent complexity of unravelling developmental effects that are related to risk and resilience (e.g. the need for cumulative combined indices of risk[74]), but also demonstrates that these can become confounded when examining the systems and processes that constitute programmes of early education.

Continuing impacts of early education

The clearest continuing effect of pre-school that was identified by the EPPE project was in a drop in the number of children whose development was deemed to be at risk of requiring SEN with the number of these children dropping from a third to a fifth between entering and exiting pre-school (Sammons, Sylva et al., 2004a). A further continuing effect comes from a comparison of children who lived in similar environments and yet experienced very different levels of pre-school: Children who never went to pre-school were more likely to have SEN at Key Stage 1 than were children who had simply attended these programmes of early education and care (Sammons, Taggart et al., 2004). Furthermore, the EPPE team also found a continuing effect for *"intensive"* (Guralnick, 2004) high quality pre-school. Higher quality pre-school combined with a longer period in this provision was still manifesting developmental benefits in children even once they had begun primary school (Sammons, Sylva et al., 2004b). The continuing effect of high quality pre-school for children at age 7 thus suggests that higher quality pre-school may have long lasting beneficial effects to developmental trajectories. Sammons, Thomas, and Smees (1995) offer an explanation as to why this might be the case,

> *"...attainment at age 7 years remains a good predictor of long-term educational outcomes as measured by public examination results at age 16 years"* (Sammons, Thomas, & Smees, 1995)

[72] Thus making duration of attendance a developmental risk for subsequent poor behaviour
[73] Overall quality therefore protecting against the risk
[74] See Section 1.1.1

The main effects that were found to be exerted by the educational quality (ECERS-E) of the programmes of early education and care upon their development at entry to Reception class were also found by the EPPE project as remaining in evidence until the end of Key Stage 1 (Primary Year 2, age 7). A higher quality educational curriculum during these programmes was significantly associated with higher self-regulation and positive social behaviour together with lower levels of anxiety and anti-social behaviour (Sammons, Sylva et al., 2004b). These results were also broadly mirrored in the educational outcomes of reading, writing, and mathematics and the effect of quality was also moderated by longer durations of attendance (again with reference to Guralnick's (2004) *"intensity"*; see Section 1.2.4).

In reference to the mitigation of risk through protection (see Sammons, Sylva et al., 2004a) that for those whose development was identified as being *"most vulnerable"*[75] due to the impacts of cumulative risks (see Section 1.1.1), a longer duration of higher quality early education and care was concluded to be able to best protect these children's development such that that gains were noted in subsequent levels of educational attainment. Further, because the original report only consisted of a visual comparison of main effect sizes and no investigation into moderation effects, it also serves to demonstrate how the possibility for pre-school protecting development against the effects of risks was an area that was only briefly examined by the original EPPE project.

Subsequent analysis of the development of the children who were studied in the EPPE project when they reached ages 9 and 10 (primary year 5, circa 2006-2007) found that pre-school quality continued to have a positive impact upon cognitive development (here: maths and reading) over and above factors relating to the child, their family, and the quality of the primary schools that they had attended (Grabbe *et al.*, 2008). Furthermore and of great relevance to this chapter, "*Attending a higher quality or more effective pre-school acts as a protective factor for children who go on to attend a less academically effective primary school...* " which provides strong evidence that high quality pre-school may be able to alter children's developmental pathways, albeit

[75] Using 'vulnerability' as a synonym for 'at risk' that was discussed at the beginning of this Chapter

with a small (but nonetheless significant) effect. Finally, Grabbe and colleagues (*ibid*) offer an explanation as to the mechanism underlying these long term effects: high quality pre-school seemed able to enhance young children's pre-reading ability.

Finally, the effects of the educational quality (ECERS-E) of the programmes of early education and care were also found to be still evidenced (albeit diminished) at the end of Primary Year 5 (when all children were aged 10). Largest benefits in cognition were found for children's reading over mathematics (Sammons, Sylva, Melhuish, Siraj-Blatchford, Taggart, Grabbe et al., 2007), whilst for social behaviour, the largest benefits were found for children's ability to self-regulate (Sammons, Sylva, Melhuish, Siraj-Blatchford, Taggart, Barreau et al., 2007; Sammons et al., 2008). Moreover, all of these effects remained in evidence a year later (at exit from primary school) with the most highly educational programmes of early education (ECERS-E) still proving beneficial to children's cognitive and social skills (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2008). In addition, the overall quality of these programmes (ECERS-R) that includes aspects of both processes and structures, was found to exert beneficial net effects upon self-regulation and pro-social behaviour whilst at the same time lessening hyperactivity and anti-social behaviour (Sammons et al., 2008).

However, when moderations of developmental risks were examined at exit from primary school in order to investigate potential protection, only two net effects were evidenced (Sammons et al., 2008; Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2008). More highly educational programmes of early education lessened the gender differences in behaviour between boys and girls and proved especially beneficial to those children who were identified as having Special Educational Needs (SEN)[76]. Although the protection this suggests was only implicit, it is also worth noting the sparsity of the measures of quality that were found to offer these effects; none were found for staff-child interactions, staff qualifications, or staff-child ratio. Furthermore, this lack of findings seems somewhat surprising given that these other measure of quality were found to have direct and risk-mitigating effects upon measures of development during the pre-school period. As a result, attempting to unravel why this was remains a question for future research.

[76] Who, with significantly lower than average cognitive and/or social development; can be viewed as having development that is manifesting the effects of significant earlier risks.

1.3 Conclusions

What is currently known?

> *"A growing concern in social policy over the last decade has been the increasing marginalisation of less privileged individuals and relatively disadvantaged social groups"* (Schoon, 2006)

In direct response to such concerns, relevant research has identified that it is possible for early education to alter the trajectory of a child's developmental pathway from one of future vulnerability to one of future resilience by complementing the care and education that children receive from their families and the wider community (UNESCO. 2006). Although Curtis and Nelson (2003) define such a process as *enrichment,* they also draw attention to the difference between enrichment as supplementation and enrichment as intervention. It is this discrepancy that underlies the different effects that can be expected when comparing programmes of early education to those of Early Intervention (Reynolds & Ou, 2003). Early Interventions attempt to effect long term change by *direct* engagement (including by the direct removal of risks) with traditionally family based social risks (such as poverty) that produce future vulnerabilities (e.g. Head Start; see Zigler, Gilliam, Jones, & Styfco, 2006). At the same time, programmes of early education and care, as characterised by less intensive and more variable duration and quality, are less likely to offer the same effects (significant risks are likely to remain present). However, this is not to say that early education cannot necessarily produce similar long term protective effects. Instead of the direct removal of risks (such as support for single mothers to gain employment and thereby a higher income) such effects are more likely to be the result of *indirect* promotion (i.e. mitigating the effects of risks), such as by increasing the school readiness of children.

Why might this be? Recent attempts have been made to integrate commonly disparate research that investigates the effects of programmes of early education with the rapidly advancing field of developmental psychopathology and the notions of developmental risk and resilience. The nine main features of research into the impacts of environmental factors (offering both risk and protection) upon cognitive and social/behavioural development from infancy through adulthood is summarised by Rutter and Rutter (1993) and provides a framework for understanding the

previously noted partially protective effects of programmes of early education and care:

1. Environmental factors have been found to affect behaviour at all ages
2. People's responses to experiences are heavily influenced by their age
3. Long term effects of stressful experiences come from long term exposure
4. Longer term effects come from experiences during infancy rather than the toddler period
5. Experiences during childhood can have long lasting effects, even when the environment radically changes
6. Though effects fade over time, these are influenced by subsequent experiences
7. Whether or not these effects change or persist depends on the psychological characteristic under consideration
8. *(These effects are not limited to just humans but can be observed in animals[77])*
9. What causes a short-term change can be both the same and different to that which causes long-term change

Applying these features to the contribution of early education to vulnerable and resilient developmental pathways, three explanations are offered. Firstly, the effects of early education and care that are either subsequently vulnerable or resilience inducing, rely upon the age of entry and the subsequent duration of attendance (points 2, 3, and 4). Secondly, the observed persistence of the impacts of programmes of early education and care (point 5) upon subsequent development rely upon subsequent schooling (point 6) and the nature of the psychological domain (i.e. cognitive or social behavioural; point 7). Finally, any short term effect on development can prove beneficial into the future, although this is not necessarily a given (point 9).

What still remains unclear? The multiplicity of the effects that programmes of early education and care have been shown to have upon young children's development (see above) complicates investigations that aim to determine whether it can negate vulnerability to support resilience. Moreover, although the effects of Early Interventions upon vulnerability and resilience are well documented (e.g. the Kauai longitudinal study; Werner, 1993), generalising these effects to early education and care may not be valid because each offers a different type of enrichment (as Curtis

[77] Obviously less relevant to this investigation

and Nelson define it above). Partly as a consequence and partly due to the paucity of previous research (Yates, Egeland, & Sroufe, 2003), the contributions of programmes of early education and care will only be strongly established by a large scale investigation into the effects of such programmes themselves. However, the first major investigation into the effectiveness of British programmes of early education and care, the Effective Provision of Pre-school Education (EPPE; Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004), has yet to determine or even comprehensively investigate the possibility of such effects. It is for all of these reasons that *'the contribution of early education to vulnerable and resilient developmental pathways'* has remained uncertain and as such necessitates further research with Borge, Rutter, Cote, and Tremblay (2004) commenting that,

> *"It is necessary to ask what are the circumstances under which group day-care decreases the risk and what are the circumstances under which it increases it?"* (Borge, Rutter, Cote, & Tremblay, 2004),

And Melhuish (2004),

> *"In what ways might early years provision be used for early intervention with children at high risk for developing special needs both intellectual and behavioural?"* (Melhuish, 2004)

And finally Schoon (2006),

> *"Most research on resilience has focused on middle childhood and adolescence, while early childhood is a less researched period... ...Yet the early years are generally considered as a critical time for acquiring many of the basic skills, attitudes and values that tend to remain over the life span... Young children may also be the best candidates for interventions that result from increased understanding of the processes that lead to positive outcomes under conditions of risk."* (Schoon, 2006)

2. METHODOLOGY

This chapter begins with an introduction and description of the aims, research questions, and strategies that underlie this study (Section 2.1). The second part (Section 2.2) then aims to familiarise readers with the EPPE project, its sample of children, families, and pre-schools, and the ethical issues that were adhered to in both this and the original EPPE investigations. Section 2.3 details the instruments and procedures that were used by the EPPE project to measure those psychological, social, and educational concepts that were pertinent to this project. Section 2.4 then goes on to document the statistical analyses that were used in answering the research questions before discussing the reasons that lay behind the particular procedures that were used. The chapter concludes (Section 2.5) with a review of the key aspects of this methodology that are essential when it comes to understanding the results of the analyses undertaken (Chapters 3-5).

Starting with an introduction to the research principles of this study, Section 2.1 presents the aims of this investigation, the formal research questions that emerged from these, and the rationale that underlies both. The research strategy of secondary analysis is then presented and justified through comparisons against previous studies with similar aims and by documenting the advantages of this approach over an alternative primary analysis.

Discussion of the research strategy leads into the next section (2.2) in which the project whose data were re-analysed is presented and discussed. The Effective Provision of Pre-school Education (EPPE) project was a longitudinal British investigation funded by the then Department for Education and Employment (DfEE)[78]. EPPE aimed to examine the impacts of programmes of early education on children's cognitive, social, and behavioural development from the average age of 36 months until the end of their second year of primary school (at the end of Key Stage 1). This section compares the EPPE sample of children, families, and pre-schools to equivalent national figures in order to establish the representativeness of the sample before consideration is given to the ethical principles that were adhered to by not only the EPPE project, but this investigation as well.

[78] Subsequently the Department for Education and Skills (DfES), and currently the Department for Children, Schools and Families (DCSF)

Section 2.3 describes the measurement instruments that the EPPE project used to assess the three concepts that were central to this study: 1) The quality of provision in programmes of early education; 2) young children's development between the average ages of 3 and 7 years; and 3) the risks to these children's development stemming from the contexts in which they develop. The instruments used by EPPE in the assessment of these concepts are detailed with their composition, validity, and reliability, discussed along with the data gathering procedures that were used during the original EPPE project.

This is followed by a presentation of the design of the analyses. To begin, consideration is given to the complications that have been encountered in previous research that has investigated the impacts of risks on children's development. More specifically, this consideration includes problems encountered by such studies with the analytical methods that they have employed in determining whether the risk-development relationship can be mitigated. Discussion then focuses on the methodological difficulties faced by previous research in its attempts to ascertain whether early education of a high quality can protect young children's development tthat might be considered 'vulnerable' due to the significant impacts of risks. Finally, the analytical procedures used in this investigation are introduced together with a discussion of their appropriateness for answering the research questions.

2.1 Research Principles

The principles underlying this investigation originated from the findings and theories of previous psychological, educational, and social research which were drawn upon in the process of forming broader research aims and subsequent research questions. The rationale linking these aims and questions to previous research is now discussed along with the study design that was chosen in order to answer the questions posed by this investigation.

2.1.1 Research Aims

This thesis aimed to identify whether and by what means programmes of early education could promote resilience in young children who had been negatively affected (made vulnerable) through exposure to risks. Based on the notion of

developmental trajectories, key skills at entry to school are examined as developmental milestones that can foster either vulnerability or resilience in the developmental pathways that follow. Such impacts have proven unclear due to both the paucity of previous research on this topic as well as the ancillary broader research that has identified early care and education as having both positive as well as detrimental impacts upon children's development (compare Belsky, 2001 to Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004 for example).

The context in which this research is conducted is one in which programmes of early education have never been so strongly promoted by the British government (see *Meeting the Childcare Challenge: A Framework and Consultation Document*, 1998; *Inter-departmental childcare review: Delivering for children and families*, 2002; National Statistics, 2006). Because of their uncertain impact yet undeniably strong promotion, determining the impacts of early education to the vulnerable development of young children has the potential to enhance our understanding of how the current generation of young children's development can be promoted and protected. In attempting to do so, this investigation brings to light of how the futures of young British children may be being shaped by the educational policies of the government; policies that have been partly founded upon the earlier research evidence that this study aimed to build upon.

2.1.2 Research Questions

Based upon the findings of previous studies, the aims of this investigation led to the following research questions:

1) Can high quality programmes of early education mitigate the impact of risks to promote resilience in the social and cognitive development of young children at school entry at age 5?
   a) *How do these effects impact subsequent vulnerable and resilient developmental pathways between ages 5 and 7?*
2) Through what means might early education achieve such effects?
   a) *Can early education that is of high quality supplement the care and education provided by families?*
   b) *Can early education that is of high quality increase children's school readiness?*

2.1.3 Rationale for Questions

The rationale behind the research questions of this investigation lay primarily in the findings of previous research that had investigated the relationships between risks, resilience, vulnerability, and protection within the context of the developing child. Furthermore, these studies and their findings were also considered in conjunction with those that originated from educational research. In particular, emphasis was given to the methodologies and findings of investigations that had aimed to establish the relationships between programmes of early education, risks, and young children's development (e.g. Burchinal, Peisner-Feinberg, Bryant, & Clifford, 2000; NICHD, 2000a).

Question 1: Can high quality programmes of early education mitigate the impact of risks to promote resilience in the social and cognitive development of young children at school entry at age 5?

This question lay at the heart of this research and arose from the range of impacts that have been found in research on early education and young children's development together with each of these and psychosocial risks. Based upon these relationships, this research aimed to make novel contributions to educational, social, and developmental psychological research. With such information, it then became possible to examine the provision of early education in the United Kingdom.

In order to best answer this central research question, the impacts of risks and early education were not confined to a particular domain of children's development. Rather, this study took a holistic view of children's development, appreciating that children do not develop skills and abilities that are independent from each other. The impacts of risks and early education were examined on young children's cognitive *and* social/behavioural development. The means by which this was accomplished is discussed in Section 2.4.

In addition, this question also postulates a *means* by which programmes of early education might be able to promote resilience in children's development. Previous research that has investigated resilience and vulnerability in children's development

has revealed that when children are exposed to 'risks' (stemming from the contexts[79] in which they develop) this hinders future development. By contrast, 'resilience' is argued to be a *process* whereby the deleterious relationship between risk and development is mitigated by a context, situation, or event which is said to result in 'protected' development. How these relationships were operationalised in this investigation is discussed further in Section 2.4.1.

The small amount of educational research that has examined whether early education can lessen the impacts of risks upon children's development has theorised that such effects will vary according to the 'quality' of this early education (e.g. Burchinal, Peisner-Feinberg, Bryant, & Clifford, 2000). This theory shaped the directionality of this central research question and also those that followed: each sought to determine the means by which early education might achieve such risk mitigation.

Question 1a: How are these effects related to subsequent vulnerable and resilient developmental pathways between ages 5 and 7?

Leading on from the central research question is the longevity of any of the protective effects that were identified. Although programmes of early education were hypothesised to mitigate the impacts of risks during the pre-school period, the value of such findings would be greatly enhanced by establishing whether there was a developmental legacy through the school years. This research question looked at the effects of risks and protection on children's development once children had left pre-school and assumed that development during this period would shape the developmental pathways to come.

Question 2a: Can early education of a high quality supplement the care and education provided by families?

The rationale for both this question and the one immediately after was shared, both served to extend question 1. Because the majority of risks to children's development (via 'adversity') are believed to originate from the environments in which they develop and the majority of young children develop in the context of their care providing families, so these surroundings have the potential to be sources of risk to

[79] Including those personal such as gender

children's development. Likewise, because early education of a high quality is theorised to be a protective factor that might mitigate the impacts of risks, this question hypothesises relationships between: 1) the resilience that might be promoted by early education and 2) the care-giving environments that children experienced at home.

Question 2b: Can early education of a high quality increase children's school readiness?

This final question posits a means by which early education could have a resilience promoting protective effect that lasts beyond the period children attended their programmes of early education. Drawing upon previous research that has investigated the effects of early education, it was postulated that any longitudinal impact on children's development will come from providing children with a better start to primary school. As with question 1, the holistic approach to development was maintained; school readiness was theorised to take the form of *both* enhanced social development (particularly self-regulation) as well as cognitive skills.

2.1.4 Research Strategy

Establishing the contributions of early education to children's developmental outcomes required longitudinal information about their development from the point in which they were enrolled in their programmes of early education. With it, baseline and subsequent developmental pathways, both vulnerable and resilient, could be established which allowed for the impacts of early education to be brought to light. This investigation hypothesised that the provision of *high quality* early education would be able to promote resilience in the development of children from the point in which they began early education onwards into primary school. Such an impact was theorised to result from early education supplementing the *social* and/or *cognitive* development of children which may, in turn, have future long term indirect effects by increasing children's school readiness.

To investigate these hypotheses, a series of secondary analyses were conducted that reanalysed the developmental and educational data belonging to, and originally gathered by, the Effective Provision of Pre-school, Education (EPPE) project (see

Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004). Although the EPPE studies were the first in the UK to investigate the *effectiveness* of early education for mainstream children, these investigations were not intended to establish the contribution of early education to children's vulnerable and resilient developmental pathways. Thus, by pursuing this aim with the EPPE data, this investigation drew upon and also extended the findings of the original EPPE studies and thereby can claim to be the first of its kind to be conducted within the UK. The original EPPE project, its aims, design, and sample are discussed further in Section 2.2.

Because both this investigation and the EPPE studies researched the contributions of early education to children's development, the data gathered by the EPPE project was highly suitable for reanalysis. This suitability was evidenced in the essential longitudinal information that the EPPE project gathered concerning children's development and their programmes of early education. For this investigation, data about both development and early education were necessary for estimating developmental pathways and the contributions that were made by programmes of early education. The measurement instruments that were used to gather this longitudinal information and their composition, validity, and reliability are considered at length in Section 2.3.

The title of this study illustrates the necessity for longitudinal data that was aimed at measuring children's development. Moreover, establishing the contribution of early education to developmental pathways carried with it a further implication: the longitudinal data needed to span a long enough period for resilient and vulnerable developmental pathways to become established and then subsequently identified. Given the fixed period in which this doctoral research had to be completed, the strategy of secondary analysis permitted the study of a longer period of development than would have been possible with a comparable primary analysis. Indeed, in other investigations of children's development, the problem of a limited time-span has been commonly overcome by adopting just this strategy (e.g. Brooks-Gunn, Phelps, & Elder, 1991; Cherlin, 1991; Duncan, 1991; McCall & Appelbaum, 1991).

Despite the suitability of the information that was gathered by the EPPE project, the reanalysis of their data obliged this study to broadly adopt the decisions that the EPPE

team made in their research design and strategies. Consequently, the research strategy of this investigation took the form of a longitudinal cohort design that investigated a multi-level (see Section 2.4.2) and nationally representative sample (see Section 2.2.1). Whilst designs including representative samples have been used in previous studies of vulnerability and resilience, others have included participants who were selected due to their development being at relatively high-risk (being evidence of vulnerability). However, by using a broadly representative sample, the contributions of early education could be generalised across a wider range of both young children and programmes of early education than would have been possible from investigating a sub-sample that was believed to be at high-risk.

By reanalysing the EPPE data, the design constraints that were imposed on this investigation influenced not only the research strategy, but also how the difficulties that were encountered by the EPPE research were dealt with. For example, generalisable results were obtained by using a broadly representative sample rather than one thought of as at high-risk. Alternatively, another example is the longitudinal and simultaneous examination of multiple domains of development rather than a cross-sectional study limited to a single domain. The research strategies obliged by the reanalysis of the EPPE dataset increased the validity of its results in comparison to those that have been found in studies that preceded this investigation.

2.2 The Effective Provision of Pre-school Education Project (EPPE)

The origins of the EPPE project lay in the findings of the Rumbold (1990) and 'Start Right' (Ball, 1994) reports. Whilst both noted the potential of programmes of early education to impact long term educational attainment, they also noted that existing conclusions were not based upon large scale investigations which have the potential to return conclusions of greater generalisability than those obtained from smaller experimental studies (see Sylva, 1994). However, it was in light of the findings of these relatively small studies that EPPE was designed to become the first large scale UK research project to examine the effectiveness of pre-school and investigate the variation *between* programmes of early education using multi-level models (described in Goldstein, 1987). The EPPE project used a longitudinal cohort design that examined the development and educational attainment of 2,800 children (+300 'home' children) as they entered pre-school and originally ended with their Key Stage

1 assessment at age 7. The families of 500 children were randomly approached and recruited from each of 6 types of early education that were nested within 5 English regions (see Section 2.2.1). The subsequent findings of the EPPE project have since been noted to have influenced both pre-school policy and practice throughout the UK (Sylva & Pugh, 2005).

EPPE was designed to investigate three broad topics:

4) "The effects of centre-based pre-school education and care on children in the age range 3-5;"
5) "The 'structural' (e.g. staffing profiles) and 'process' characteristics (e.g. interaction styles) of more effective pre-school centres;"
6) "The contribution of child and family characteristics to children's development"

(Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004)

These three design objectives highlight the shared focus of the EPPE project with this investigation: both examined the impact of educational and social factors on young children's psychological development. Although the design that was employed by EPPE might have been similar to those of traditional child cohort studies (e.g. the 1970 British Cohort Study), this was not the case. Rather, the decision was made to sample pre-schools rather than children due to the limitations that a child cohort design would have had for testing centre effects, for which 20 children per setting is the minimum. By employing a design that recruited families whose children were already attending pre-school, the 'nesting' of many children within pre-schools was achieved and this enabled conclusions about centre effects to be drawn with increased reliability and validity (see Section 2.4.2).

For meeting their aims and objectives, the EPPE team used an assortment of instruments and measures that collected data through a variety of means and which were then analysed with both quantitative and qualitative tools (see Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004). These measures and methods included:

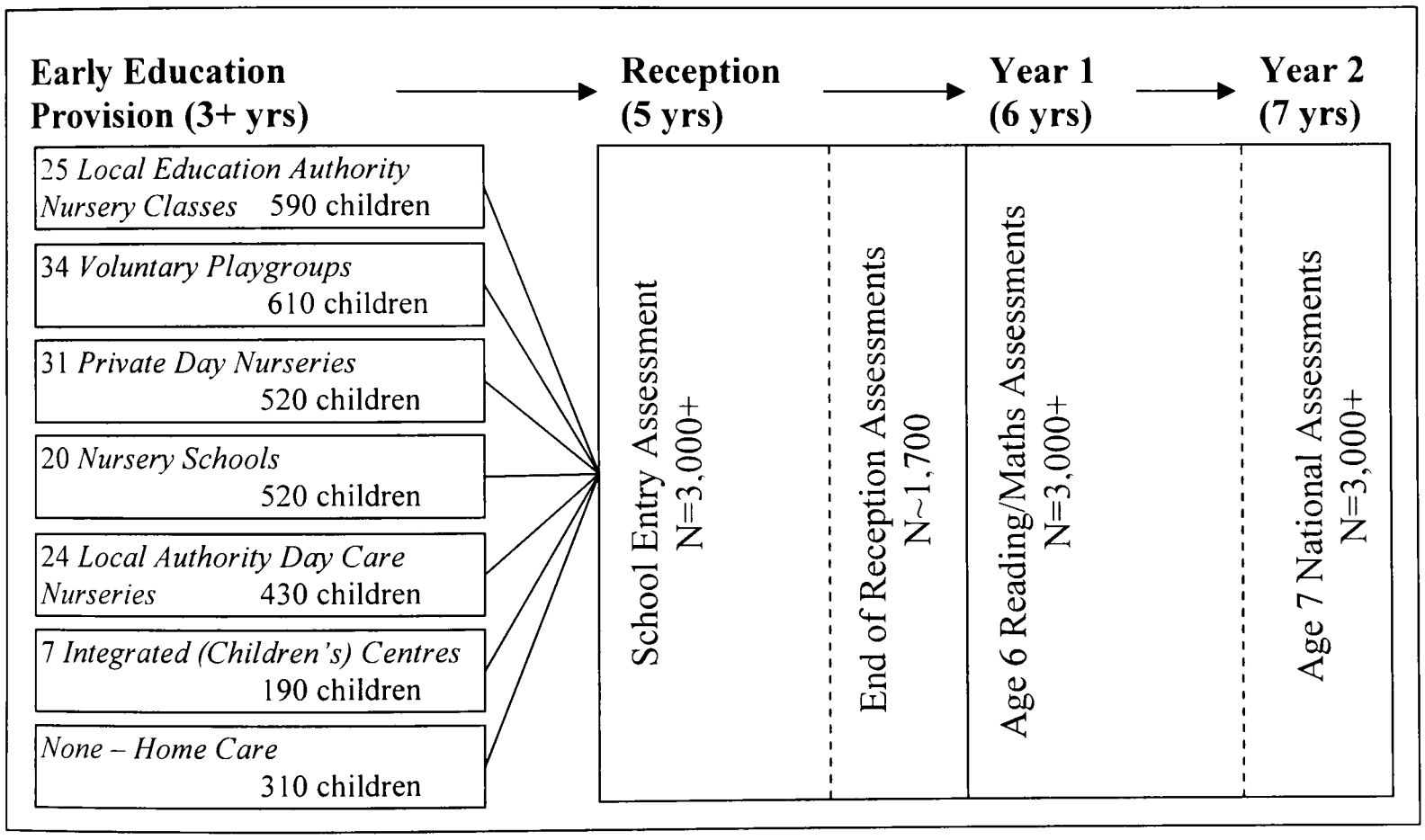
- Parental interviews and questionnaires of child and family characteristics
- Field officer assessments of pre-schools and also children's cognitive development

- Centre staff and class teacher assessments of children's social development
- Access to primary school records of children's attainment at Key Stage 1

2.2.1 The Sample

Figure 2.1 displays the stratified random sampling strategy that was used in the original EPPE project. Over 2,800 children from six different programmes of early education as well as 300+ children who had not been enrolled in early education were recruited and studied in a longitudinal design that spanned a period of 4-5 years.

Figure 2.1 The design of the EPPE project: Sampling and longitudinal data gathering procedures (Sylva et al., 2006)



Whilst those children and families who agreed to participate in the EPPE investigations were 'nested' within pre-schools such that there were approximately twenty children per pre-school, the pre-schools themselves were nested within five English regions (and six Local Education Authorities, LEAs). The inclusion of each region was designed to create a sample that reflected urban, sub-urban and rural areas and included: a Shire County, a Midlands city, a North-East region, East Anglia, and a borough of Inner-London.

The six different types of early education presented in Figure 2.1 take very different forms, and as a result, they offered the children that were enrolled in them differing experiences and opportunities. Each is presented and discussed in Sylva et al., (1999) but can be summarised as:

1) **LEA Nursery Classes** (n=25). Offering half day education and care during the working week, this form of provision carried the title nursery 'class' as they were located within primary schools.
2) **Voluntary Playgroups** (n=34). The type of care offered by this provision was extremely variable in terms of both staff qualifications (ranging from none to Qualified Teacher Status, QTS), and the resources that were available to children and staff (e.g. equipment and space). It offered half day care and was unique in being parent governed.
3) **Private Day Nurseries** (n=31). Neither administered nor governed by local authorities or LEAs, these nurseries charged for the child care that they offered which lasted as long as a full day.
4) **Nursery Schools** (n=20). Most commonly offering half day education and care, this form of pre-school had qualified teachers as managers and was viewed by LEAs as the 'traditional' type of provision.
5) **Local Authority Day Care Nurseries** (n=24). These nurseries are traditionally run by local authority social services. Whilst the primary goal of this form of provision was to provide child care for up to a full day, an educational focus was also part of this care in 13 of the sampled centres (therefore being termed *'combined'* centres).
6) **Integrated (Children's) Centres** (n=7). Far fewer pre-schools of this type were sampled by EPPE project as in 1997 these "integrated" centres were relatively new (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004). Somewhat similar to nursery schools, the care they provided differed in that it promoted greater parental involvement, combined aspects of both child care *and* education (hence their title 'integrated'), and offered longer hours of care (including full-day).

Recruitment of the Pre-schools and Families

Families and children were first approached to take part in the EPPE project between January 1997 and June 1998 with the aim of recruiting approximately 2000 children who would be evenly distributed between the five sampled geographical regions and the types of pre-school provision: nursery classes, playgroups, day nurseries, and LEA nurseries. However, an uneven distribution of these forms of provision was expected (and subsequently found) across the five geographical regions. For example, Norfolk had fewer playgroups whilst North Tyneside had more LEA nursery classes (Sammons et al., 1999).

Importantly, the recruitment of children and their families into the EPPE investigation was not conducted in an *ad hoc* fashion. Rather, each child was required to meet a set of eligibility criteria before their families were approached. These included each child being a minimum 36 months of age and having attended the targeted pre-school for a minimum of 10 weeks (with 3 sessions or 5 hours a week) prior to recruitment (Sammons et al., 1999). Furthermore, for those children attending multiple pre-schools, the pre-school sampled by the EPPE project had to be the primary one that the child attended. The resulting characteristics of the children and pre-schools sampled by the EPPE investigation are now presented and their representativeness discussed through comparison to national figures relating to years at the beginning of the EPPE project (1997; Schuman, 1999) as well as those that are more recent (2003; Large & Ghosh, 2006). This comparison provides information on the wider background in which the EPPE research took place as well as indicating how representative the sample (and consequently the findings) has remained over time. The more representative the EPPE sample has remained of current pre-school attendees and families, the greater the external validity (generalisability) of the results stemming from this secondary analysis.

Representativeness

EPPE used a sampling procedure designed to gather a sample that was over-representative of families from socially disadvantaged and ethnic minority backgrounds as higher rates of attrition were expected for these families. Over the next two years of the project (1997-1999), the drop-out rates of families were as expected and when the sampled children reached 5 years of age, they and their

families were found to be broadly representative of those in the rest of England (see Tables 2.1 and 2.2).

Table 2.1 Indicators of Socio-Economic Status (SES) in the EPPE sample (1997), UK (1997), and England (2001) taken from Melhuish et al., (1999) and National Statistics, (2003a) respectively.

Indicators of Socio-Economic Status	**UK 1997** (unpublished)[a]	**ENGLAND 2001** (all people 16-74)		**EPPE 1997** (mean)	Just Mothers	Just Fathers
Socio-economic classification[b] %	**100**	**71.58**		**85.30**	**86.60**	**74.70**
Large employers and high managerial occupations		3.50				
Higher professional occupations		5.11	*(sum:) 8.61*	5.8	4	7.6
Lower managerial and professional occupations	26.9		18.73	18.5	19.1	17.9
Intermediate occupations		9.48				
Small employers and own account workers	46.3	6.98	*(sum:) 16.46*	22.5	33.2	11.8
Lower supervisory and technical occupations	20.9		7.11	15.1	6.7	23.5
Semi-routine occupations			11.65	15.15	19.1	11.2
Routine occupations	5.9		9.02	3.6	4.5	2.7
Long term unemployed	-		1.01	-	-	-
Never Worked	-		2.72	4.65	8.2	1.1
Mean Individual Income £	**19,375.20[c]**	**23,384.40[c]**		**-**	**10,000 - 19,999[d]**	**10,000 - 19,999[d]**
Education[b] %	**99.95**	**93.31**		**83.96**	**95.27**	**72.64**
None	15.90	29.08		17.83	20.40	15.26
level 1[e]	36.35	16.63		29.80	37.11	22.48
level 2[f]	14.65	19.36		10.91	12.07	9.74
level 3[g]	14.65	8.34		7.57	8.10	7.03
level 4/5[h]	18.40	19.90		17.86	17.59	18.13

a. Socio-economic classifications and education levels in the UK in 1997 are taken from Prior, Courtenay and Charkin (1999), cited in Melhuish et al. (1999).

b. Appendix 1 details the matching of scales that was carried out on all original codings

c. Both figures were calculated by multiplying the mean weekly earnings by 52 with data coming from Daniels (2007).

d. Original mode average categories

e. 1+'O' level passes, 1+CSE/GCSE any grades, NVQ level 1, Foundation GNVQ

f. 5+'O' level passes, 5+ CSEs (grade 1), 5+ GCSEs (grades A-C), School Certificate, 1+ 'A' level/'AS' level, NVQ level 2, Intermediate GNVQ

g. 2+ 'A' levels, 4+ 'AS' levels, Higher School Certificate, NVQ level 3, Advanced GNVQ

h. First degree, Higher degree, NVQ levels 4 and 5, HNC, HND, Qualified Teacher Status, Qualified Medical Doctor, Qualified Dentist, Qualified Nurse, Midwife, Health Visitor

As well as recruiting a sample that was broadly representative of all socioeconomic groups, the EPPE project also managed to achieve a sample that was characterised by ethnic diversity (especially after attrition). Table 2.2 compares the ethnicity of children in this study against the ethnicity of children throughout England (see Schuman, 1999; Large & Ghosh, 2006). Although families from ethnic minorities were slightly over represented when their children were aged 3, this disparity had lessened by the time their children were aged 7. Indeed, over time the distribution of ethnic minorities in England itself came to more closely resemble that of the families followed in the EPPE studies. Furthermore, by investigating a sample that was broadly representative of both the ethnic background and socioeconomic groups of England, greater validity was lent to the generalisation of findings back to the English population.

Table 2.2 The changing ethnic backgrounds of the English sample and population over the course of the original EPPE project

Ethnicity	EPPE % at age ~3	EPPE % at age ~7	English % 1997	English % 2003
White	76.4	77.9	93.6	91.0
Black Caribbean heritage	3.7	3.6	0.9	1.1
Black African heritage	2.1	0.8	0.6	1.0
Black other	0.7	0.7	0.2	0.2
Indian	2.1	2.1	1.6	2.1
Pakistani	5.6	5.3	1.0	1.4
Bangladeshi	1.3	1.0	0.4	0.6
Chinese	0.2	0.1	0.3	0.4
Any other ethnic minority	2.0	1.8	0.5	0.4
Mixed ethnicity	6.1	5.5	0.7	1.4

In addition to over sampling families from ethnic minority backgrounds, this investigation also over sampled early education centres that were classified as 'maintained provision' (e.g. nursery schools and classes). However, the six types of early education provision that are illustrated in Figure 2.1 were also found to be the six most common types of early education provision in the United Kingdom (see Table 2.3). As might be expected, the EPPE project also identified several key differences between these distinct types of provision. Firstly, the quality of the pre-schools differed across the six different types of provision: programmes of early education which integrated care with education were found to have (on average) higher quality educational provision and also provided better care (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004). Secondly, different types of children attended different types of early education with children from disadvantaged backgrounds being less likely to go to private pre-schools (Sammons, Taggart et al., 2002). Such systematic differences illustrate how it was necessary to pay heed to not only the differences between young children, but also the differences between centres of early education. To do otherwise would have been to assume homogeneity within both, an assumption that would have been unfounded given the previous findings of the EPPE project.

Table 2.3 Comparison of the 1997 EPPE pre-school sample to the pre-school population of England in 2008 (from National Statistics, 2003b, 2008)

Type	England 2008	EPPE 1997
All Providers *(number of 3 and 4 year olds)*	1,136,300	2,860
%	*95*	-
Private and voluntary providers	413,100	1130[a]
%	*35*	*40*
Independent schools	36,400	-
%	*3*	-
Maintained nursery and primary schools	683,000	1,730[b]
%	*57*	*60*

a. Voluntary playgroups and Private Day Nurseries

b. LEA nursery classes, Nursery Schools, LA Day Care Nurseries, and Integrated (children's) centres

2.2.2 Ethics

Many of the ethical considerations that are pertinent to both educational and psychological research (BERA, 2004; BPS, 2006) were addressed in the primary analyses of this data that was undertaken by the original EPPE project. However, the re-analysis of the data raised additional considerations that were specific to this investigation. For example, the proposal for this research was submitted for approval to both the University of Oxford's Ethics Committee *and also* the Principal Investigators of EPPE who had secured the original ethical approval from the ethics board at the Institute of Education, University of London.

Reassuring both the EPPE team and the then DfES (now DCFS) who funded the EPPE (now EPPSE) project that this research was to be carried out in an ethical manner obliged *negotiating access* to their data and led to a formal letter specifying the ethical procedures that were to be followed (see Appendix 2). This letter details the data management procedures that were used by this investigation in compliance with the *Data Protection Act* (1998): the data of the EPPE projects was securely stored on a single computer that was password protected in an office to which there was restricted access.

The ethical promises that were made to the families who took part in the EPPE investigations remained applicable for this study because the author became part of the EPPE project, as well as being formally monitored by its principal investigators. One of the consequences of the status of this doctoral investigation in regard to the EPPE project was that permission to publish papers that used the EPPE data in research journals had to be obtained from both the principal investigators as well as the EPPE project's DCSF manager. This serves as both an example of the integration of this investigation within the EPPE project as well as how the participants (families, their children and schools) were protected in this study. Regular updates were given to the EPPE team and to the government as analyses progressed.

Anonymity and Confidentiality

Ensuring both of these was a particular concern for this investigation as the reanalyses were undertaken at a different University and site to the original project. Both the *confidentiality* and *anonymity* of the families who participated in the EPPE project

was ensured by the removal of all information that identified the families. This included not only parental details but also information identifying their children and the pre and primary schools they attended prior to the EPPE team making their data available for re-analysis.

2.3 Instruments

The instruments and information used throughout the EPPE project to measure children's cognitive and social development, the risks to this development, and the different qualities of their early education are presented in Table 2.4. Each of the three main columns corresponds to one of the key concepts of this investigation: *Risks* are theorised to hinder *development,* and *early education of high quality* is hypothesised to ameliorate the effects of risks and thereby promote resilience.

Table 2.4 Instruments and information used by the EPPE project in the measurement of concepts also used in this investigation

Risks to Development	**Children's Development**		**Quality of Early Education**	
	Cognitive	*Social/Behavioural*	*Structural*	*Process*
21 Risks identified from the EPPE data and previous research that were categorised as representing either a *child* or *familial* ecological level of risk (see Tables 2.8 and 2.9 and section 2.3.4)	**Pre-school & Primary school entry:** British Ability Scales (BAS) **Primary School** Academic Attainment: *Year 1, maths & reading* *Year 2/ Key Stage 1, maths, reading & writing*	**Pre-school entry:** Adaptive Social Behaviour Inventory (ASBI) **Primary school entry:** Extended ASBI; Child Social Behaviour Questionnaire (CSBQ) **Primary School:** *Year 1,* Strengths and Difficulties Questionnaire (SDQ) *Year 2/Key Stage 1,* Strengths and Difficulties Questionnaire (SDQ)	Manager: highest academic qualification Manager: highest childcare qualification Staff: average age Staff: average highest academic qualification Staff: average highest childcare qualification Centre size: *no. of staff no. of children*	Early Childhood Environmental Rating Scale Revised (ECERS-R) Early Childhood Environmental Rating Scale Extension (ECERS-E) Caregiver Interaction Scale (CIS)

Table 2.4 shows seven measures that were used by the EPPE team and which featured in this investigation These seven instruments measured a) children's development (BAS, ASBI, CSBQ, SDQ) and b) the quality of the early education that these children received (ECERS-R, ECERS-E, CIS). Table 2.5 gives a detailed summary description of each of these measures that includes: the scale and range of their measurement, any subscales that were used in this investigation, and evidence of the robustness from previous studies. Section 2.3.2 subsequently expands upon Table 2.5 by discussing each of these measures in more detail after Section 2.3.1 first discusses general principles of data collection and management.

Table 2.5 Summary table of the instruments used in this investigation including information on the robustness of scales and indicators

struments	Scale of measurement	Subscales (*only those used in this investigation)*	Robustness/Validity/Reliability
ritish Ability :ales (BAS)	(<0.1%) 36-162 (>99.9%) age standardised scores (rasch) derived from raw scores[80]	Only the composite score *General Cognitive Ability (GCA)* score was used; no subscale analyses	Repeatedly demonstrated from derivation of items through to concurrent validity of ability scores. E.g.: Hill (2005); Rust and Golombock (1999); Stone (1992); Cook (1988)
daptive Social ehaviour ıventory \SBI)	3-point (*1=rarely exhibited behaviour, 3=almost always*)	(Exploratory Factor Analyses derived, see Sammons et al., 2003)	
		Co-operation & Conformity	(*Chronbach alpha*) 0.88
		Peer Sociability	0.85
		Confidence	0.70
		Anti-social	0.70
		Worried/Upset	0.61
hild Social ehaviour)uestionnaire :SBQ)	5-point (*1=rarely/never exhibited behaviour, 5=almost always)*	(Exploratory Factor Analyses derived, see Sammons et al., 2003)	
		Self-Regulation	(*Chronbach alpha*) 0.88
		Co-operation & Conformity	0.94
		Peer Sociability	0.87
		Anti-social/Worried	0.84
		Empathy & Pro-social	0.89
		Openness	0.78
trengths and)ifficulties)uestionnaire SDQ)	3-point (*0=not true of child, 2=certainly true*)	*Emotional Symptoms (0-10)* *Conduct Problems (0-10)* *Hyperactivity (0-10)* *Peer Problems (0-10)* *Prosocial Behaviour (0-10)*	Structural validity of factors demonstrated by Palmeiri and Smith (2007). Internal consistency, lack of response bias, and external validity demonstrated by Emerson (2005)
:arly Childhood :nvironmental ⟨ating Scale ⟨evised ECERS-R)	7-point (*1=inadequate provision, 7=excellent*)	Mean of 43 indicators across 7 subscales: *Space and Furnishings, Personal Care Routines, Language Reasoning, Activities, Interaction, Programme Structure, Parents and Staff*	From Sylva, Siraj-Blatchford, & Taggart, (2006): % agreement across indicators = 86.1%; Inter-rater reliability weighted kappas all > 0.50. Factor structure validity demonstrated in: Sylva et al (1999); Rossbach, Clifford, and Harms (1991)
:arly Childhood Environmental Rating Scale Extension (ECERS-E)	7-point (*1=inadequate provision, 7=excellent*)	Mean of 18 indicators across 4 subscales: *Literacy, Maths, Science and Environment, Diversity*	Predictive validity demonstrated by EPPE (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004). Factor structure validity demonstrated in: Sylva et al (1999);
Caregiver Interaction Scale (CIS)	4-point (*1=not at all characteristic, 4=very much*)	*Detachment* *Punitiveness* *(Over) Permissiveness* *Positive Relationships*	From (Arnett, 1989): items selected on the basis of 80% agreement between 3 observers. 4 factor structure from Principal Components Analysis where min. loading=0.49

[80] which themselves cannot be directly compared as each child takes different sets of items

2.3.1 General Principles of Data Collection and Management

After the EPPE project had recruited its children and families from those that were enrolled in centres of early education, a fieldworker specific to the area in which each family lived conducted a semi-structured interview with the parents. The 1:1 interview took place in (mostly) the family home and gathered information about the characteristics and structures of the home and family that this study used to provide measures of risk to development (see Section 2.3.4). In addition, the fieldworker also assessed the cognitive abilities of the child when they were at pre-school (see Section 2.3.3). This provided a baseline that permitted the impacts of pre-school upon subsequent development to be measured. Accompanying these home and pre-school visits for child and family data were field worker assessments of the structures and processes of the main form of pre-school that the child was enrolled in and an assessment of the child's social skills and behaviour that was carried out by a pre-school centre worker most familiar with the child (see Section 2.3.3).

When the children taking part in the EPPE project left their pre-schools and entered the reception class of their primary school, the same procedures for measuring their social and cognitive skills were repeated. Whilst EPPE fieldworkers assessed children's cognitive abilities, children's social skills and behaviour were assessed by their class teachers. Although this repeated means of measurement was not extended to the parental interview and assessment of family and home structures, some of these initial measures were invariant over time, for example child weight and mother age at time of birth. That said, some of the measures taken at baseline were also likely to have varied over time (e.g. the Home Learning Environment, see Section 2.3.4) which means that for this investigation, the developmental risks represented by these measures are constrained in their timing. In other words, whilst the abilities, skills, and behaviour of children could be measured as varying over time, the risks to this development reflected only the time period in which the initial measures were gathered.

The final two measurement points used by the original EPPE investigation and which yielded data that was reanalysed here took place at the end of children's first and second years of primary school (Key Stage 1). Although the approach used to

measure children's social skills remained consistent to that used earlier, the measurement of children's cognitive skills and abilities did not. Rather than using psychometric assessments of children's cognitive abilities, fieldworkers instead assessed children's maths and reading skills at the end of Year 1 through paper and pencil tests. At the end of Year 2, EPPE obtained children's scores on their Key Stage 1 national assessments of maths, reading, and writing from the schools.

The instruments and procedures that were used in gathering this information are now described in turn. Beginning with the structural and process qualities of early education, this discussion then considers the tools that were used to assess young children's development between the ages of 3 and 7, and ends with a detailed examination of the measures used to assess the risks to this development.

2.3.2 The Qualities of Early Education

The concept of 'quality' is one that is hotly debated by researchers investigating the impacts of early education and has been argued to be something that "is not a universal concept but depends on national curricula and cultural priorities" (Sylva et al., 1999). Indeed, the assumption of a measurable 'quality' has led to the widely accepted bifurcation of quality into sub-domains entitled: *structural* and *process* (Currie, 2001). Whilst structural quality refers to observable attributes such as caregiver/child ratio, process quality alludes to attributes that are harder to observe such as the interactions of caregivers with the young children in their care. This notional division of quality is one that is adopted by this investigation in order to aid in the interpretation of any protective effects identified as being conferred by the quality of pre-schools to the development of young children's skills and abilities. Would structures or processes be more likely to protect children's development?

For process qualities, the EPPE project used multiple instruments to measure a variety of different processes that included the *overall* quality of pre-schools (which included structural measures), the quality of *curricular provision,* and *caregiver-child interactions* (see, Sylva et al., 1999; Sammons et al., 2003). In assessing each of these domains of process quality, a separate and corresponding instrument was used, although there is overlap between what each instrument measures:

1. *Overall Quality:* The Early Childhood Environmental Rating Scale Revised Edition (ECERS-R; Harms, Clifford and Cryer, 1998)
2. *Educational Quality:* The Childhood Environmental Rating Scale Extension (ECERS-E; Sylva, et al., 2006)
3. *Interactional Quality:* The Caregiver Interaction Scale (CIS; Arnett, 1989)

In addition to these three measures of process quality, the EPPE team also measured and surveyed the structural qualities of pre-schools that had been identified as the dominant form of centre based child care for each child (via parental interview). Identified via a interview survey of pre-school centre managers, the six measures of structural quality that were used in this investigation are detailed below (Section 2.3.2) and concentrated on the size of centres and the qualifications of the staff therein. In addition, the assessment of quality that was provided by the ECERS-R served to further measure structural quality for example *outdoor facilities* and *room space*.

Accompanying the assessments of overall, process, and structural qualities was the duration that each child had been in attendance in their primary/dominant form of pre-school. Although duration of attendance is a measure that relates to each child rather than each pre-school (such that each child has an independent duration), it is also related to pre-school insomuch as it is partially dictated by the type of provision that each child was enrolled within. Table 2.6 presents the differences that were found between the measures of quality and duration when comparing the different types of early education provision studied in the EPPE investigation. Even though each of the measures of quality assessed a different facet, the similarity in how these varied across the differing types (at the mean level) lends credence to the notion of underlying *overall* quality that is more fundamental than either the structures or processes that are theorised to comprise it.

Table 2.6 Differences between the different programmes of early education in the UK as identified by the EPPE studies (adapted from Sylva et al., 1999; Taggart et al., 2000; Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004).

Type of early education provision	Reflected Measures of *Structural* quality		Mean Rankings of *Structural* Quality				Mean Rankings of *Process* Quality scores		
	Children per staff member	Duration of attendance (mean number of sessions)	Managers: highest childcare qualification	Managers: highest academic qualification	Experience	Staff: highest childcare qualification	ECERS-R	ECERS-E	CIS *
EA nursery asses	1:13	476	2	2	2	2	3	3	2
oluntary aygroups	*1:8*	*114*	*6*	*6*	*3*	*6*	*6*	*6*	*6*
ivate day urseries	1:8	246	5	5	6	5	5	5	5
4 nurseries	*1:8*	*320*	*4*	*4*	*5*	*4*	*4*	*4*	*4*
ursery hools	1:13	160	1	1	1	1	2	2	3
tegrated ntres	*1:10 - 1:13*	*264*	*3*	*3*	*4*	*3*	*1*	*1*	*1*

he 'punitiveness' sub-scale did not differ significantly by type and so is not included in this ranking

Structural Qualities

One of the key distinctions presented in the previous section of this chapter (2.3.2) was the differentiation of the assessment methods that were used to measure structural and process qualities. Whilst structural qualities can often be relatively straightforward to establish (for example, through the use of postal questionnaires to ascertain staff qualifications) process qualities are much less tangible, an argument that is supported by use of high-influence measurement instruments for this purpose in the EPPE project. However, despite the apparent ease in the availability of information concerning the structural qualities of early educational settings, obtaining this information poses some unique challenges to researchers. Examples are subsequently discussed before the relationship between structural and process quality is introduced, a relationship that leads readers into a detailed discussion of each of the three measures of process quality.

Of the measures used to assess the quality of the pre-schools that were included in this investigation, the educational qualifications of the staff feature prominently (four of

the six). Further, separate measurements were made of the academic and childcare qualifications of the 141 pre-school managers and the caregiving staff that they employed. The use of the term *measurement* rather than *assessment* is a deliberate one: a process of measurement rather than (survey) assessment was necessary due to the extensive diversity of both the academic and child care qualifications that are available in the UK (see Calder, 1995; Harker, 1998; Menmuir, 2001). In order to establish, understand, and then relate these measures to others, it was necessary for the EPPE team to criterion-reference the highest qualification that was reported as being possessed by each caregiver against an ordinal scale of qualification that had a fully encompassing range (see Appendix 3).

The standardising transformation of the educational (academic and child care) qualifications of staff is a method that is commonly used and is illustrated by the comparisons presented in the earlier Table 2.1 where a consistent 4-point scale of educational qualifications was used across nationwide surveys and studies: while the lowest level encompassed 5 discrete educational qualifications[81], the highest level included 12[82]. Appendix 3 details the 5-point coding scheme that was used by the EPPE project (based on QCA, 1999) to standardise the 60+ discrete qualifications that were reported by the sampled caregiving staff and managers.

Dividing the assessment of staff education by manager/caregivers is one that reflects a common theme found throughout this investigation: that of an *ecological perspective* (e.g. Bronfenbrenner, 1979, 1986) which addresses the nesting of systems and individuals within ever broader systems and groupings. Also seen in the categorisation of risks to development (familial vs. child) and quality itself (e.g. staff numbers vs. staff-child relationships), the separation of managerial qualifications from those of their employees captures the differences that can exist between their roles in a pre-school setting and from these, the relationships that might therefore be shared between them and the children in their care (see Mitchell-Copeland, Denham, & DeMulder, 1997; Pianta, 1997; Richman & McGuire, 1988)

[81] O level; CSE; GCSE; NVQ level 1; Foundation GNVQ
[82] First degree; Higher degree; NVQ levels 4 and 5; HNC; HND; Qualified Teacher Status; Qualified Medical Doctor; Qualified Dentist; Qualified Nurse; Midwife; Health Visitor

The inclusion of measures of structural quality as possible protective moderators of the relationship between risk and young children's development is supported by the findings of earlier studies that have shown that structural quality (and duration) is related to child development (e.g. Melhuish, 2004). Each of the six measures that were included in this investigation and their relationship to young children's social and cognitive development is now illustrated with reference to the findings of the EPPE project (Sammons, Sylva et al., 2002; Sammons et al., 2003), the largest European study of its kind to date (Sammons, Elliot et al., 2004).

First, the ratio of children to staff is a concept whose effect on children's development is one that the EPPE project identified as being difficult to study with a non experimental design (Sammons, Sylva et al., 2002). However and despite such confounds, a significant association was nonetheless identified in the EPPE project between fewer children per caregiver and these same children demonstrating greater "Early Numbers Concepts". To ease the likelihood of a confounded effect and to help distinguish the impacts of educational training from centre size, this investigation included the number of children and the number of staff per centre as the first and second measures of structural quality.

The third and fourth measures of structural quality used in this investigation were the child care and academic qualifications of the caregiving staff. The EPPE project found a significant relationship between the proportions of staff with very high and/or very low qualifications and young children's social development and behaviour. Higher qualifications promoted better behaviour and social skills. A similar albeit less evidenced relationship was found for cognitive development with a higher proportion of staff with very high qualifications being associated with young children displaying greater pre-reading progress. From these findings, the EPPE team speculated the qualifications of staff to have indirect effects on the development of young children in their care such that higher qualifications lead to first higher quality and subsequently then on to promoted child development.

The hypothesised relationship between the qualifications of those caring for children in pre-school centres, a linked advantage in centre quality scores, and then the enhanced development of young children is reinforced by the findings of the EPPE

team concerning the child care (5th) and academic qualifications (6th) of centre managers. Of the six measures of process quality examined in the EPPE project, (see below and Table 2.7) all except one (punitiveness in relationship) were found to vary with the qualifications of managers; higher qualifications were associated with high quality provision. Taken together, the findings concerning the qualifications of staff and the development of the young children in their care were concluded as indirect: mediated by intermediate improvements to quality *processes* of care.

The duration of each child's attendance at their pre-school was measured in three ways by the EPPE project: number of months between baseline assessment and assessment at entry to reception class; number of sessions registered per week; and number of sessions attended between baseline assessment and exit (from attendance records). Of these, it was the first, number of months between baseline and repeat assessment, which was used in this investigation. This was a decision based upon the positive relationships that the EPPE project found between the number of months of children's attendance and their development together with the limitations that were identified with the two alternative measures.

The first of the alternative measures of duration, the use of the number of sessions has been referred to as, "A relatively weak indicator of amount of provision" (Sammons, Sylva et al., 2002) and was found to vary across type of centre as well as not reflecting variations between weeks. Although these criticisms may also be levelled at the use of the number of months that children had been attending pre-school, number of months, unlike number of sessions, was significantly associated with the progress that was made by young children in their cognitive development[83]. Although attendance records account for weekly variation in attendance, they only recorded duration of attendance at the targeted EPPE pre-school (whose quality was measured). As 20.3% of the children who were sampled by the EPPE project moved pre-school at least once, using number of sessions as a proxy measure for duration would have resulted in these children having a lower recorded scored of duration of attendance at pre-school. It was for all of these reasons that the difference in months between the

[83] "Cognitive development" refers to assessments of: pre-reading; early number concepts; language skills; non-verbal reasoning; and spatial awareness (see Section 2.3.3)

baseline and reception entry assessments was used as the measure of how long each child attended their main form of child care, the duration of their attendance.

Before moving on to consider the measurements of process quality, it is important to reiterate the non-independence of the qualities that this investigation made use of. The relationship between *structures* and *processes* is one that has been previously established and researched (e.g. Phillipsen, Burchinal, Howes, & Cryer, 1997) with a recent UK Government initiative aiming to aid child development by raising the *overall* quality of pre-schools through improving the qualifications of their staff ("The Transformation Fund"[84], 2007). Excluding the measure of overall quality (ECERS-R), the bifurcation of quality by structures and processes was one that was adopted by this investigation as a continuation of the *ecological perspective* to child development that was referred to earlier.

Caregiver Interaction Scale (CIS)

The CIS (Arnett, 1989) consists of 26 items that were clustered into 4 subscales to measure the interaction between a typical caregiver and the children in their care. Of the four subscales, three were negative behaviours: Detachment, Punitiveness and (over) Permissiveness. The single remaining subscale was positively worded with the title 'Positive Relationships' and included questions that attempted to measure caregiver enthusiasm and warmth. By contrast, the three negative subscales consisted of items that reflected the inherent negativity of these scales: 'Punitiveness' measured interactions including caregiver harshness and over controlling behaviour, 'Permissiveness' focussed on a lack of caregiver control and child discipline, and finally, 'Detachment' assessed such behaviours as avoidance of involvement with the children in their care.

Unlike the other instruments for the quality of early educational settings (the ECERS-R and E), the CIS was not used as a single measure but rather at the individual subscale/factor level. Furthermore, the CIS assessed a form of quality that focussed exclusively on the interaction of staff with children rather than a more educational or *overall* environmental quality. Including the CIS in this study was important because

[84] Which has since been renamed, "The Graduate Leader Fund".

the EPPE project had hypothesised it as being more strongly related to social and behavioural child outcomes than either the ECERS-R or the ECERS-E (Sylva et al., 1999). In addition to the specific focus of the CIS and the strength of previous findings, the decision to use this measure was based upon the observation that many existing definitions of process quality have paid particular emphasis to the interaction of staff with children (e.g. Espinosa, 2002).

Carl (2007) provides an extensive and critical review of the format and validity of the CIS after first citing its widespread use in research and intervention programmes in nine American States. The criticisms presented by Carl fall into three broad categories: definitions, adaptations, and variability. The first of these, *definitions*, argues that the CIS lacks specific definitions of otherwise subjective terms and that this hinders the reader in understanding exactly what features of caregiver-child interactions are measured. For example, the wording of the fourth item: "Places high value on obedience" asks the rater to use their own subjective beliefs concerning what it is that constitutes placing high value on a behaviour and what it is that constitutes obedience. Moreover, the item is also asking the rater to make a value judgement of a caregiver's beliefs which may match neither the beliefs of the rater nor those of Arnett himself. From the possibility of varied inconsistent definitions highlighted by these examples, the consistency of the measurements obtained by the CIS can be seen to suffer which suggests caution when interpreting results from statistical analyses.

The second criticism of the CIS that is presented by Carl (2007) concerns the various *adaptations* that have been made to the factor structure/categories into which the 26 constituent items of the CIS fall. Although Carl cites studies that have used the same factor structure as that employed by the EPPE project, research is also presented that has used alternatives including a three factor solution made up of "sensitivity", "punitiveness", "detachment" (Ghazvini & Mullis, 2002) and an expanded 37 item CIS that replaces the positive and punitiveness subscales with ones labelled "sensitivity" and, "harshness" (Keystone University Research Corporation, 2001). This variation in the usage of the CIS and its items hinders the conglomeration of research findings concerning the CIS although the central measurement of interactions between caregivers and children remains constant.

Finally, the *variability* of the measurement scale that is employed by the CIS is also called into question in the review of Carl (2007). The 4-point scaling is referred to as, 'arbitrary' and, 'subjective' and it is claimed that this therefore limits the value of the scale for differentiating the qualities of pre-schools that are neither especially high nor low. Despite these criticisms, Carl nonetheless reports that the measure is, 'extensively used' and that attempts have been made to objectify the 4-point scale by associating each of its values to a percentage occurrence figure. As an example, the value of 3 may represent an occurrence of 'roughly 50% of the time' (Fiene et al., 2002). As a result and because of the unique contribution that the CIS offered to the measurement of the quality of pre-schools, it was deemed appropriate to use this instrument in this investigation, although with appropriate caution.

Revised Early Childhood Environmental Rating Scale (ECERS-R)

The ECERS-R (Harms, Clifford, & Cryer, 1998) is an instrument that is designed to assess the overall quality of pre-school environments for children aged between 2½ and 5 years of age (ECMERC, 2006) and has been used in more than twenty countries including the UK (Sylva, Siraj-Blatchford, & Taggart, 2006). As its name suggests, the instrument uses a rating scale that is comprised of 43 items with values ranging from 1-7 (1=inadequate, 3=minimal, 5=good, 7=excellent) to assess seven areas of pre-school quality grouped into seven subscales. Although it is primarily an observational measurement tool, the ECERS-R also involves a staff interview procedure for supplementing observations when a feature of the centre is not observable and with information about the setting and room more generally. In both cases, information obtained through interview helps to ensure the consistency and validity of the observations.

The seven subscales of the ECERS-R are designed to measure seven domains of the quality of pre-schools and consist of assessments of the social interactions between staff and children, the teaching strategies used by the staff, and teaching resources. The subscales that the 43 individual questions are organised into and the areas of quality the subscales assess are as follows (and see Appendix 3):

1. Space and Furnishings. Half of the eight items that contribute to this subscale focus on different aspects of children's play and learning such as gross motor skills.

Complementing these are the four remaining items/questions which examine the wider environment of the pre-school setting including the display of children's artwork and the space for privacy.

2. *Personal Care Routines.* Covering all aspects of the day-to-day care routines as well as focusing on health and safety practices, the six questions of this subscale require the researcher to observe the children for an extended period as the subscale includes assessments of routines governing: greeting/departing, meals/snacks, nap/rests, and toileting/nappy changing.

3. *Language Reasoning.* The four items of this scale assess provision to support language development. Although each item shares similarities with those in other subscales (e.g. "*Encouraging children to communicate*" with those in the "*Interaction*" subscale), the uniting of these items due to their relation to language development demonstrates the importance of *Developmentally Appropriate Practice* (DAP; Bredekamp, 1987; Bredekamp & Copple, 1997) to the ECERS-R.

4. *Activities.* This title appears to be something of a misnomer given that so many of its ten component questions ask the observer to look for the provision of developmentally appropriate (e.g. for fine motor skills) *play materials* such as blocks, art materials and sand/water. However, higher scores are given only if children are observed to be using the material in a way that research shows will lead to learning.

5. *Interaction.* The questions/items of this subscale concentrate on the relationships between caregivers and children with content mirroring that found in the Caregiver Interaction Scale (CIS; Arnet, 1989). Although this similarity also extends to examining child peer interactions the similarity ends with this subscale making a unique distinction between the supervision of children's gross and non-gross motor activities.

6. *Programme Structure.* The four items that comprise this subscale serve to examine the nature and timing of the play activities that children have offered to them. At the simplest levels, a variety of play activities are scrutinised (e.g. indoor, outdoor,

group, free) whilst at higher levels scoring focuses on suitability for the needs of individual children, including the needs of children with disabilities.

7. *Parents and Staff.* Differentiating itself from the other scales, the six items that make up this subscale focus on the quality of the provision as meeting the needs of the *adults* (the parents and staff) rather than the children. Particular emphasis is paid to whether adequate provision is provided to meet the needs of both of these parties over and above that which will facilitate the children's development.

The decision to include the ECERS-R in this study was based on the need to include a measure of the *overall,* as well as the more interactional and educational qualities of the pre-schools that were investigated in the EPPE project. In doing so, the decision was made to include the measure at the total rather than subscale level. The rationale for this was that a single measure of quality per pre-school would serve as an estimate of the overall and general quality rather than specific types of quality which were theorised to be better measured by the more focussed ECERS-E and CIS instruments. This decision was supported by the use of the ECERS-R at the instrument level (total score) in previous research (e.g. Sylva et al., 1999).

In discussing the validity and reliability of the instrument, the authors have themselves reported the high degree of predictive validity that has been found for the original (non-revised) ECERS scale which they claim can be extended to its revision (Harms, Clifford, & Cryer, 1998). Therefore rather than attempting to re-establish the validity of this revision, (Harms, Clifford, & Cryer, 1998) instead suggested that the inter-rater reliability of the measure is a 'major question' that concerns the validity and reliability of the now revised scale. In ensuring a sufficient agreement between raters, field tests were carried out that offered further support to the use of the scale at the overall level. An average percentage agreement between raters was found to be 86.1% which led to an interclass correlation of 0.915.

Early Childhood Environmental Rating Scale Extension (ECERS-E)

Developed in a attempt to expand several of the items of the ECERS-R (Harms, 2006), the revised ECERS-E (Sylva, Siraj-Blatchford, & Taggart, 2006) serves as an extension to this observational tool and consists of four supplementary scales that are

designed to provide a more detailed assessment of the degree to which English pre-schools adhere to the Curriculum Guidance for the Foundation Stage (DfEE, 2000; see Sylva et al., 1999). This more focussed examination on the pre-school curriculum complements the ECERS-R which adopts a more holistic focus by attempting to measure overall quality (see Section 2.3.2). The four subscales of the ECERS-E are entitled: Literacy, Mathematics, Science and Environment, and Diversity (tailoring the curriculum to individual learning needs).

The format of the ECERS-E was based on that of the ECERS-R and it was the relationship between these measures, together with how the ECERS-E was used by its authors in their EPPE project, which prompted the use of this measure at the single scale level in this thesis. The ECERS-E was developed to measure the quality of the educational provision that is provided by *English* pre-schools in particular (Sylva et al., 1999). It is on this basis that this study (like EPPE) made the assumption that it remained valid and reliable to use both measures simultaneously and to use the ECERS-E in the manner to which it was intended: to supplement the measurement of the overall quality of pre-schools that was provided by the ECERS-R.

Establishing the predictive validity of the ECERS-E was especially important for its use in this project given that its subscales were developed to measure the pedagogy within pre-schools that was hypothesised to enhance the learning of the young children in attendance. With this end in mind, the EPPE project demonstrated that the educational quality as measured by the ECERS-E better predicts the growth of young children's cognitive abilities once they left pre-school than the overall quality as measured by the ECERS-R (Sylva, Siraj-Blatchford, & Taggart, 2006). This difference demonstrates the predictive validity of the ECERS-E by offering support for the hypothesis that a more educational focussed measure of quality (ECERS-E) should be more strongly linked to the subsequent cognitive development of young children than a measure of quality that is broader in scope (ECERS-R).

The inter-rater reliability of the ECERS-E was established by the EPPE project (Sylva et al., 1999). Twenty five of the one hundred and forty one pre-school centres investigated in the EPPE sample were randomly selected to form the sample of pre-schools in which the inter-rater reliability of the ECERS-E was established. Due to

the stratified sampling of the EPPE project, separate reliability coefficients (kappa and percentage agreement) were calculated for each of the five geographical regions. Kappas were found to range from 0.83 to 0.97 whilst percentage agreements ranged from 88% to 96%. These relatively high figures (close to upper limit) support the conclusion that there was a high degree of agreement between those who used the ECERS-E to rate the curricular adherence of the pre-schools who were studied in the EPPE research.

In addition to assessing inter-rater reliability, the investigatiors of the EPPE team (Sylva et al., 1999) also worked to establish the convergent validity of all three of the measures of pre-school quality that were used in both the EPPE project and this investigation: the ECERS-R, E, and the sub-scales of the CIS. Significant correlations were found between these measures in the direction expected, such that positive correlations were found when both measures assessed either high or low quality (e.g. ECERS-R and E) and negative correlations when one measure assessed high quality and the other low (e.g. ECERS-R and the detachment subscale of the CIS). The exact correlations and assessments of predictive validity can be found in Sammons, Sylva et al., (2002) and Sammons et al., (2003). The high degree of both inter-rater reliability and convergent validity lends support for the use of all of these measures in this study, particularly as it uses the same data as the EPPE project that led to the development of the ECERS-E.

Table 2.6 expands upon the differences in quality that the EPPE project found between the types of pre-school (see Table 2.6) by demonstrating the systematic variation of all six measures of process quality. As in Table 2.6, Table 2.7 illustrates that pre-school centres that integrated care with education were found to have the highest average process quality, not only at the overall level (ECERS-R), but also for curricular provision (ECERS-E) and the relationships between carers and young children (CIS). This systematic variation in quality is an extremely important one for this investigation that focuses on the impact of quality on the relationship between risks and child outcomes. Any evidence that quality protects will be a protection that varies across types with the highest quality pre-schools offering greatest protection. That being said, the types of pre-school studied by the EPPE project when it began in 1997 are not representative of the types of pre-school now found 10 years later. Over

this period, government policies such as the *Childcare Act* (2006) have led to the increase in integrated centres, especially in disadvantaged neighbourhoods where more socio-demographic risks to young children's development can be seen to be highest (see also Brown & Dillenburger, 2004; DfES, 2003)

Table 2.7 Mean process qualities of pre-school across types in the EPPE project (adapted from Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004)

Type of pre-school	Mean ECERS-R	Mean ECERS-E	Mean CIS sub-scales[1] positive	permissive	Detached
Nursery class	4.9	3.7	3.5	**1.3**	1.3
Playgroups	3.4	2.1	2.9	1.6	1.7
Private day nurseries	4.0	2.9	3.2	1.5	1.5
Local Authority day care	4.6	3.2	3.3	1.6	1.5
Nursery schools	5.3	4.0	3.5	I.4	1.2
Integrated (combined) centres	**5.5**	**4.6**	**3.7**	**1.3**	**1.1**

[1] *punitiveness excluded as it was found to be invariant across type*

2.3.3 Young Children`s Development between the Ages of 3 and 7 Years.

The EPPE studies used a variety of instruments to assess the abilities, skills, and behaviours of the developing young children in its sample. As the EPPE project investigated distinct geographical areas in England, separate teams of researchers were trained not only to use the instruments in the correct manner (ensuring the validity of their use), but also to use them in a manner consistent with their fellow team members and the rest of the EPPE researchers as a whole (inter-rater reliability). These measurements taken by researchers were then complemented by those taken of young children's behaviour and social development by (at first) pre-school centre workers and then (subsequently) primary school teachers.

Children were first assessed at their entry to the EPPE project at mean age 39 months before being assessed again when they entered the reception class of their primary school at mean age 51 months. Two subsequent assessments took place during Key Stage 1, at the end of the first and second years of primary school. However, at the end of this period, the assessments were complemented by the children's performance on national tests. Although the use of multiple instruments was designed to ensure their appropriateness for the children's abilities at each time point, it nonetheless

prevented the most explicit representation of development from being modelled in these analyses (using growth modelling; Wolfle, 2003).

Social and Behavioural Development

The social and behavioural development of the children was assessed on an individual basis during the time that the children attended early education centres and the subsequent first two years of primary school. When the children entered the EPPE project, their behaviour and social skills were measured by a 26 item questionnaire: the Adaptive Social Behaviour Inventory (ASBI; Hogan, Scott, & Bauer, 1992) which was administered by a pre-school centre worker who knew the child well. Although EPPE continued to assess social and behavioural development until the end of Key Stage 1, the method and means of this assessment changed once the children began primary school (Sammons, Sylva et al., 2004a). This first change was to the Child Social Behaviour Questionnaire (CSBQ; Sammons et al., 2003), an adaptation of the ASBI which was administered by the children's primary school teachers and included (*amongst others*) ten items taken from the Strengths and Difficulties Questionnaire (SDQ; R. Goodman, 1997). The second change occurred when children reached the end of year 1 of primary school, where assessment was carried out by teachers using solely the SDQ. Both of these changes are tabulated in Table 2.8 and led to differing and often non-equivalent sub-scales that measured slightly different aspects of children's social skills and behaviour.

Table 2.8 The changing instruments that the EPPE project used in measuring the development of children's social skills and behaviour

Time point	Instrument used	Factor Analysis sub-scales
At entry to study (~3 years old)	Adaptive Social Behaviour Inventory; **ASBI**	**5:** *Co-operation & Conformity*; Peer Sociability; *Confidence*; Anti-social; *Worried/Upset*
At entry to primary school reception class (~4 years old)	Adapted ASBI: The Child Social Behaviour Questionnaire; **CSBQ**	**6:** Self-Regulation; *Co-operation & Conformity*; Peer Sociability; *Anti-social/Worried*; Empathy & Pro-social; *Openness*
At end of: primary Year 1; primary Year 2/Key Stage 1	Strengths and Difficulties Questionnaire; **SDQ**	**5:** *Emotional Symptoms;* Conduct Problems; *Hyperactivity;* Peer Problems; *Prosocial Behaviour*

The Adaptive Social Behaviour Inventory (ASBI)

Designed to provide an age appropriate standardised measure of young children's adaptive and social behaviours, the ASBI was developed and tested as part of a wider study of 3 year olds whose development was identified as '*at-risk*' (The Infant Health and Development Programme; IHDP, 1990). Hogan, Scott, and Bauer (1992) grounded the development of the ASBI in a historical perspective that extended back to the 1930s and the Vineyard Adaptive Behaviour Scales (Doll, 1953). However, despite Hogan, Scott, and Bauer's detailed examination of existing and historical measures of adaptive behaviour, they concluded that none were suitable for providing an outcome measure in the IHDP. This lack of suitability centred on several perceived limitations with existing measures: inappropriate wording and content; inappropriate for use at a single timepoint; and the inappropriateness of existing measures for parental (or teacher) administration.

The use of the ASBI as a measure of the development of young children's social skills and behaviour in this investigation was strongly supported by the purpose for which, and the context within, the ASBI was developed. Not only was the ASBI developed for assessing children of the same age in both Hogan's and the EPPE studies, but as mentioned above, it was also developed to measure behaviour that was identified as being at-risk (Hogan, Scott, & Bauer, 1992). This sensitivity of the ASBI for assessing the behaviour of children at high risk was one of the driving forces throughout the creation of the measure with the authors adopting a similar ecological perspective to risks as is taken here. Hogan and colleagues reported that the format and wording of the ASBI was designed to be sensitive to the following child and familial risks: young children born prematurely; low leves of maternal education; first language of parents not being English; and limited educational activities in the home. The suitability of the use of the ASBI for this investigation is further evidenced by its authors ensuring that it was developed to be sensitive to the effects of attending pre-school on children's behaviour (Greenfield, Wasserstein, Gold, & Jorden, 1997; Hogan, Scott, & Bauer, 1992).

From a sample of 545 three year old American children spread across 8 States, the 3-point-scale items in the original ASBI assessment battery were reduced to 30 (see Appendix 5) from an original 83 with a 3 factor solution being found to underlie

them: 1) Express; 2) Comply; and 3) Disrupt. By contrast, the factor analysis of the EPPE project identified a 5 factor solution from a sample of ~3,000 English children (see Table 2.89). Whilst this differing factor structure offered support for the original subscale of "Comply" (closely matching "Co-operation and Conformity), it appeared to split "Express" ("Confidence" and "Peer Sociability") and "Disrupt" ("Worried/Upset" and "Anti-social").

This investigation adopted and used the EPPE factor structure rather than that of the original ASBI analyses due to the much larger sample size, the differing countries in which both studies took place, and the desire to use the findings of the EPPE project concerning children's social development to both support and inform the analyses and findings of project. In doing so, the factors/subscales that were extracted from the EPPE factor analyses were used as manifest variables by the analyses of this investigation. Although the argument could be made that *comparable* subscales should have been made from Confirmatory Factor Analyses (CFA) when using Structural Equation Modelling (see Section 2.4.3), these scales would never have exactly matched those of the original EPPE analyses and would have increased the risk of making erroneous comparisons in the subsequent discussions and conclusions.

Child Social Behaviour Questionnaire (CSBQ)

The Adaptive Social Behaviour Inventory (ASBI) was designed to measure only the social skills and behaviour of 3 year old children at this single age; no attempt was made to create a measure appropriate to the developing child. As a result, when the EPPE project came to assess the social/behavioural development of young children when they were entering the reception class of primary school (mean age 51 months), the items in the ASBI assessment battery were re-examined for their suitability to this older age group. An extra 15 items were added to the original 30 of the ASBI (see Appendix 5) with 10 of the items coming from the Strengths and Difficulties Questionnaire (SDQ; R. Goodman, 1997, see below) and 5 coming from an, as yet, unpublished scale focussing on classroom behaviours (Sammons et al., 2003). In addition, the ASBI was further adapted by having a 5-point rating scale (1=rarely to 5=almost always) replacing the 3 point scale of the original.

Given the changes and additions made to the ASBI in the construction of the CSBQ, when the EPPE team ran an exploratory factor analysis of the 45 items, a factor structure very different from that of the original ASBI was revealed (see Sammons et al., 2003). The "Co-operation and Conformity" and "Peer Sociability" scales remained very similar to those at entry to pre-school along with the "Confidence" subscale remaining the same albeit renamed "Openness". Of the 15 new items added to the ASBI, 9 of them indicated a factor separate from those of the ASBI items, a factor that the EPPE team identified as measuring "Self Regulation".

The relative consistency of factor structures between the EPPE ASBI factors and those of the CSBQ offers support for not only the stability of these new factors over time, but also for the reworking of the factor structures of the original ASBI that was undertaken by the EPPE team. Whilst "Comply" closely matched "Co-operation and Conformity" and "Express" was divided into "Peer Sociability" and "Confidence"/"Openness", the CSBQ offered support for the original ASBI subscale of "Disrupt" that was bifurcated in the factor analysis undertaken in the EPPE project. In factor analysing the items of the CSBQ, the previously identified subscales of "Anti-social" and "Worried/Upset" were found to come together in a subscale that mirrored "Disrupt" and which the EPPE team titled "Anti-social/Worried".

However, the lack of consistency between the factor structure of the original ASBI and those of the ASBI and CSBQ as used by the EPPE project reflects the multi-faceted nature of social skills and behaviour that was conceptualised by the original authors of the ASBI (Hogan, Scott, & Bauer, 1992), the EPPE project (Sammons et al., 2003), and this investigation. This perception of social skills was reflected in the analyses of this project where the sub-scales of the ASBI and the CSBQ were used individually rather than being combined into a single measure of general social skills (unlike with cognitive development during pre-school). Further, the inconsistency in factor structures warranted caution in the use of those derived by the EPPE project as measures of children's social skills. Although this investigation used all of the ASBI subscales that were derived from the factor analysis of the EPPE investigations as this instrument had been established as reliable, valid, and fit for the purpose to which it was used (e.g. Greenfield, Wasserstein, Gold, & Jorden, 1997), this degree of certainty could not be extended to the CSBQ.

As a result, this investigation used only two of the CSBQ subscales that the EPPE team derived from their factor analyses of the items that were used to assess the social skills and behaviour of children at entry to primary school: Self-Regulation and Anti-social/worried Behaviour. This decision was further supported by the findings of previous research that have shown the importance of these social skills/behaviours for the school readiness of young children. For example, Carlton and Winsler (1999) argue that self-regulation is one of the key skills that young children need at school entry for their subsequent learning and development (see also Blair, 2003; Grolnick, Kurowski, & Gurland, 1999).

Yet further support for the focus of this investigation on self-regulation and anti-social/worried behaviours comes from Duncan and colleagues (2007) who identified self regulatory skills as being conceptually distinct from other behaviours such as those that are deemed problematic (i.e. anti-social behaviours). The authors report that these behaviours have impacts on later academic achievement that are independent from not only one another, but also from children's cognitive abilities (see also Boyd, Barnett, Bodrova, Leong, & Gomby, 2005). The relationship between problematic behaviours (such as those that are anti-social) and subsequent child development were of particular concern to this investigation given that recent studies have concluded an increase in such behaviours to be associated with long term and low quality pre-school provision (Belsky, 2001; Loeb, Bridges, Bassok, Fullern, & Rumberger, 2005; NICHD, 2003a).

Strengths and Difficulties Questionnaire (SDQ)

At the end of the first and second years of primary school (throughout Key Stage 1), class teachers assessed children's social skills and behaviour using the Strengths and Difficulties Questionnaire (SDQ; R. Goodman, 1997). Although the EPPE project used an extended version of this instrument that included additional questions, the original sub-scales of the SDQ remained both intact and viable for use (see Sammons, Sylva et al., 2004a). As a result, this investigation was able to use the original sub-scales of SDQ at both the end of years 1 and 2 with these scales being entitled: Hyperactivity, Emotional Symptoms, Conduct Problems, Peer Problems, and Prosocial Behaviour (see Table 2.8 and Appendix 5).

In justifying their altered use of the Strengths and Difficulties Questionnaire from that of the original project, EPPE's use of an extended SDQ was justified through comparison to the *consistent* use of the other social development scale that the EPPE team extended: that of the ASBI into the CSBQ. Although the original structure of the ASBI was no longer appropriate for use with the CSBQ as the scale of the items had been adapted and the instrument was used to assess the social skills of an older group of children than that for which it was intended, this was not the case with the SDQ. With this latter instrument, its original questions and their scales remained unaltered in form as well as being used for assessing the ages of children for which it was designed. Consequently, whilst the merits of using the original ASBI factor structure in the CSBQ were mitigated through its usage, this mitigation of merits did not hold when it came to the use of the SDQ at the end of primary school years 1 and 2.

This investigation's use of the original subscales of the SDQ rather than those derived by EPPE is supported by an extensive body of research that has demonstrated the reliability and validity of not only these subscales but the instrument itself. For example, Woerner et al. (2002) verified the structure of the SDQ subscales for normative populations of children from ages 6-16 through factor analyses conducted on 900 German children. A similar investigation with similar findings was carried out by Muris, Meesters, and van den Berg (2003) with a sample of 560 Dutch children. This study also found the subscales to be internally consistent and stable with the scores appropriately correlating with those of other measures of social skills and behaviour (thus demonstrating concurrent validity). The study by R. Goodman (2001) confirmed the veracity of these findings for *British* children by assessing the strengths and difficulties of over 10,000 children between the ages 3-16. With this investigation, R. Goodman also demonstrated the sensitivity of the SDQ to the entire range of strengths and difficulties encountered by this age range of children.

Cognitive Development and Academic Abilities

The EPPE project used a variety of measures to assess young children's cognitive development as they grew older. When the children first entered the EPPE project, their cognitive abilities were assessed by a trained researcher using the British Ability Scales (BAS; Elliot, NFER-NELSON, Smith, & McCulloch, 1996). This instrument was again used when children began primary school using age appropriate subscales.

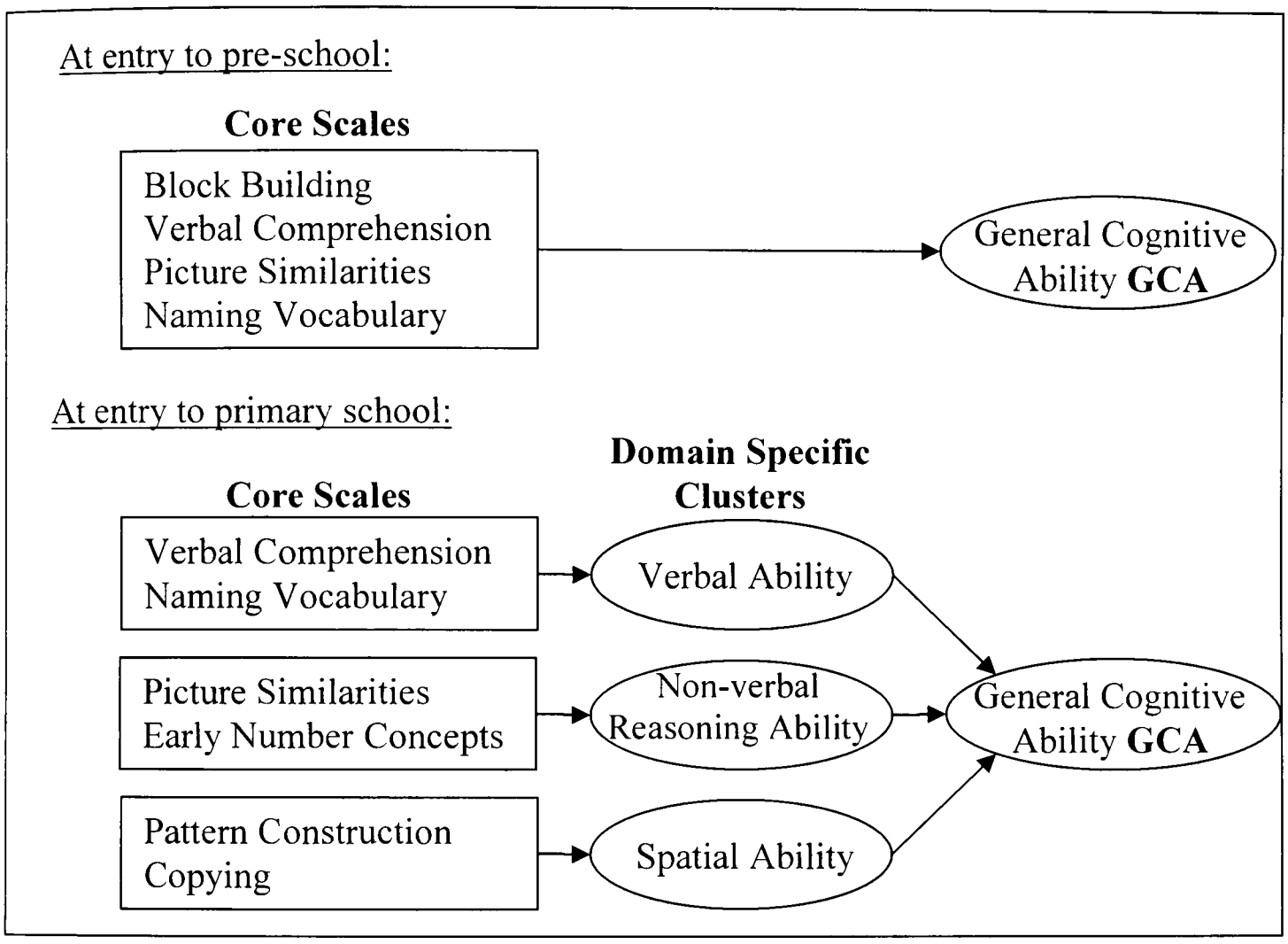
Once children were settled in primary school, cognitive abilities were assessed through their attainment in assessments of education performance (e.g. SATS). When the children reached the end of their first year in primary school, researchers from the EPPE project measured two domains of children's ability/performance: *reading* (the NFER-Nelson Primary Reading Test; N. France, 1979) and *mathematics* (the Maths 6 Test: Hagues, Caspall, Clayden, NFER-NELSON, & Patilla, 1997). One year later at the end of Year 2, EPPE collected information concerning 2,793 (91.6% of sample at age 3) children's performances on National Assessments from the children's primary schools as National Key Stage 1 test scores were not yet available to the public (Sammons, Sylva et al., 2004b). As in the previous year, this information provided EPPE with information about children's reading and mathematics skills, but this time also about their writing ability.

British Ability Scales (BAS)

The EPPE project used the second edition of these scales (Elliot, NFER-NELSON, Smith, & McCulloch, 1996) in the measurement of young children's cognitive development at entry to pre-school and reception. The BAS II is a measure that is comprised of a number of core scales, higher domains of cognitive ability, and General Cognitive Ability (GCA) that are designed to assess children's core cognitive skills, and achievement in learning, which allow clinical diagnoses to be made between the ages of 2.6 years to 17.11 years. Figure 2.2 illustrates the scales of the BAS used in this investigation and the hierarchical relationships that exist between them at each time point. Despite changes in the core scales between time points, the attainment of a measure of General Cognitive Ability remained constant. Furthermore, it was the discrepancy in the consistency of the scales in measuring core skills and GCA that prompted this investigation to use the more general of these measures. Controlling for the *same* general ability at entry to pre-school allowed for

the developmental impacts that were specific to risk and the quality of pre-school to be more accurately identified at entry to primary school.

Figure 2.2 Hierarchy of the scales of the BAS that this investigation used at entry to pre-school and primary school (adapted from Elliot, Smith, & McCulloch, 1997)



Published in 1997, the National Foundation for Educational Research (1996) reported the BAS II to be an updated revision and restandardisation of the original British Ability Scales (Elliot, Murray, & Pearson, 1979), their earlier 1983 revision (BAS-R; Elliot, Murray, & Pearson, 1983), and their American extension published as the Differential Ability Scales (DAS; Elliot, 1990). V. Hill (2005) documented how these latter revisions of the original BAS contributed to its eventual overhaul and republication as the BAS II. In adapting the BAS into the DAS, six of the original scales were replaced by four which led the structure of the BAS II to more closely resemble the Wechsler Intelligence Scales for Children (WISC; Wechsler, 1992) than the original BAS. This similarity between the structures of the BAS II with an intelligence test offers grounds for criticism of the BAS II, as it was a measure that explicitly rejected any attempt to measure intelligence because of the controversy that surrounds this process (V. Hill, 2005).

Perhaps unsurprisingly for a measure that was first published 30 years ago and that has undergone repeated revision and adaptation, the validity and reliability of the BAS II has been demonstrated with samples closely matching those of the EPPE investigation (e.g. Elliot, Smith, & McCulloch, 1997). Both the original BAS and its 1997 revision were developed and standardised based on the responses of large representative samples of British children aged 2-18 (3,500 and 1,700 children respectively (V. Hill, 2005). The representativeness of the BAS II to the British population made it an especially appropriate measurement for use in the EPPE investigation due to its similarity in timing (mid 1990s) and population. Finally, whilst the close association of the BAS to theories of cognitive development demonstrates the concurrent validity of the measure (e.g. Cook, 1988), studies such as (Stone, 1992) further support this investigation's use of the BAS by confirming the hierarchical structure of the BAS scales and clusters with experimental studies.

Primary Reading Test 1

Designed to measure the word and sentence reading abilities of children between the ages of 6-12 years, the Primary Reading Test (N. France, 1979, 1981) provided an age standardised assessment of reading ability where standardised scores were developed based on the responses of 20,000 British children (Davies & Brember, 1995). Of the 48 items that made up the test, 10 were devoted to word reading and involved the presentation of pictures alongside 5 possible naming choices. The other 38 items focused on sentence comprehension and asked the child to fill in the missing word of a sentence with 1 candidate from a list of 5 (Harris & Beech, 1998). For example, "The bus was... (dog, mug, time, cow, late)". Although the test was untimed, an average completion time had been found to vary between 20 to 30 minutes (NFER-NELSON, 1999).

The Primary Reading Test was developed for the standardised assessment of a wide range of British children's reading abilities. The suitability of the measure was further ensured by its authors (the NFER) internally standardising the scores that were obtained from the instrument for the EPPE sample (Sammons, Sylva et al., 2004a). However, despite the size of the original sample used for developing age standardised measures of reading, there remains debate concerning the validity of the

standardisation procedures given that nearly 30 years have passed with some researchers now only using only raw scores (e.g. McLean & Hitch, 1999). Nevertheless, there is also ongoing research that still makes use of the age standardised scores such as that published by Davies and Brember (1997a, 1997b, 1999) who examined the test and found its standardisation procedure to remain both age suitable and valid. Furthermore, the reading scores returned by the test have also been found to be highly correlated with the ratings of children's abilities that were obtained from teachers (Triga, 2004).

Although originally published in 1978, the Primary Reading Test was revised in 1981 and divided into 2 tests where each was suitable for the assessment of a different age range of children (N. France, 1981). The first of these, the Primary Reading Test 1, was used by this investigation and the EPPE project as this version was designed to provide an accurate assessment of the early stages of children's learning to read between the ages of 6-10 years. Davies and Brember (1997a) note that the items in this version of the test provide a sensitive assessment of children's reading ability that is able to discriminate within the full range of abilities. Given that this investigation focused on risks to young children's development, the sensitivity of the Primary Reading Test to the lower end of ability supported the use of this measure.

Maths 6 test

The Maths 6 test (Hagues, Caspall, Clayden, NFER-NELSON, & Patilla, 1997; NFER & Patilla, 1999) was used to assess children's understanding and knowledge of mathematics. Developed by the same company as the Primary Reading Test, this mathematics assessment tool was the second in a series numbering from 5-14 where each number corresponded to the age of the child for whom the test was designed to be appropriate for. This series of measures have since been updated and revised into the 'Progress in Maths 4-14' series that have been developed to be appropriate for the assessment of the abilities of British children in particular (Clausen-May, Vappula, & Ruddock, 2004). Further, the measures of mathematics ability obtained from the Mathematics 5-14 series remained valid for interpretation despite its revision by remaining equivalent to those obtained from its newly standardised replacement (GL Assessment, 2007b).

The Maths 6 test that was used in this investigation consisted of 26 orally and graphically administered questions that can be age and National Curriculum Level standardised by reference to a continually updated internet website (GL Assessment, 2007a). However, as with the Primary Reading Test, the raw scores were subjected to standardisation procedures by the NFER to result in age standardised scores (Sammons, Sylva et al., 2004a). It is this especially validated and internally standardised set of scores that was used by this investigation to assess the mathematical abilities of children and provided a partial measure of the development of cognitive skills at the end of the first year of Primary school.

Patilla (2003) notes that the test, "*...helps to identify those pupils experiencing difficulties in specific areas*". This sensitivity to a wide range of abilities made the Maths 6 test particularly useful in establishing which children maybe manifesting the effects of exposure to developmental risks. From these similarities it can be seen that the EPPE project utilised a pair of complementary measures of children's educational performance at the end of the first year of primary school which were both likely to be sensitive to the impacts of developmental risks and which were especially suitable for re-use in this investigation.

Decimalised Key Stage 1 National Assessments

At the end of the second year of Primary school the EPPE investigation obtained and then decimalised children's scores on their Key Stage 1 assessments of reading, writing and mathematics. This decimalisation procedure resulted in *scales* of educational attainment that measured the cognitive abilities of children who were now either at or approaching age 7 (2001). The decimalised scores were used because they provided a finer differentiation of the abilities of young children than the corresponding *levels* that were attained from the National Assessments. Decimalisation was accomplished by EPPE using the following formula:

$$\text{Decimalised score} = \text{SAT Test Level} + \left(\frac{(\text{raw score} - \text{lowest level score})}{\text{highest level score}} \right)$$

The statutory standardised National Assessments that take place at the end of the second year of primary school assess educational attainment in English, maths, and

science through the use of a variety of tests and tasks. Unlike the timing of latter Key Stage assessments, these tests may be administered at any point in the school year from January onwards (National Assessment Agency, 2008b). Although teachers are aided by the tasks in making their final assessments of children's abilities at the end of Key Stage 1, this is a process made by teachers themselves rather than the external markers that are relied upon in subsequent National Assessments. Moreover, the reliability of the standardisation procedure (to ensure consistent levels across schools and years) is accomplished by an extensive pre-testing of the tests and tasks and by seeking advice from experienced test markers (National Assessment Agency, 2008a).

Specific to the reading, writing, and maths assessment levels that were used by this and the wider EPPE investigation, there was substantial variation in the methodology of the various tests and tasks that informed these. For example, for poorer readers the reading test was conducted by teachers on an individual basis and required each teacher to make a preceding judgement of the reading level of the child based on the level they believed the child to be reading at. Based on this decision, a book was then jointly selected by the teacher and child from a pre-selected list of comparable books before the teacher asked the child to read her/his choice of book to them aloud. Following the teacher guidelines presented in the '*Teacher's handbook*' (Qualifications and Curriculum Authority, 2001), the teacher was prompted through *'what to do'* and *'what to look for'* in arriving at a standardised judgement of reading ability that was based on given examples and written questions that assess a child's understanding of the story (Qualifications and Curriculum Authority, 2008). Children of average or higher ability in reading took a written test.

Contrasting the *individual* methods that were used to assess the reading ability of low achieving children are the *group* based methods advocated for use with the assessment of their writing and maths skills. For writing, two tasks were set of differing durations (~30 and 45 minutes) alongside a standard spelling test whilst for maths a written test involved children reading text, writing numbers, and then explaining how they arrived at their answers (Qualifications and Curriculum Authority, 2008). The mixture of skills required by this maths test demonstrates the non-independence of the assessments; children were required to use more than the skills supposedly being tested in fulfilling the task. As a result of this mixture of skill

dependence, the assessment of each becomes less clear which makes it harder for subsequent analyses to differentiate effects between reading, writing, and maths. In other words, from the methods used to assess Key Stage 1 maths attainment, there is a propensity for analyses that use this measure of maths in conjunction with those assessing reading and writing to show commonality in the relationships that involve these more linguistic skills.

2.3.4 Risks to Development

Central to this investigation is the notion that there are circumstances in a child's life that pose a risk to their development (Luthar & Cicchetti, 2001). This is fundamental and underlies the concept of *developmental resilience* (see Luthar & Cicchetti, 2001) and the hypotheses that aspects and qualities of pre-school may offer protection to children's development (see Section 2.1.2). As a result, the measurement of these risks and the methods that were used to obtain them were of critical importance to any analysis that planned to investigate them. The following section presents the individual measures that were gathered by the EPPE project and which were postulated by this investigation to pose a risk to children's development. The second section (2.3.4) then outlines one of these measures that was identified as a risk and that was especially developed by the EPPE project: poor Home Learning Environment (HLE). The third and final part of this discussion of risks then presents a critical examination of the previous methods that have been used by the EPPE project to measure *overarching* risks to development. This is an especially important part of this chapter as it underlies the analyses, discussions, and conclusions that follow.

Individual Potential Risks

Table 2.9 presents the 11 measures that the EPPE project identified as being *strongly* related to the slower growth of children's skills and abilities in their sub-study project entitled: Early Years Transition and Special Educational Needs (EYTSEN; Sammons, Taggart et al., 2002, 2004a, 2004b). These 11 social, familial, and home demographic variables were assessed through parental interview when families entered the EPPE project and were dichotomised and summated by the EYTSEN investigation to give a cumulative risk score (see Section 2.3.4). Each measure was identified as posing a statistical risk to development from multi-level (hierarchical linear) regression analyses; each measure was

found to be a significant predictor of lower cognitive and social skills ($p<0.05$; see Sammons, Taggart et al., 2002).

Table 2.9 Child, parent, and home characteristics associated with slower development in the EPPE studies (taken from Sammons, Taggart et al., 2002)

Measured Variables	Dichotomised disadvantage indicator	(n)
Child:		
1. First Language	English not first language	(235)
2. Large Family	3 or more siblings	(483)
3. Pre-Maturity/	Premature at birth or	(507)
4. Low birth weight	below 2500 grams	(236)
Parental:		
5. Mother's highest qualification level	No qualifications	(501)
6. Social class of Father's occupation	Semi-skilled, never worked, absent father	(457)
7. Father's employment status	Not employed	(378)
8. Young mother	Age 13-17 at birth of EPPE/EPPE-E child	(14)
9. Lone parent	Single Parent	(698)
10. Mother's employment status	Not working/Unemployed	(1344)
Home Environment:		
11. Home environment scale	Bottom quartile	(164)

Expanding upon the work of EYTSEN, Tables 2.10 and 2.11 present 21 variables (an additional 10) that this investigation identified from previous research as being a) likely to pose significant risks to young children's development and b) which were measured by the EPPE project. Table 2.10 provides a description of the 7 variables that were conceived to pose *child* level risks to young children's development. Of all the variables presented in this Table, *birth weight* can be seen to have a much larger variance than the others due to its measurement scale (grams). This was a problem for subsequent analyses because when variables are measured differently, with some having variances outside the range 1-10, it becomes increasingly common to encounter convergence problems (L. K. Muthén & Muthén, 1998-2001). To solve this problem and also complete the necessary mean-centring of variables that were to be used in interaction terms (see Section 2.4.1), it was therefore decided to *z-score* all variables before any analyses were undertaken[85]. Finally, in order to simplify the Confirmatory Factor Analysis (CFA) part of the subsequent analyses that follow (see

[85] This included the z-scoring of risk indicated by dichotomous measures such as speaking English as an Additional Language (EAL) or being born prematurely. The necessity and the (lack of) effect of this procedure are discussed more in Appendix 6.

Section 2.4.3), the categorical variable that recorded children's ethnicity was dummy-coded into six dichotomous variables with *"White"* serving as the reference category (following recommendations such as those of Hardy, 1993).

Table 2.10 Child level risks to young children's development

Variable	n	mean	standard deviation	*High risk n*
Child level risks				
1 Child's gender	2857	0.48	0.50	
Male (0)	1489			*1489*
Female (1)	1368			
2 "English an additional language (EAL)"	2857	0.08	0.28	
English (0)	2622			
not English (1)	235			*235*
3 Birth weight *(in grams)*	2752	3315.98	624.22	*419*
4 Number of siblings	2786	1.38	1.11	*1309*
5 Birth order	2783	1.83	0.98	*692*
6 Ethnicity	2854			
Bangladeshi	25			*609*
Black	180			
Indian	55			
Pakistani	75			
Mixed	185			
Other	89			
White	2245			
7 "Any event affected your child's development?"	2783	0.34	0.47	
No (0)	1838			
Yes (1)	945			*945*

The far right hand column of Table 2.10 displays the number of sampled children whose development could be considered to be at *high risk* due to each of the 7 child level measures. For non-ordinal categorical measures (Gender, EAL, Ethnicity "Any event..."), the number of children given in the far right hand column simply corresponds to the risk indicating condition. By contrast, for the ordinal/ratio variables in Table 2.10 (Birth weight, Number of siblings, Birth order), the number of children whose development could be considered to have been at high risk corresponds to $\geq \pm 1$ standard deviation (as appropriate). As can be seen in Table 2.10, there was a great deal of variation in the number of children whose development could be considered as at high risk due to each of the measures.

Like Table 2.10, Table 2.11 also contains a description of variables that this study hypothesised as posing risks to young children's development. However, unlike the variables presented in Table 2.10, Table 2.11 describes 14 variables that this study conceived of as working together in the form of a combined *familial* level of risk. As with child level risks, not all of the individual risks were measured on a similar scale (e.g. family salary and HLE) which again prompted z-scoring of all variables prior to the analyses.

Just as with Table 2.10, the far right hand column of Table 2.11 displays the number of sampled children whose development could be considered to be at *high risk* due to each of the 14 family level measures. For the non-ordinal categorical measure "Two parent family", the number of children given in the far right hand column simply corresponds to the risk indicating condition. By contrast, for the ordinal/ratio variables in Table 2.11[86], the number of children whose development could be considered to have been at high risk corresponds to $\geq \pm 1$ standard deviation (as appropriate). Just as with the child level measures presented in Table 2.10, Table 2.11 reveals that there was a great deal of variation in the number of children whose development could be considered as at high risk due to each of the measures alone. One of the consequences of this varying level of risk exposure across the sample was that some risks would be more likely to have significant effects than others. The results of Chapter 4 subsequently reveal the impact of this variation upon the measurement of a combined developmental risk.

[86] family salary, mother, partner, and highest family occupational statuses, mother and partner qualifications, mother and partner employment statuses, "Either parent working?", Mother and partner age groups, number of non-parental carers, HLE

Table 2.11 Familial level risks to young children's development

Variable	n	mean	standard deviation	*High risk n*
1 Family salary (£)	2178	27495.41	25875.04	*760*
2 Mother's occupational status (*reversed*)	2744	3.59	1.68	*287*
Professional non manual (1)	123			
Other professional non manual (2)	589			
Skilled non manual (3)	1018			
Skilled manual (4)	178			
Semi skilled (5)	549			
Unskilled (6)	122			
Unemployed (7)	0			
Never worked (8)	165			
3 Partner's occupational status (*reversed*)	2174	3.26	1.43	*121*
4 "Highest status in family?" (*reversed*)	2781	2.08	1.38	*573*
5 Mother's qualifications	2723	1.98	1.40	*501*
None (0)	501			
Vocational (1)	423			
16 Academic (2)	1048			
18 Academic (3)	248			
Degree or equivalent (4)	374			
High Degree (5)	129			
6 Partner's qualifications	2073	2.15	1.55	*484*
7 Mother employment status	2780	0.77	0.88	*1344*
Unemployed (0)	1344			
Employed part time (1)	861			
Self employed and employed part time (2)	448			
Employed full time (3)	127			
8 Partner employment status	2183	2.37	1.06	*477*
9 "Either parent working?"	2178	1.89	1.21	*471*
No one working in the house (0)	471			
Mum working and partner not (1)	314			
Mother's partner working and mother not (2)	373			
Both mother and partner working (3)	1020			
10 "Two parent family?"	2790	0.75	0.43	
No *(0)*	698			*698*
Yes *(1)*	2076			
11 Mother's age group	2779	3.16	0.66	*332*
16-20 *(1)*	22			
21-25 *(2)*	310			
26-35 *(3)*	1697			
36-45 *(4)*	721			
46-55 *(5)*	22			
56-65 *(6)*	7			
66-75 *(7)*	0			
12 Partner's age group	2218	3.47	0.68	*95*
13 No. of non-parental carers	2794	1.06	1.05	*279*
14 Home Learning Environment (HLE)	2748	23.42	7.6	*369*

Home Learning Environment (HLE)

The last of the identified risks presented in Table 2.11, the Home Learning Environment, is a scale measure that was developed by the EPPE team for the purpose of assessing the learning opportunities that were available to children in their homes (see Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004). The construction of the scale was based upon the responses of parents to questions that were asked in the interviews that were conducted when families entered the EPPE study. Most of the parents who could not speak English were interviewed by a researcher and an interpreter in order to collect detailed information from all families. Specific to the HLE were those interview questions that asked parents about the degree to which they and their child engaged in learning activities such as reading, singing, and the frequency with which a child was taken on educational visits (e.g. to the library).

In order to differentiate the effects of family activities from family background, the EPPE team decided to include no social demographic measures (such as parental income or education) in this scale. This attempt at measuring the learning processes that were taking place in the home as independent from the structures and background of the family is one that mirrors the bifurcation of pre-school quality that was discussed in Section 2.3.2. As with these programmes of early education, the EPPE team hypothesised that it would be the *processes* rather than the *structures* that would directly impact young children's development (see Currie, 2001) and this was a relationship that was subsequently identified. The Home Learning Environment was found to have a stronger relationship with children's development over the pre-school period than any measure of family structure (social demographic) previously identified as posing a developmental risk (see Melhuish, Sylva, Sammons, Siraj-Blatchford, & Taggart, 2001).

Since its conception, the Home Learning Environment (HLE) has seen further use in other large scale longitudinal studies that have also investigated children's development and its relationship to the processes that are taking place in children's homes. Amongst others, these investigations have included the Families, Children, and Child Care study (FCCC; see Stein, Malmberg, Sylva, Barnes, & Leach, in press),

and the Millennium Cohort Study (MCS), a birth cohort investigation which has tracked nearly 19,000 British children born between the years 2000-2002 (see Mathers, Sylva, & Joshi, 2007). The findings from these investigations indicate that the HLE has proved to be a reliable measure and it is on this basis that it is reused by this investigation as a measure that captures those differences in family functioning that impact children's development.

Measuring Cumulative Risk

The discussion of the instruments and measures that were used in this study concludes with an examination of the approach to measuring developmental risks that has featured in both the previous investigations of EPPE (Sammons, Taggart et al., 2002), and many previous studies of risk and resilience (Sameroff, Gutman, & Peck, 2003). Despite the frequency of its use, the technique of constructing *cumulative risk indices* has faced strong criticism concerning its underlying assumptions (see Section 1.1.1 for details). It is this conflict in prior use despite criticism that prompted the initial analyses that were conducted by this investigation: an attempt was made to develop an alternative approach to the measurement of combined risk (see Section 2.4.3 for rationale and Chapter 4 for results). This analysis was critical for those that followed as the measurement of developmental risk is absolutely fundamental to the aims and research questions of this study.

Providing an overview of the discussions of the measurement of cumulative risk that can be found throughout this investigation, Chapter 1 (Section 1.1.1) introduced cumulative risk indices and the rationale behind their use. It was the combination of risk factors rather than the actions of individual risks that epidemiological research (e.g. Lloyd-Jones et al., 2004) found to be important when considering illness and child development. At the same time however, the procedures involved in the creation of a traditional cumulative risk index - dichotomising and summating individual risks - have been heavily criticised with alternative procedures suggested (e.g. Burchinal, Roberts, Hooper, and Zeisel, 2000).

The use of cumulative risk indices was common enough that the original EPPE investigations constructed their own and termed it an Index of Multiple Disadvantage (IMD). A discussion of the rationale behind this measure and its composition follows

along with a reiteration of the problems inherent in such measures that were first mentioned in Chapter 1. Next, the discussion of an alternative approach to the measurement of risks in combination can be found in Section 2.4.3 of this chapter ("Reflective vs. Formative Measurement"). As part of a broader Structural Equation Modelling (SEM) statistical framework, Confirmatory Factor Analysis (CFA) is postulated as providing two possible alternatives to cumulative risk indices via the measurement of a 'latent combined risk'.

Section 2.4.3 presents formative measurement as an alternative approach that is well suited (valid) to the measurement of risks in combination and a detailed rationale for this claim is provided. This method improves upon the cumulative risk index by making fewer assumptions concerning how risks '*work together*', how they jointly impact children's development, and how they represent variables corresponding to underlying ecological levels (child vs. familial). Chapter 4 then compares a cumulative index of risks against a CFA using formative measurement and tests the hypothesis that the CFA approach should produce a more accurate measure of combined cumulative risk. This hypothesis is specified because the CFA approach makes less assumptions concerning how risks work together.

Index of Multiple Disadvantage (IMD)

Beginning with the work of the EPPE project to measure overarching risks to development, the origins of their cumulative index (the Index of Multiple Disadvantage; IMD) are outlined in the EYTSEN sub-study (Sammons, Taggart et al., 2002). The origins of the IMD are reported to lie in the investigation of educational impacts on children from Inner London Education Authorities that was undertaken by Sammons, Kysel, and Mortimore (1983). Sammons and colleagues found evidence of a heterogeneous school population where familial backgrounds of social disadvantage led to lower attainment in education. These findings led the authors to conclude that educational resources needed to be prioritised appropriately to meet the needs of disadvantaged communities. To facilitate this prioritisation, Sammons and colleagues (*ibid*) created an Educational Priority Index (EPI) which allowed educational resources to be targeted to children from such disadvantaged backgrounds. Over a decade later, the EPPE project created their cumulative IMD that was inspired by the

findings of Sammons et al. (*ibid*) and which attempted to measure the association between children's backgrounds and educational attainment.

Tthe index created by the EPPE team was a measurement tool that is analogous to the *cumulative risk indices* that are widely used in the study of risk and resilience (e.g. Sameroff, Gutman, & Peck, 2003) and which were presented and discussed in Chapter 1 (see Section 1.1.1). Because cumulative indices and the Index of Multiple Disadvantage are (essentially) identical constructs, both use the same procedures in their construction: both dichotomise and summate the measures that are made of concepts which are theorised to either exacerbate or be the sources of risk to children's development. The assumption behind this procedure is that as the *volume* of risks increases, there is a parallel increase in the likelihood of maladaptive development, or in the case of the Index of Multiple Disadvantage, the identification of Special Educational Needs (SEN). Table 2.12 shows the composition of the IMD, ten indicators were used in the creation of an ordinal scale. The least disadvantaged children were exposed to no indicators whilst the most disadvantaged were exposed to five or more. Each of the indicators was included in the index because it was found to independently and significantly characterise the backgrounds of children who were found to be at risk of SEN (Sammons, Taggart et al., 2002).

Table 2.12 The indicators of multiple disadvantage identified by the EPPE and EYTSEN investigations (adapted from Sammons, Taggart et al., 2002)

Variable	n	Mean	standard deviation	Cut-off for high risk	%
Risk Factors					
irst language [a]	2899			English not first language	9.55
English	*2622*				
not English	*277*				
lumber of siblings [b]	2899	1.45	1.18	3 or more siblings	15.04
re-maturity [a]	2898			Premature at birth	16.77
no	2412				
yes	486				
irth weight in grams [b]	2891	3331.78	620.50	Below 2500 grams	7.60
lothers' qualification levels [a]	2899			No qualifications	20.73
none	601				
age 16 vocational	59				
age 16 academic	1077				
age 18 vocational	372				
age 18 academic	250				
degree or equivalent	369				
higher degree	128				
other professional	20				
other	23				
ocial class of fathers' occupations [b]	2891			Semi-skilled, never worked, absent father	33.66
professional non manual	238				
other professional non manual	550				
skilled non manual	350				
skilled manual	706				
skilled	74				
semi skilled	334				
never worked	20				
father absent	619				
athers' employment status [a]	2899			Not working/Unemployed	11.56
employed full time	1518				
employed part time	90				
self employed	329				
combination (p/t and self employed)	8				
not employed	335				
father absent	619				
Mothers' age at child birth [b]	2899			Age 13-17 at child birth	0.83
13-17	24				
18-22	325				

23-32	1762				
33-42	759				
43-52	24				
53-62	5				
Household structure [a]	2899			Single Parent	13.66
never married, single parent	*396*				
never married, living with partner	*422*				
married, living with spouse	*1758*				
separated/divorced	*300*				
widow/widower	*4*				
other	*19*				
Mothers' employment status [a]	2898			Not working/Unemployed	50.69
employed full time	*443*				
employed part time	*863*				
self employed	*109*				
part time	*13*				
not working	*1469*				
other	*1*				
Home Learning Environment [b]	2899	*23.29*	*7.62*	Bottom quartile	25.00

a Measure originally used in categorical form

b Measure originally used in at least ordinal form

Table 2.12 reveals the distribution of the 11 demographic variables that were used to construct the cumulative index and the percentage of young children who fell below the cut off points for each of these risk indicating variables. The large disparity between the percentages of children who were identified as at risk across these variables is partly the product of the sample that was studied by EPPE initially over-representing disadvantaged families (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004). For example, only a relatively small percentage of children were born with a weight that was low enough for this to be found to be statistically associated with their later cognitive development (8%). Conversely, due to the over-representation of disadvantaged children, a much larger percentage of children had fathers who were relatively unskilled, unemployed, or absent, a situation that was found to be associated with these children displaying significantly lower cognitive development (34%). Table 2.12 also shows that 4 of the demographic variables contained missing data but also that this percentage was extremely small: those demographics measure with missing data had either a single or at most 8 non-respondents (0.03% or 0.28% respectively).

Although the Index of Multiple Disadvantage was found to differentiate children who demonstrated poor attainment at the end of their first year at primary school (Sammons, Taggart et al., 2004a), the methods that were used in its construction (as a form of cumulative risk index) were ones that have been criticised as being overly simplistic (e.g. Burchinal, Roberts, Hooper, & Zeisel, 2000; Greenberg, Speltz, DeKlyen, & Jones, 2001). Indeed, because cumulative indices can be argued to be the traditional method used to identify vulnerable developmental pathways, the strong critique made of them prompted this investigation to develop the alternative approach that is documented in Chapter 4.

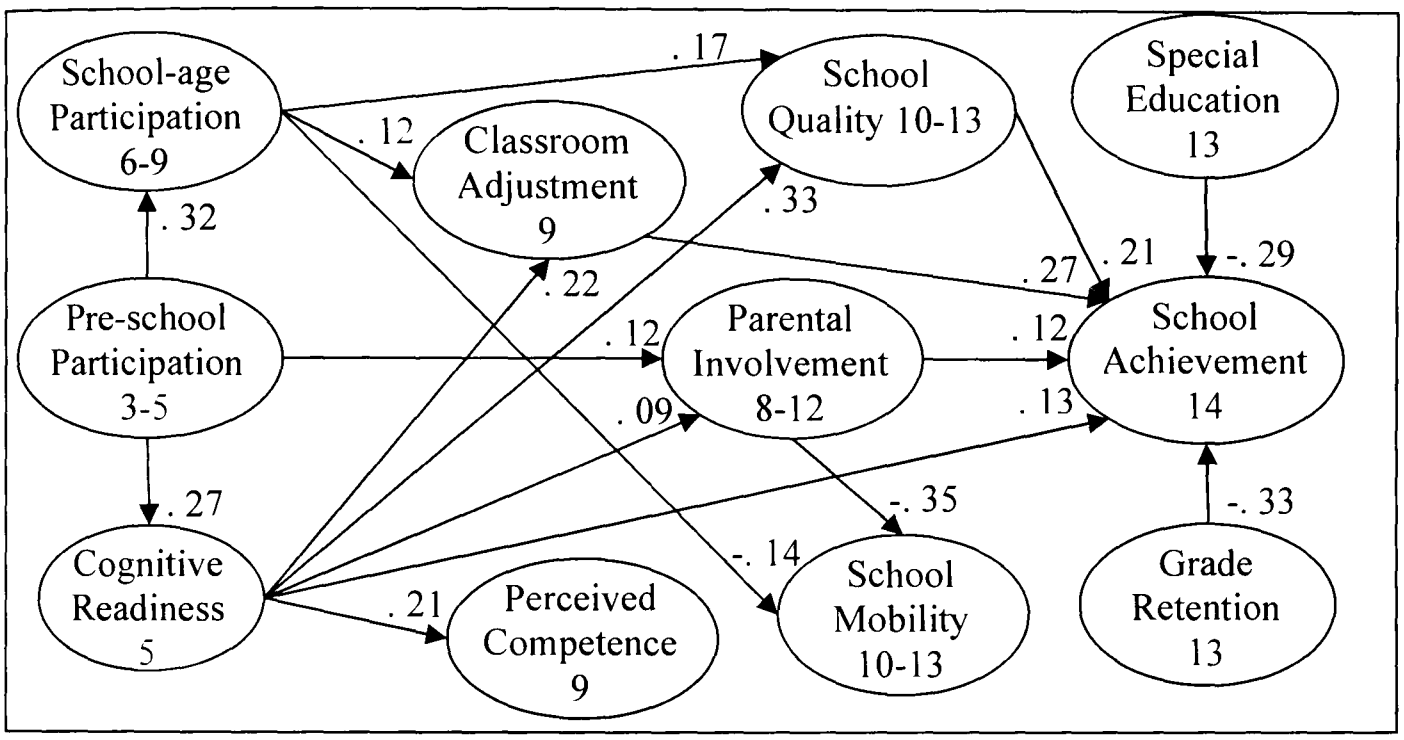
Referring back to the Index of Multiple Disadvantage and Table 2.12, the descriptions and percentages on the right hand side of this table determined the values that were used by the EPPE project to transform the original measures into risk-assessing dichotomies. Critically, these were not the arbitrary cut-offs that have been heavily criticised (e.g. MacCallum, Zhang, Preacher, and Rucker, 2002) but rather the dichotomisation was instead based upon critical values that were obtained from exploratory multi-level regression analysis (see Sammons, Taggart et al., 2002). The resultant dichotomies were then summed to form the cumulative risk index (the IMD) that was then used throughout the EPPE studies and which this investigation attempted to build upon.

2.4 Statistical Analysis

To meet the research aims that were presented at the beginning of this chapter, the analyses in the current study needed to effectively represent the relationships between: the development of children, the risks to their development, and the various facets of early education that were hypothesised to be related to both. Figure 2.3 serves as an example of an analysis strategy that was used by a previous study (The Chicago Longitudinal Study; Reynolds & Ou, 2003) to meet a set of comparable research aims. To investigate the same set of concepts as this investigation (development, risks, early education), Reynolds and Ou used Structural Equation Modelling (SEM) for their analyses and claimed that it was an especially suitable technique for, *"theory driven tests of hypotheses of causal mediation"* (p.451 Reynolds & Ou, 2003). This reference to hypotheses of mediation refers to sets of relationships that are theorised

to be shared between variables over time (see Section 2.4.1) and which are investigated simultaneously when using SEM. For example, Figure 2.3 illustrates not only the impacts of educational quality upon development, but also the impacts that both of these then had upon parental involvement in schooling.

Figure 2.3 Pathways from Child-Parent Centre Program intervention to school achievement at age 14 (taken from Reynolds & Ou, 2003)



The modelling of developmental pathways by statistical pathways (e.g. that illustrated in Figure 2.3) used in the investigation of Reynolds and Ou (2003) was a very different strategy to that which was used in the analyses of the original EPPE project. Rather than testing causal chains of effects such as those tested by Reynolds and Ou (*ibid*), the EPPE investigations conducted multi-level regression analyses in which those measures that were hypothesised to be partially dependent upon others were only ever tested independently of one another. In contrast, the analyses illustrated in Figure 2.3 made it possible to test a whole hypothesised longitudinal system of causal effects on dependent variables simultaneously. It is the similarity of the aims and hypotheses of this investigation to those of studies such as that of Reynolds and Ou rather than to those of the previous EPPE investigations that prompted SEM to be adopted here. The consequences, costs, and benefits of using Structural Equation Modelling in this project are discussed further in Section 2.4.3.

Before discussion turns to the statistical modelling techniques used in the current study, this chapter details the causal hypotheses that were used to link the research driven questions stated at the beginning of this chapter (see Section 2.1.2) to the SEM used in their testing. In particular, the following section presents a critical review of hypotheses of *moderation*, the ways in which these are operationalised in statistical analyses, and the impacts that both moderation and its implementation have had in the past when used to investigate developmental resilience and early education. This first section concludes by using the following review to outline and justify the analytic procedures that are subsequently rmployed in the current study.

2.4.1 Establishing Protection through Moderation

In investigations of developmental resilience it has been common for studies (including this one) to attempt to identify factors thought to alter the effects of risks upon development. Of the choices awaiting researchers who test such hypotheses, one of the most central is the degree to which a conclusion of protected development can be inferred based upon 'effect-modifiers' (Hinshaw, 2002) known as *moderation* (also, *"causal interaction effects"*, Wu & Zumbo, 2007). Further, even if a hypothesis of moderation is accepted as representing protection (see Section 2.4.1), there follows subsequent unclear choices concerning how best to test this moderation and the implicit consequences that are associated with this decision. The lack of clarity surrounding hypotheses of moderation, how they are implemented, and the previous instances of both in studies of risk and resilience as well as early education are now discussed with the aim of providing the reader with a critical understanding of the factors that influenced the design of this study. Determining the extent and the veracity of *establishing protection through moderation* is concluded with an introduction to the specific type of moderation hypotheses that were used in this investigation: ones termed '*moderated-mediation*'.

Issues in Statistical Implementation of Moderation

In perhaps *the* seminal paper that outlined hypotheses and tests of both moderation and mediation, Baron and Kenny (1986) laid down detailed guidelines concerning how to ascertain their existence. For moderation, how one tests for such an effect is dependent upon the levels that the hypothesised independent and moderating variables

are measured by. More specifically, the authors described the conditions under which researchers should dichotomise a continuous hypothesised moderator before using this dichotomy to divide and statistically compare subgroups:

1) When the independent variable is categorical and the moderator effect is hypothesised to take the form of either quadratic or step functions,
2) When the independent variable is continuous and the moderator effect is hypothesised to take the form of a step function.

However, the debate concerning how one should represent a moderating effect has since departed from these seemingly concise guidelines. Fifteen years later, Kraemer, Stice, Kazdin, Offord, and Kupfer (2001) now refer to a *"struggle"* between two approaches for testing hypotheses of moderation: subgroup analyses based upon a dichotomisation of samples, versus the construction of multiplicative statistical interaction terms. Each approach has both its benefits and drawbacks and each of these alternatives is now considered in turn.

Costs and Benefits of Dichotomisation and Subgroup Comparison

Frazier, Barron, and Tix (2004) highlight the cost of this analytical approach in a succinct fashion noting that it can lead to spurious main and moderating effects whilst disguising those that may have existed before. McClelland and Judd (1993) are even more unequivocal in their opinion of the dichotomisation procedure in particular (e.g. using median-splits); referring to it as a *'serious mistake'* which creates imprecise measures that reduce statistical power, increase measurement error, and promote false moderation effects. Yet only seven years later Farrington and Loeber (2000) argue against this and comment that dichotomisation *does not* necessarily decrease the strength of statistical relationships and that it allows for different types of interaction effect to be easily distinguished and studied in subsequent subgroup analysis. Two years on from this and MacCallum, Zhang, Preacher, and Rucker (2002) claimed that using this strategy for testing interaction effects is one partially based upon insufficient knowledge on the part of many researchers and reiterate the criticisms of lost information leading to reduced statistical power and spurious statistical effects. Indeed, the debate surrounding the strategy of dichotomisation of variables and subgroup comparison has moved so far from the guidelines provided by Baron and Kenny (1986) that it is hard to decide whether one should ever use this approach and

if so, under what circumstances. For example, some researchers are even prepared to advocate trial-and-error procedures to be used with dichotomisation and group comparison rather than the alternative approach: constructing multiplicative statistical interaction terms (Essex et al., 2006).

Costs and Benefits of Statistical Interaction Terms

Although avoiding many of the problems associated with the dichotomisation and subgroup comparison strategy, the use of multiplicative statistical interaction terms (usually within a statistical regression analyses) as an alternative have also been subject to their own criticisms. One of the strongest of these comes from the, "...*ground breaking*" (Hinshaw, 2007) article of Kraemer, Stice, Kazdin, Offord, and Kupfer (2001). The authors present an argument that these multiplicative interaction terms are, at the very least, partially products of the linear regression model in which they are used; that the nature of any conducted statistical analysis will *directly* influence the detection or otherwise of these statistical constructs. Furthermore, not only are the nature of the analyses that are undertaken claimed to influence the likelihood of detecting an interaction effect (and thereby moderation), but there are multiple techniques that can be employed in operationalising these (Frazier, Barron, & Tix, 2004). For example, Marsh, Wen, and Hau (2004) document several different approaches that are used to detect *latent* interaction terms in Structural Equation Models.

Wu and Zumbo (2007) note an additional and important complication in interpreting moderation effects when using multiplicative statistical interaction terms. Whilst moderation presumes that one factor is especially crucial (e.g. risk) and another alters the causal effect of this initial factor on some outcome (e.g. protection), it is *also* valid to interpret these effects in another way without any difference in the employed methodology. This second interpretation concerns an effect that the authors term *non-causal interaction,* one where both predictors of an outcome (e.g. risk and protection) are important and the multiplicative interaction term represents merely an additional non-linear effect. This alternative explanation is used to highlight the importance of substantive theory when researchers are hypothesising and testing moderations with interaction terms (Nicholson, Hursey, & Nash, 2005). One cannot rely on the data alone when concluding the existence of a moderated relationship;

such a hypothesis must be confirmed from the background to the study and the findings of earlier investigations.

Further criticisms arise from the problems encountered with the scales upon which multiplicative statistical interaction terms are measured (e.g. Rutter & Silberg, 2002). For moderators, unless the value of zero holds a conceptual meaning, Wu and Zumbo (2007) argue that any resulting multiplicative statistical interaction term will be meaningless. The solution to this problem is either to centre[87] (see Kraemer & Blasey, 2004), or to standardise hypothesised moderators with Frazier, Barron and Tix (2004) documenting the consequences of implementing either strategy. However, one of these solutions, centring, is not always necessary when it comes to actually testing multiplicative statistical interaction terms in statistical computer programs (e.g. B. O. Muthén, 2005). Furthermore, the uncertainty over which of these strategies is the most effective reflects the inherent uncertainty surrounding how exactly one should test statistical interactions and thus also hypotheses of moderation (for example, compare Baron & Kenny, 1986; against, Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001). It is this high degree of uncertainty and lack of clarity which can be seen as offering an explanation as to why different researchers as well as larger bodies (e.g. NIMH, 2002) continue to publish revised guidelines that continue to disagree with one another well after those that were published by Baron and Kenny over two decades ago in 1986.

Issues in Investigations of Resilience

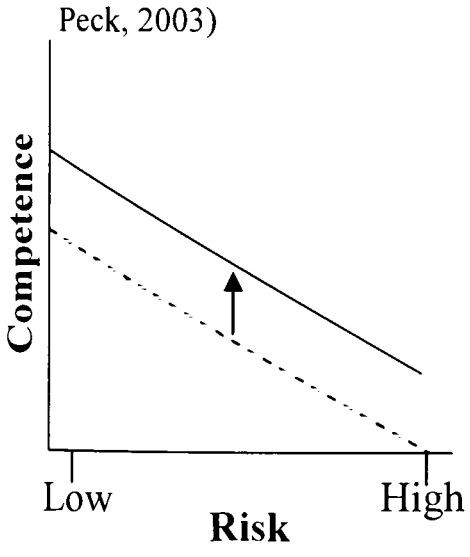
The confusion and mixed messages concerning hypotheses of moderation and the means of their operationalisation extends from the methodological literature into those fields that make use of them such as research which focuses on developmental resilience. In their review of the use of mediator and moderator effects in developmental and behavioural pædiatric research, Rose, Holmbeck, Coakley, and Franks (2004) point out that whilst a 'resource' effect (also known as , "*promotion*", Sameroff, Gutman, & Peck, 2003) is represented by main effects, a protective factor can only be determined by establishing moderation. Alternatively, in their critical evaluation of the construct of resilience Luthar, Cicchetti, and Becker (2000a) argue

[87] Where a centered score is equal to an individual's score minus the sample average

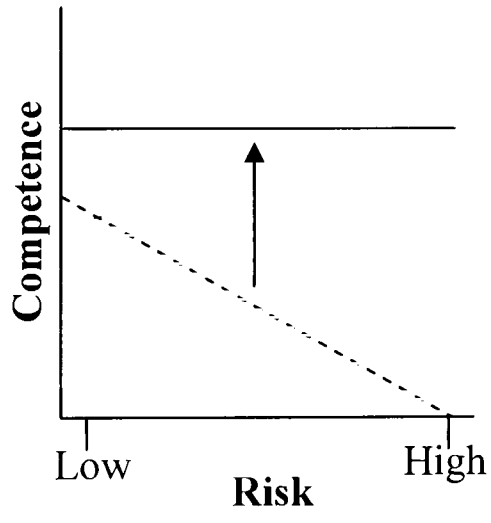
that a means of representing moderation, statistical interaction terms, are *not* a pre-requisite for the identification of a protective effect. Rather, the authors argue that *"protective"* should be used to describe overall effects that are beneficial with more precise terms used when dealing with cases of significant statistical interaction terms (see Figure 2.4). The disparity in the guidance provided by these different sets of authors serves to exemplify how the complications in testing hypotheses of moderation are compounded when used in investigations of resilience. Indeed, Kraemer, Stice, Kazdin, Offord, and Kupfer (2001) go so far as to argue that moderation itself is so imprecise that nearly any two variables can be found to moderate one another depending upon the linear model that is employed and a large enough sample size.

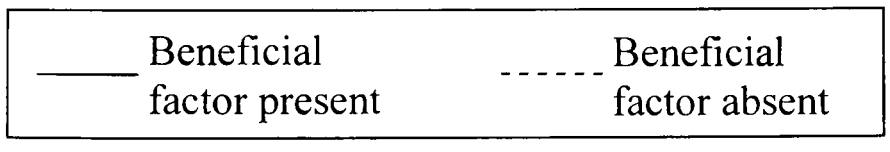
Figure 2.4 The different meanings of *'Protection'* found in investigations of resilience.

Protection - (Luthar, 1993);
'resource' - (Rose, Holmbeck, Coakley, & Franks, 2004);
'promotion' - (Sameroff, Gutman, & Peck, 2003)



Protection - (Rose, Holmbeck, Coakley, & Franks, 2004; Sameroff, Gutman, & Peck, 2003);
'protective-stabilizing' - (Luthar, 1993)





Whilst replicating the arguments concerning how to test hypotheses of moderation in studies of resilience, the arguments over terminology (as illustrated in Figure 2.4 above) can themselves be compounded by confusion over the meaning of the terms they employ. For example, Roosa (2000) and Luthar Cicchetti, and Becker (2000b) present arguments for and against (respectively) the use of what they refer to as

"interaction effects" in the study of resilience. However, these authors appear to be repeating the arguments made concerning how to establish *moderation*: Roosa argues that resilience depends upon statistical interaction effects whilst Luthar *et al.* argues that it is findings within risk groups (subgroups) that are of central importance. By way of some explanation, it is possible that there is confusion over terminology with 'interaction' being used as a synonym for 'moderation' such as in Roosa's assertion that, *"...researchers identified main effects within their samples that are, in fact, interaction effects..."* Roosa (2000)

Semantic differences between the definitions of terms that are used by authors confuse the points they raise about the use of 'interactions' in studies of resilience. These points include Roosa's claim that Luthar's arguments devalue the role of 'interactions', and Luthar *et al*'s assertion that, *"interaction effects are at the heart of resilience research"*. Furthermore, this example of the confusion surrounding moderation and interaction terms illustrates just *one* of the compounded complications inherent in establishing moderation within studies of resilience.

Hypotheses of Moderation in Studies of Resilience

Even if one accepts that protection can only be conferred through a moderation of risk (e.g. Rutter, 1987), the means by which this can be established has been demonstrated to vary (see above) and this compounds the difficulties in determining protection. Consequently, the use of either dichotomisation and subgroup comparison or statistical interaction terms as approaches for testing hypotheses of moderation is an argument that can also be found in studies of resilience (e.g. Luthar, Sawyer, & Brown, 2006). Beginning with the first of these alternatives, Luthar (2006) argues that by dichotomising a sample according to risk, separate effects of opposing directionality within each resulting subgroup can be detected. For example, a beneficial effect under conditions of *high* risk might also be a detrimental effect under conditions of *low* risk (e.g. an authoritarian parenting style, Cauce, Stewart, Rodriguez, Cochran, & Ginzler, 2003). However, it has also been argued that the examination of high-risk subgroups requires substantive theoretical justifications concerning the nature of the sub-sample to be made *a priori* (Rutter, Pickles, Murray, & Eaves, 2001).

Alternatively, Luthar (1993) has also argued the converse; that researchers are forced to rely upon multiplicative statistical interaction terms in order to demonstrate moderating/buffering effects. However, because unstable findings are frequently found with the small effect sizes associated with these terms, researchers (including Luthar) have also cautioned against their use with some have even arguing that they capture only a, *"conceptually interesting subgroup of resilience phenomena"* (Luthar, Cicchetti, & Becker, 2000a). Furthermore, by 2006 Luthar appears to have changed her mind and points out these terms can obfuscate main effects by increasing the number of variables included in any analyses which leads to reduced statistical power (Luthar, 2006).

Mirroring the differences that can be found between the use of hypotheses of moderation and their operationalisation in studies of resilience, Masten *et al.* (1999) outline two different but complementary perspectives that can be found in investigations of resilience. First, Masten describes a *dimensional* perspective that focuses on variables and uses statistical analyses including regression, path analysis, and the Structural Equation Modelling that is employed in this investigation. Second and alternatively, a *categorical* perspective instead concentrates on groups and subgroups of people and employs methods such as cluster analysis, analysis of variance (ANOVA), and discriminant function analysis. Furthermore, the use of ANOVAs within the categorical perspective was instrumental in the development of the theory of moderation itself (Holmbeck, 1997; McClelland & Judd, 1993). Consequently, it seems plausible that such associations between method of analysis and the hypothesis of moderation might influence the perspective of researchers who are attempting to investigate protection based upon this hypothesised effect. However, the detection of protection and resilience that is based upon moderations is further complicated by the uncertainty over what the term 'interaction' actually refers to and whether statistical interaction terms are sufficient for capturing this.

The Quality of Pre-School as a Protective Factor

Just as the complications that surround hypotheses of moderation and statistical interaction terms are compounded in investigations of developmental resilience, so too is this extra degree of complication found when moderation and interaction terms are used in investigations of early education. As might be expected, this is an effect

that has proven even more pronounced in investigations that have brought together these ideas to test whether the quality of pre-school can moderate the impacts of risks upon development. Of the limited previous research that has been carried out to date, disappointingly weak results have been found and presented as being, *"Contrary to the expectations"* (NICHD, 2000a) of some authors. Two examples of this research (Burchinal, Peisner-Feinberg, Bryant, & Clifford, 2000; NICHD, 2000a) are now critically examined with reference to the guidelines and debates that have just been presented above. This review is crucial to this study as the disappointing results of these investigations directly influenced the analyses that were undertaken here: Analyses that tested whether the quality of pre-school could offer protection young children's development.

Starting with the paper of Burchinal, Peisner-Feinberg, Bryant, and Clifford (2000), the investigation it documents was explicit in its decision to use tests of moderation to investigate whether high-quality child care could protect children whose development was at risk. The authors postulated that the relationship between the quality of pre-school and developmental outcomes would vary across different levels of risks (an *effect modifier,* Hinshaw, 2002) with risks including: child gender and ethnicity, family poverty, and parental values. Operationalising the moderation hypotheses was achieved by multiplying *dichotomised* risk variables with variables hypothesised to confer protection, but with no justification given for this strategy and no mention of how this might affect the likelihood of identifying significant moderation/protective effects. These relationships were then tested in two separate regression models, linear (for continuous outcomes) and log-linear (for categorical outcomes) that each controlled for the nested complex samples that the investigation was based upon. The authors reported only one case of significant protection, high quality pre-school was found to protect the language development of children from ethnic minority backgrounds.

Aside from omitting any justification for the strategy of both dichotomising continuous variables *and* constructing multiplicative statistical interaction terms to test hypotheses of moderation (which should be theory-based, Frazier, Barron & Tix, 2004), additional criticisms may also be levelled at this study. Burchinal *et al.*'s use of their statistical terms in both linear and log-linear models are exactly the conditions

reported by Kraemer, Stice, Kazdin, Offord, and Kupfer (2001) as differentiating the very existence of all multiplicative statistical interaction effects, statistically significant or otherwise. Given their apparent mixture of the approaches to operationalising their hypotheses of protection through moderation (using both dichotomisation/subgroup comparison and multiplicative interaction terms) and their lack of consideration as to how the models that they used would influence their outcomes, it is perhaps little surprise that Burchinal and colleagues report that their study,

> *"...failed to provide further evidence supporting hypotheses about the protective effect of good-quality child care for children experiencing risk factors..."*
>
> (Burchinal, Peisner-Feinberg, Bryant, & Clifford, 2000)

Akin to the paper of Burchinal and colleagues, the paper authored by the NICHD (2000a) also tested a hypothesised protective effect of pre-school on children's development through the use of moderation. Likewise, multiplicative statistical interaction terms were again used to represent this moderation with continuous composite risk variables[88] being multiplied by a continuous measure of the quality of pre-school care (*risk x quality*), and children's duration of attendance (*risk x duration*). However, this paper made explicit its decision to use this particular strategy rather than that of dichotomisation and then extreme group comparison, claiming that this choice made their study one of *relative risk*. Multiple regression analyses were then used to assess the impacts of risk and pre-school on receptive language at 36 months of age, whilst repeated-measures mixed models were used to assess child behaviour measures taken at 24 and 36 months. Only limited evidence was found of moderation and none for protection (which they refer to as *"compensation"*); children from single parent homes and from ethnic minority groups were found to have lower prosocial behaviour when in lower quality pre-school care.

Although the paper of the NICHD was more explicit in its choice of strategy for representing a moderating effect, it still found only limited results. Further, these outcomes were concluded *despite* using the methods outlined above for formulating and testing hypotheses of protection/moderation and in spite of supportive previous

[88] Obtained from a Principal Component Analyses

research. In outlining the possible reasons for this, the authors further demonstrate how complications inherent to the study of developmental risks and resilience, early education pre-school effects, and testing hypotheses of moderation are compounded when investigating them together. The limitations of the study's sample provide evidence of this. The authors of the study concluded that by excluding families whose mother's were drug addicts, teenagers at child birth, or living in unsafe neighbourhoods, many risk conditions that could have impacted children's development were eliminated from the sample.

The under representation of potential risks to development in the study by the NICHD (2000a) demonstrates the impacts of risk selection on the results obtained from statistical interaction terms: selectively excluding risks was theorised to have led to an under sampling of high risk conditions which lessened the impacts of interaction effects of the form *risk x protection.* In addition, this impact of risk exclusion also highlighted the importance of studying multiple risks simultaneously in statistical models that contextualise children's lives by the environments in which they live (see Bronfenbrenner, 1979).

In attempting to establish pre-school early education as a protective factor, two features can be observed from the above two studies: 1) *How they attempted to identify the protective factor* - Both used the widely accepted hypotheses of moderation (e.g. Rose, Holmbeck, Coakley, & Franks, 2004); 2) *How they went about testing their hypotheses* - Both used multiplicative statistical interaction terms. The similarity of these studies' aims, methods, and results, together with the differing limitations that can be made of each demonstrates the complexity of answering the research question that both attempted. Interaction effects have been noted as being at best small and unstable (Luthar, Cicchetti & Becker, 2000a) and when relied upon to provide evidence of a protected development due to pre-school, there are many aspects of study design and methodological/analytical procedures that have been demonstrated to impinge upon this relationship.

Determining Whether Pre-School can Protect

Given that conclusions of protection are fragile when based upon tests of moderation as evidenced in the studies cited above, what guidance can be drawn for researchers

who aim to investigate the possible protection conferred by high quality pre-school? Despite the debates presented in the preceding sections that have concerned hypotheses of moderation in studies of developmental resilience, some direction as to best practice can be established along with limitations to bear in mind when examining any results obtained from statistical analyses.

The first guideline that can be determined from the pre-existing literature concerns the means of operationalising hypotheses of moderation. Despite caution being recommended with their use and interpretation, statistical interaction terms appear to have been less criticised as a method of determining the existence of a moderating effect than dichotomisation, sample splitting, and subgroup comparison. As a result, multiplicative interaction terms seem to be the best method of testing a moderation hypothesis in this investigation, a conclusion that is supported by their use in the similarly aimed studies of Burchinal and colleagues (2000), and the NICHD (2000a). However, this is not to say that subgroup comparisons and analysis are invalid in and of themselves. Rather, subgroup analyses that are based on a series of dichotomisations and sample divisions (rather than naturally occurring dichotomous variables) has remained an approach that is at best, only suitable under special conditions (e.g. Baron & Kenny, 1986), and at worst not suitable at all (e.g. McClelland & Judd, 1993).

Second, despite being demonstrated to have an important impact on development (see Section 2.3.4); the interrelationships amongst risks can impact the likelihood of a protective measure being found to significantly moderate their effect. For example, the study of the NICHD (2000a) created a measure of combined risk that reflected the ecological origin of this risk, an appropriate approach that was driven by the pre-existing literature. However, by excluding some families on the basis of their risks, the study limited the breadth of the combined risk that it measured. In turn, this limited the degree to which the study could identify a significant protective effect; the excluded families may have been those whose risks could have been protected against.

The conclusion that there are negative effects associated with limiting sample selection by the risks to which certain individuals are exposed provides further

evidence that supports the use of interaction terms rather than the dichotomisation and sub-sampling alterative. Maintaining a sample which fully represents the developmental risks encountered by those investigated not only provides results which have a greater degree of ecological validity, but also increases the breadth of the risks that the hypothesised protector has the opportunity to protect against.

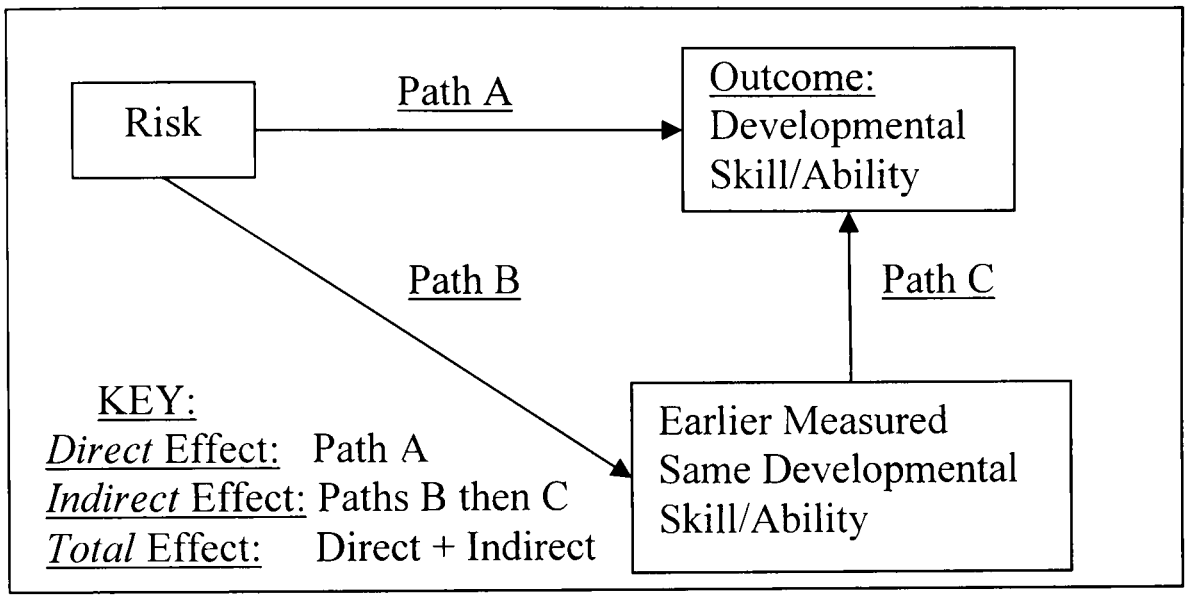
The third guideline that can be established from pre-existing studies is one that is based upon the observation that it has proved difficult to detect hypothesised moderations of the effects of risk upon development when researching the effects of pre-school. Although research has indicated that higher quality pre-school should be able to protect development, the studies to date have indicated that any protection is limited and is susceptible to the design of the study and analysis in which it is searched for. To maximise the likelihood of these effects being detected whilst minimising the likelihood of Type I and II errors, statistical analyses and its results could strongly benefit by taking into account those effects that could obscure a protective relationship.

One effect that can hinder the detection of a significant interaction is the exclusion of earlier levels of development in statistical models. With the inclusion of these measures, the ecological validity of the analyses is increased as developmental outcomes are represented as being partially the product of earlier developmental levels. This was an approach not attempted in the studies of Burchinal and colleagues (2000) and the NICHD (2000a). In both studies, no cognitive or social developmental outcome was ever represented as being partially a product of earlier levels of these same skills and abilities. This is despite the strength of the association that exists between any measures of the same abilities at differing times. Furthermore, this is also despite the logic that if risks are believed to have a direct effect on development during a certain period, then the effects of risk at the end of this period are going to be divided between those that are *direct* and those that stem from the risk reduced development in the preceding period (*indirect*).

The division of risk effects into those that are direct and those that are indirect through the lowered preceding developmental skills and abilities is a relationship that can be represented through the hypothesis of *mediation.* Figure 2.5 illustrates such a

relationship with reference to the direct and indirect effects of risks upon developmental skills and abilities. The direct effect of risk on the outcome is represented by path A, whilst there is an additional indirect effect represented by paths B and C and through earlier levels of the same ability. If the indirect effect is omitted from this model then path A ceases to represent a direct effect of risk; it instead now represents the *total* effect of risk (both direct *and* indirect).

Figure 2.5 Differentiating the *total*, *direct*, and *indirect* effects of risks upon development: A model of mediation



Referring back to the studies of Burchinal and colleagues (2000), and the NICHD (2000a), although both were concerned with moderations of the direct effects of risk upon development, by failing to account for the indirect effects, the authors actually tested whether high quality pre-school could moderate the *total* effects of risk. If the authors had separated the two effects from one another, then their analyses would have more closely matched the aims of their studies. In turn, their studies would have been more likely to detect the significant protective effects of pre-school education which both investigations hypothesised to exist.

In conclusion, the methodology and findings of previous studies and reviews concerning how to establish protection through moderation, and how this varies when investigating developmental resilience and pre-school education guided the design of a number of features of the statistical analyses in the current stusy. Firstly, multiplicative interaction terms where used to operationalise the hypothesis of

protection[89]. Second, models of mediation were used to account for earlier levels of development and the effects of risk upon these. Third, this mediation served to increase the likelihood of detecting a significant moderation of risk as well as increasing the ecological validity of the analyses over the standard regression models that were used in previous studies. Fourthly, unlike the standard regression analyses that have been used previously, it is relatively simple to fully test mediational models with SEM (see Figure 2.5 above) as it can simultaneously represent all of their component pathways whilst also testing for a significant moderation of risk.

2.4.2 Clustered Samples

The design of the analyses undertaken by the current investigation were influenced not only by those designs that were used and advocated in previously published studies and guidelines (top-down influences), but also from the characteristics of the EPPE dataset itself (bottom-up). These bottom-up and data driven influences are exemplified by the modelling that was incorporated into the Structural Equation Models (see Section 2.4.3); modelling that was able to represent the effect of sampling clusters of children within pre-schools.

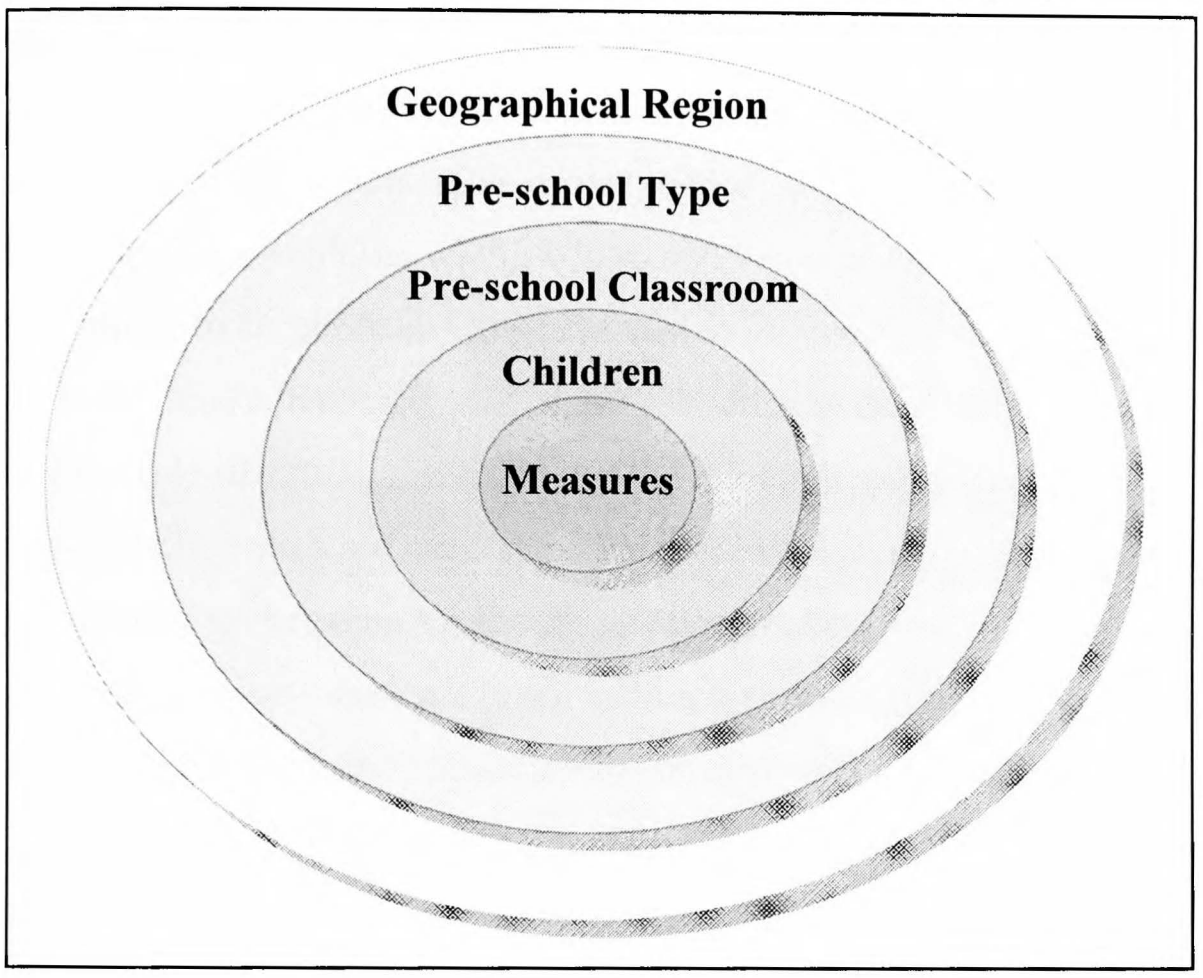
Clustered units are a feature of samples that produce effects that are commonly dealt with using the statistical technique known as Hierarchical Linear Modelling (HLM) or multilevel modelling. This is a statistical technique that was developed to allow statistical analyses to return results that take account of the hierarchical clustering of samples that can be present in quantitative datasets (Goldstein, 1987). In particular, such clustering is commonly encountered in investigations of education due to the natural nesting of children within classes, and classes within schools (see Figure 2.6). Under such circumstances, it becomes increasingly necessary to use this specialised analysis because the General Linear Model (GLM) which underlies many commonly used statistical techniques assumes that information gathered concerning the individual units of a sample (e.g. children) is independent[90]. When data is hierarchically structured, this assumption is clearly violated and it is necessary for any

[89] Of the form *risk measure x protection measure* and where both measures were mean standardised before hand.

[90] Just one of the characteristics of *parametricity* necessary for a dataset to be appropriately analysed using GLM

statistical analysis that is undertaken to take the nesting into account so that it is more likely that valid and reliable results will be obtained (L. K. Muthén & Muthén, 2007).

Figure 2.6 Hierarchical clustering of pre-schools, children, and measures in the design of the EPPE project (see Sammons et al., 1999)



In addition to the *dis*aggregation of effects by levels that is achieved through multilevel modelling, there is also a statistical technique that takes account of the effects a clustered sample may have on results without differentiating the percentage of variance in an outcome each level can uniquely explain. Termed 'aggregated modelling' (see Chambers & C.J. Skinner, 2003; C.J. Skinner, Holt, & Smith, 1989), this statistical approach does not allow for the *relative* impact of different levels to be compared. Instead, this alternative approach simply alters the standard errors of the statistical regression analysis in which it is used in order to take into account the clustering (see Asparouhov, 2005). Although it was possible to use *either* of these techniques in the Structural Equation Modelling that was carried out by this investigation, the choice was made to use the aggregated approach. This decision was made for the sake of parsimony in the analyses; to attempt to keep the analyses as simple yet also appropriate as possible. Further, underlying this parsimony was an attempt to minimise the likelihood of problems being encountered when the statistical models were actually tested using the Mplus software (see L. K. Muthén & Muthén,

2004); the less complicated the statistical models, the smaller the likelihood of encountering problems in mathematical convergence.

As illustrated at the beginning of this chapter in Figure 2.1, the design of the EPPE sample took into account the stratified sampling of children within pre-schools and aimed to recruit a large number of children per centre. This design was used in order to ensure that there would be a sufficient depth to the clustering for the multilevel analyses to return reliable results. One aspect of this process was maintaining a sufficient sample size at both the within-centre and between-centre levels and guidelines continue to be published that give advice as to what size samples should be in order for them to be considered 'sufficient'. W. J. Browne (2008) describes a widely accepted rule-of-thumb that exists for the minimum number of level 2 units, in this case pre-schools, which are needed for the successful and appropriate detection of statistical relationships: between 15 and 50. Although also noted to be somewhat arbitrary, if these rules-of-thumb are taken as rough guidelines then they indicate that there were a sufficient number of pre-schools sampled by the EPPE project (141) for the results obtained from the aggregated modelling to be relied upon as well as being an appropriate technique to use. At the same time however, such guidelines are also being built upon with ongoing research that aims to identify statistical rules and formulas which have a sounder mathematical basis and as a result should be more precise (e.g. Mass & Hox, 2004).

2.4.3 Structural Equation Modelling (SEM)

This investigation used Structural Equation Modelling (SEM) to analyse alternative measures of combined risks, examine multi-level moderations of these risks, and to model the mediations that were used to control for indirect effects. The features of the analysis that these aims necessitated were: the simultaneous representation of concepts (risk, development, pre-school), and establishing multiple inter-dependant relationships between these (combined risk, moderation, mediation). Furthermore, MacCallum and Austin (2000) propose that both the multiple representation and relationship testing are commonly achieved through SEM. MacCallum and Austin argue that SEM is a confirmatory technique which is widely used not only for longitudinal investigations, but also for studying concepts that are measured both *directly* ("manifest" e.g. the ratio of pre-school attendees to pre-school staff) as well

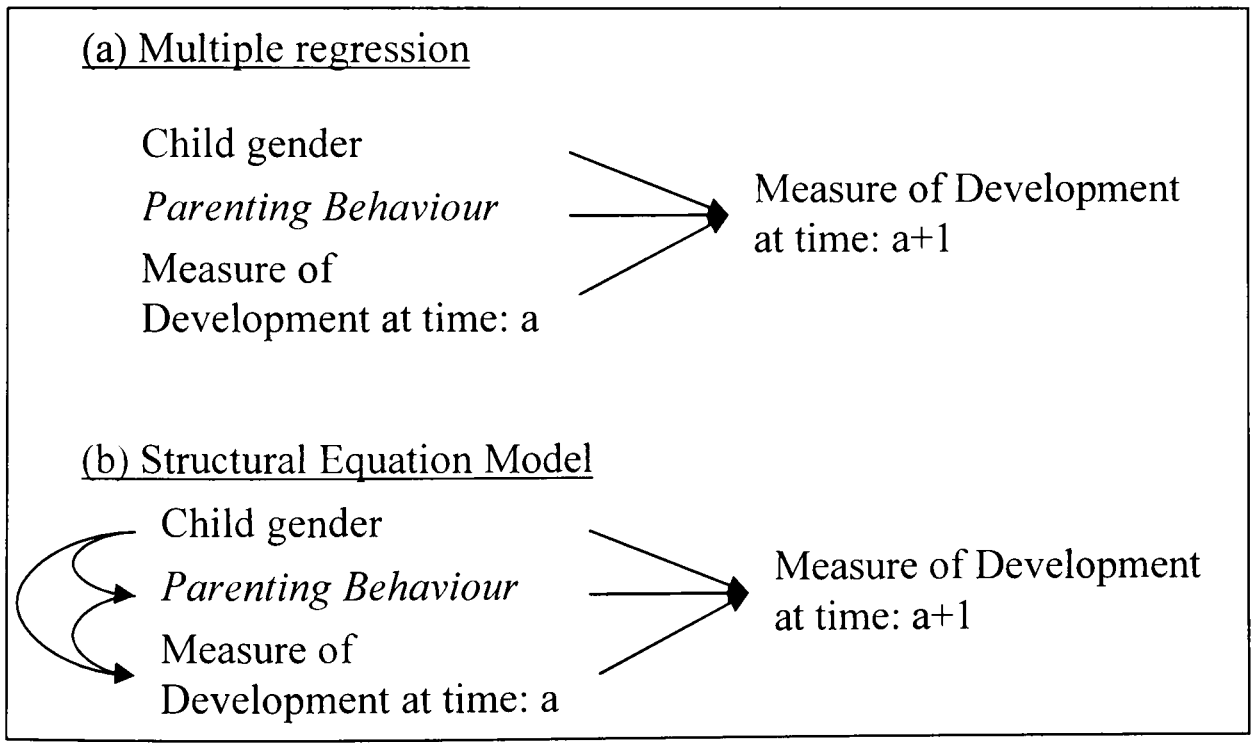
as *indirectly* ("latent" e.g. the concept of an accumulation of risk to children's development).

The benefits that using SEM brought to this investigation were not just limited to the ability of this technique to simultaneously represent and test relationships between concepts that were either manifest or latent in their measurement. Arising from these two benefits are two others which increased the appropriateness of SEM for use in this investigation. The first of these concerns the validity that is brought to results that are obtained from SEM being able to indirectly measure (through interference) latent variables. An example in this investigation was the concept of combined risk that was inferred from the individual risk experiences that each child encountered. Whilst cumulative risk indices provided an existing approach to this measurement, the latent measurement that is possible with SEM allowed for the measurement error that was associated with the indication of each risk to the latent combined risk, to be disattenuated (taken into account). As a result, the ability of SEM to represent latent variables such as combined risk was increased as it takes into account the inaccuracy of their measurement. Because of this, the ecological validity of the results that were obtained from using this approach was increased. In other words, the results that are obtained from models that took into account the variability in measurement accuracy implicitly demonstrated greater validity in their results than those of previous studies that did not.

The other advantage that was brought to the analyses from SEM being able to simultaneously measure and test concepts as well as the relationship between them, concerned the consequences for causality that came from being able to represent chains of effects over time. One of the common criticisms made of observational research designs such as that employed by EPPE is that building an argument for causality in effects is more difficult than it is with experimental designs. Although SEM remains a technique based upon non-causal correlations, it nonetheless has a greater ability to represent hypotheses of cause and effect over time than a regression modelling alternative. The simultaneous modelling of these chains of effects over time allows for intermediately (hence "mediating") effects to be reliably determined.

An example of the benefit to establishing causality that is pertinent to this investigation is illustrated in Figure 2.7 where a developmental outcome is hypothesised as being influenced by earlier developmental levels, child gender, and parenting behaviours. With the multiple regression model (a), there is no differentiation of the occurrence of, and hence possible causal relationships amongst, the predictor variables. This limitation to the modelling limits the ability (and validity) of the model to return results that accurately reflect the true causality of the effects of the predictor variables. By contrast, a SEM approach (b) allows the implicit differences in timing (and thus directionality in relationships) between the predictors to be explicitly taken into account. As a result, SEM clearly provides an approach to confirmatory longitudinal analyses that is more suitable for returning valid results concerning cause and effect than a multiple regression alternative.

Figure 2.7 Differences between the ability of multiple regression and SEM approaches to represent causality in tests of longitudinal relationships.



It is these extra degrees of validity that it is possible to achieve in analyses that use SEM rather than traditional regression models which is a further reason why this investigation used this technique rather than those employed in the original EPPE studies. The validity of the conclusions that were made by this investigation was benefited by the data that was missing from the EPPE dataset (although minimal for studies of this size, see Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004) being accounted for through statistical estimation rather than simply ignored. Fortunately, the statistical software packages that estimate Structural Equation Models

frequently include reliable algorithms for the replacement of missing data (e.g. an expectation-maximization (EM) algorithm; see Tabachnick & Fidell, 2001). The integration of these approaches into the SEM meant that the imputed results that were derived were in respect to the causal chains that were specified in the model. This is in stark contrast to the alternative that is possible in regression analyses where separate preliminary data imputation procedures based on, at most, a selection of variables and their co-variances would have had to have been carried out first.

Because SEM is a technique that is based upon the relationships that are shared between variables (covariances/ correlations) and these relationships are less reliable when identified with smaller samples, so the results obtained from SEM are themselves vulnerable to sample size[91] (Tabachnick & Fidell, 2001). The smaller the sample size, the less power SEM has for detecting small yet significant relationships and vice versa. Tabachnick and Fidell claim that a figure of 10 subjects per estimated parameter[92] of a SEM is sufficient to reliably detect large effect sizes with normally distributed variables. The association of model complexity (number of estimated parameters) with sufficient sample size in SEM is then extended by Tabachnick and Fidell who go on to claim that a sample size of 200 is *"adequate for small to medium models"*.

From the guidelines proved by Tabachnick and Fidell (2001) concerning the relationship between sample size, model complexity, and reliability of results, the analyses conducted by investigation can be examined. With a sample size of 2,857 children sufficiently clustered (see Section 2.4.2) within 141 pre-schools, this investigation was in a strong position to detect small yet significant effect sizes such as those commonly found for interaction effects (Luthar, 2006). Further, the models in which these small and significant effects can be reliably identified need not be limited to those that are "small to medium" but can instead simultaneously include other effects such as those that are mediational.

[91] As too are some measures (such as the Chi-square test) of the appropriateness of the SEM to the covariances in the data: the, "Model fit".
[92] For example the estimated parts of a standard linear regression equation: the intercept β_0; the regression co-efficient β_1; and the error term ε.

Confirmatory Factor Analysis (CFA)

Structural Equation Models are divided into parts termed structural and measurement where the structural part comprises the hypothesised relationships between concepts that are being estimated by path analysis (see Tabachnick & Fidell, 2001), and the measurement part concerns the estimation of latent variables through Confirmatory Factor Analyses (CFA). Mirroring the purpose of SEM and as its name suggests, CFA is a technique that is designed to *confirm* researchers' hypotheses about the formation of indirectly inferred latent variables. In this regard, CFA varies strongly from Exploratory Factor Analyses (EFA), a technique that is commonly carried out for generating hypotheses concerning the structure and formation underlying latent variables for which CFA is designed to empirically test. However, common across both types of Factor Analysis is the direction of causality between latent factors and measured variables (Tabachnick & Fidell, 2001). Termed, "reflective", in both cases the unmeasured latent constructs are hypothesised to be the causes of the researcher measured variables (see Figure 2.8).

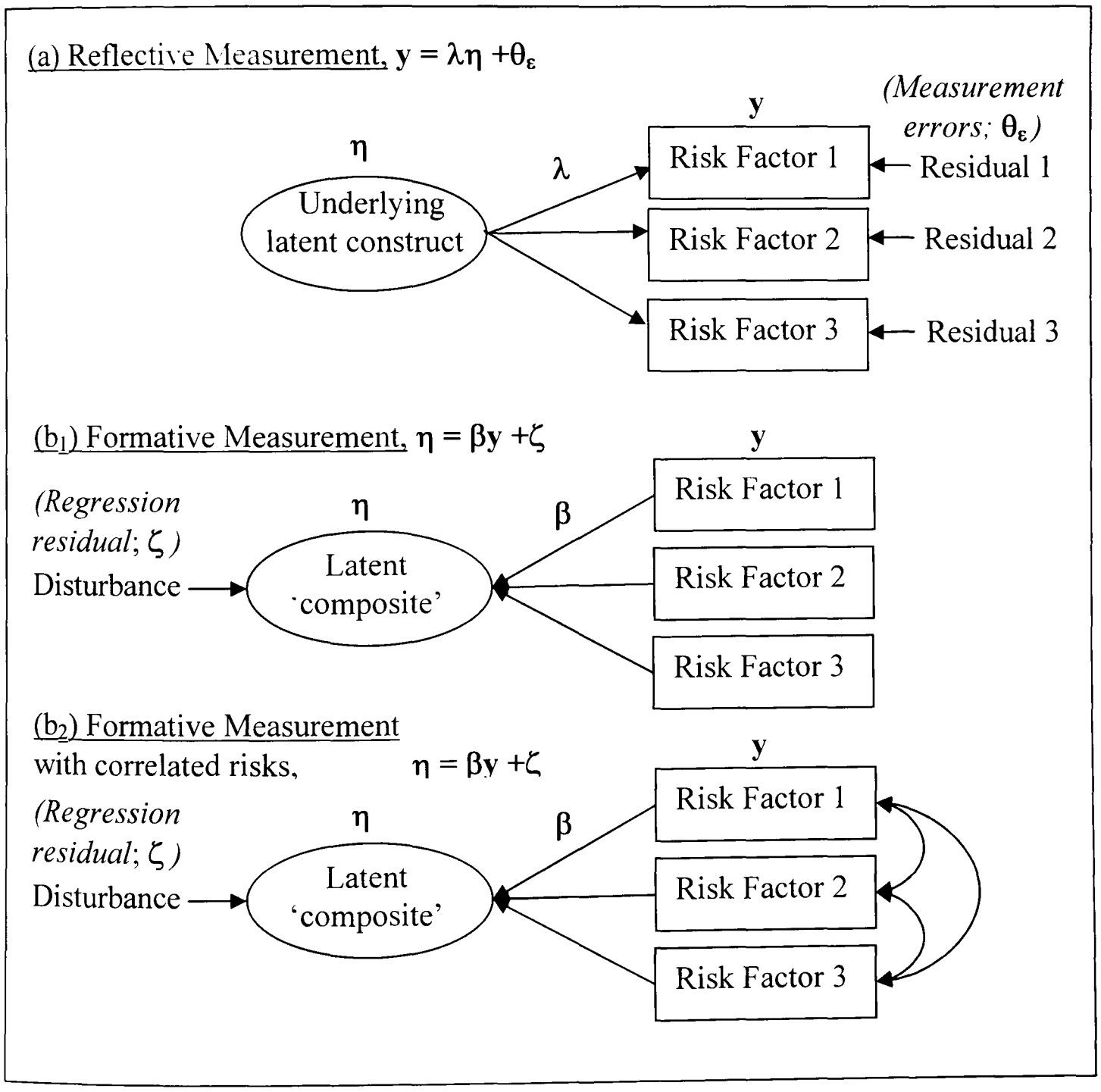
Reflective vs. Formative Measurement

One statistical procedure that can be used for the measurement of combined risk is a Confirmatory Factor Analysis that uses formative (rather than reflective) measurement and this is an approach to measuring underlying constructs that has recently received much attention in its applicability to psychological research (e.g. Howell, Breivik, & Wilcox, 2007). In addition to stress and socioeconomic status (Edwards & Bagozzi, 2000), *developmental risk* itself has been put forward as a concept that can be appropriately measured through use of this strategy (Kleine, 2006). As an example, Kleine suggests that school achievement and classroom adjustment could be considered *at risk* due to the combined effects of socioeconomic status, parental psychiatric history, and verbal intelligence.

Figure 1 illustrates the differences between formative and reflective measurement: with formative measurement, each manifest risk y is theorised to be a *cause* (β) rather than an *effect indicator* (λ) of a latent underlying latent risk η (see Kleine, 2006; Edwards & Bagozzi, 2000). By referring back to the epidemiological research that investigated the causes of heart disease (see Section 2.3.4), the validity of a formative

rather than reflective approach to measuring combined risk is illustrated. Rather than an increased risk of heart disease causing obesity and smoking, it is these individual risks *in combination* which causes the increased risk of heart disease. Furthermore, Figure 2.8 shows that the direction of causality between manifest and latent variables has consequences for how measurement error in each of these methods is represented. With reflective measurement, the individual measurement errors (the *'residuals'* θ_ε) are unique to each manifest indicator, whereas with formative measurement there is a single combined measurement error ζ (the *'disturbance'*) at the latent construct level.

Figure 2.8 Confirmatory Factor Analyses (CFA) using reflective and formative measurement (adapted from Kleine, 2006)



It is the disturbance term ζ that is at the heart of these *'latent composites'* - without it and Kleine (2006) notes that the procedure would be equivalent to Principal Component Analysis (PCA). Additionally, by estimating measurement error at the latent construct rather than manifest indicator level, it becomes harder to measure the reliability of the formative indicators when the latent composite is theorised to be a dependent variable in a larger statistical model. This difficulty stems from the disturbance term simultaneously capturing the predictive power of variables that are hypothesised as having direct effects upon the latent composite (see Diamantopoulos, 2006).

Although the differences between the direction of causality in formative and reflective measurement arguably lends validity to the formative approach as a method for representing a combined risk, some of the recent focus on formative measurement has also been critical (e.g. Howell, Breivik, & Wilcox, 2007). Furthermore, the difference in the direction of causality between these two approaches to CFA obliges researchers to accept different sets of assumptions when attempting to derive an estimate of combined risk. In addition to the impact of measurement error at different levels, Kleine (2006) also outlined differences concerning the need for inter-correlations (and thus the conceptual interplay) between indicative measured risks. The rationale of reflective measurement (case (a) in Figure 2.8) is *classical test theory* (Diamantopoulos, 2006), and this requires that indicators should be internally consistent (as represented by inter-correlations). Alternatively, with formative measurement (cases (b_1) and (b_2) in Figure 2.8) there is no need for such correlations between individual risks as the rationale for these models is different (as with cumulative indices).

The difference in the need for correlations amongst individual risks impacts the underlying assumption concerning how and why measured risks work together: the interplay between risks is explicit in reflective measurement (via the correlations) but implicit in formative where "working together" (Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001) merely refers to the hypothesis that all of the risks produce a negative impact on children's development. The departure from explicit representations of the interplay between risks that is possible with *reflective* CFA is a contrasting drawback

to the increased validity of representing a combined risk as the *effect* of coinciding individual risks.

Estimating Missing Data

When it comes to quantitative analysis, the presence of missing data has been reported to increase the likelihood of biased parameter estimates, inflated Type I and Type II error rates, and 'degraded performance of confidence intervals' (Collins, Schafer, & Kam, 2001). Graham (2007) notes that modern methods of imputing this missing data fall under two categories, 'model-based' procedures that impute missing data *and* conduct parameter estimation at the same time and, 'data-based' procedures in which missing data is estimated before a separate latter estimation of model parameters takes place. Examples of each of these are given by Graham (2007): the Full-Information Maximum Likelihood (FIML) is a *model-based* statistical procedure that is available within SEM, whilst a *data-based* 2-step procedure is conducting Multiple Imputations (MI) of the missing data before aggregating results. Introduced below, a common assumption found in both is that the pattern of missing data is somehow related to other measured variables (termed Missing At Random, MAR) and as such, that this provides a basis for its imputation.

Missing At Random (MAR) is a pattern of missingness that differs from the non-variable related pattern of 'Missing Completely At Random' (MCAR) and the 'Missing Not At Random' (MNAR) pattern in which there is a systematic reason which explains the pattern of missing data (see Collins, Schafer, & Kam, 2001 for a more detailed introduction). Although there are many procedures for estimating missing data (e.g. listwise deletion, mean imputation) the FIML and MI procedures were considered to be reliable possible means of estimating missing data in this study as both have been purported to offer reliable imputation of missingness even when not all missing data can be claimed to be MAR rather than MCAR or MNAR (Graham, 2007).

First proposed by Rubin (1978), the technique of Multiple Imputation is reported by Little and Rubin (2002), and Rubin (1996) to be a Monte Carlo simulation based technique of data replacement that is especially appropriate for use with complex hierarchical datasets (such as that gathered by EPPE and analysed here). The

technique manages to capture the inherent uncertainty over missing values that could be imputed by deriving multiple plausible estimates that are based on an accepted probability model (e.g. multivariate normality), conducting separate analyses on each dataset containing these various plausible estimations, and then combining/pooling the results of these repeated analyses.

Although MI has been described as providing 'unbiased estimation' and 'good' standard errors (Graham, 2007), it is however limited by the necessity for a large number of separate imputations to be carried out in order for reliable estimates to be obtained. Graham, Olchowski and Gilreath (2007) present a detailed argument that for a statistical power fall-off in resultant inferential statistical models to be less that 1%, a minimum of 20 imputations (rising to 100+ with greater proportions of missingness) is necessarily for the MI strategy to return equivalent results to those obtained through FIML[93]. Graham, Olchowski and Gilreath (2007) also note that this is a number of imputations that is much higher than those values suggested in previous earlier studies such as Schafer and Olsen (1998).

When it comes to SEM, an alternative approach to the handling of missing data through MI is the use of the Full Information Maximum Likelihood (FIML) procedure. Based upon the assumption of multivariate normality in the distribution of variables (also an assumption that is sometimes found in MI, see above) Arbuckle (1996) reports that prior to this year, FIML had been an underutilised procedure due to its unavailability in SEM computer packages. However, given that this is no longer the case FIML is now a more widely used alternative to MI that, like this alterative, returns averaged values for missing data (in this instance, values of Maximum Likelihood through use of the Expectation Maximisation algorithm) from a range of possible missing values that are deemed plausible from an accepted probability model (see Collins, Schafer, & Kam, 2001).

[93] Which carries with the following assumption: If more imputations produce more reliable estimates of missing data and more imputations bring the results of MI closer to those of FIML, so FIML must provide less sensitive and thus more reliable results; the FIML procedure can obtain results of a given level of reliability that only increasing imputations in MI can match as proportions of missing data increase together with the desired maintenance of statistical power.

Comparing the MI and FIML approaches and when integrated into a SEM analysis package, the FIML procedure has been reported as providing a 'good' (reliable) estimation of missing data that returns 'reasonable standard errors' (Graham, 2007). At the same time however, FIML is also not without limitations. Perhaps the most commonly encountered limitation being that the results obtained from its use are dependent upon the statistical model in which it was specified. In turn this means that the values of the estimated missing data that are achieved through FIML will depend upon the wider model in which these are estimated (Graham, 2007). Further, Graham, Olchowski and Gilreath, (2007) note that although it is beneficial to include additional auxiliary variables into models that use either the MI or FIML approach, this has been rarely done so with FIML as this requires extra steps (Collins, Schafer, & Kam, 2001) with this itself being the focus of a special paper by (Graham, 2003).

Tables 2.13 and 2.14 reveal the proportions of missing data that were found within each of the variables that were analysed in this investigation (additional bivariate patterns of missing data can be found in Appendix 7[94]). Variables measuring child level (hypothesised) risks to development had the smallest percentages of missing data (max. N=3.7%). Conversely, the greatest proportion of missing data was found for variables that measured family level (hypothesised) risks to development (max. N=27.4%). This systematic variation by risk level is symptomatic of the overall pattern of missingness falling somewhere between MCAR, MAR, and MNAR; there is the possibly that the sizeable difference in proportions of missing data might be partly due to a factor that was unmeasured. This possibility is supported by Graham's (2007) claim that the three types of missing data do not exist as mutually exclusive categories but rather form a continuum with MCAR and MNAR at either extreme and MAR lying in between. Further exploration of the pattern of missingness that is observed in Tables 2.13 and 2.14, although interesting, is beyond the scope of this investigation.

[94] Where the largest proportion of missing data was found as shared between the highest academic qualification of fathers and the total family salary with 41.79% of 2857 pairs of values missing. In other words, only 1663 children had a full set of data that was common across both of these measures.

Table 2.13 Proportions of Data Missing from those Variables that Measured Developmental Risks and Pre-school Characteristics in this Investigation (Max. N=2857)

Child Level Risks	N missing	% missing	**Family Level Risks**	N missing	% missing	**Pre-school Measures**	N missing	% missing
No. of siblings	71	2.49	2 Parent Family?	67	2.35	Duration of Attendance	142	4.97
EAL	0	0.00	Either Parent Working?	679	23.77	Positive Relationship	27	0.95
Premature birth	69	2.42	Family Salary	679	23.77	Punitiveness	27	0.95
Birthweight	105	3.68	Home Learning Environment	109	3.82	Permissiveness	27	0.95
Birth Order	74	2.59	Greatest Parental Social Class	76	2.66	Detachment	27	0.95
"Any event affected development?"	74	2.59	Greatest Mother Academic Qualification	134	4.69	ECERS-R	0	0.00
Male	0	0.00	Greatest Father Academic Qualification	784	27.44	ECERS-E	0	0.00
Dummy coded Ethnic Minority: Black	3	0.11	Mother's Employment	77	2.7	Manager's Greatest Childcare Qualifications	155	5.43
Other	3	0.11	Father's Employment	674	23.59	Manager's Greatest Academic Qualifications	155	5.43
Indian	3	0.11	No. Non Parental Carers	63	2.21	Mean Staff Age	353	12.36
Pakistani	3	0.11	Mother's Social Class	113	3.96	Mean Staff Greatest Academic Qualifications	313	10.96
Bangladeshi	3	0.11	Father's Social Class	683	23.91	Mean Staff Greatest Childcare Qualifications	305	10.68
Mixed	3	0.11	Mother's Age	78	2.73	No. of Staff	26	0.91
			Father's Age	639	22.37	No. of Children	0	0.00

Table 2.14 Proportions of Data Missing from those Variables that Measured Young Children's Development in this Investigation (Max. N=2857)

Measures of Cognitive Development	N missing	% missing	**Measures of Social/Behavioural Development**	N missing	% missing
Baseline: General Cognitive Ability	93	3.26	Baseline: Co-Operation and Conformity	15	0.53
			Confidence	14	0.49
			Anti-social (reversed)	18	0.63
			Worried/Upset (reversed)	15	0.53
			Peer sociability	14	0.49
Reception: General Cognitive Ability	283	9.91	Reception: Self Regulation	295	10.33
			Anti-social / Worried	290	10.15
Primary Year 1: Reading	393	13.76	Year 1: Prosocial Behaviour	464	16.24
Maths	402	14.07	Hyperactivity	464	16.24
			Emotional Symptoms	467	16.35
			Conduct Problems	479	16.77
			Peer Problems	462	16.17
Primary Year 2: Reading	420	14.70	Year 2: Prosocial behaviour	485	16.98
Writing	483	16.91	Hyperactivity	483	16.91
Maths	465	16.28	Emotional Symptoms	484	16.94
			Conduct Problems	483	16.91
			Peer Problems	483	16.91

In deciding which approach to use in the analyses of this investigation, the proportion of missing data, the similarity between the two approaches of estimation[95], and the ease of their respective implementations within the framework of this investigation were paramount. In particular, the following statement was especially drawn upon:

> *"In sum, our simulations show rather clearly that FIML is superior to MI, in terms of power for testing small effect sizes, unless one has a sufficient number* [of] *imputations..."* (Graham, Olchowski, & Gilreath, 2007)

Given that interactions effects are typically characterised by relatively small effect sizes (e.g. Luthar, 1993), that implementing FIML is a relatively simple procedure *within* a SEM analysis (Carter, 2006), and that the two methods are equivalent when the iterations used in a MI approach infinity, this was taken as strong support for the use the FIML approach as the means for estimating missing data in the analyses of this investigation.

Mentioned above, the proportion of data that was missing from the EPPE dataset was also a deciding factor in the use the FIML rather than MI procedure. Although increasing proportions of missing data warranted an increasing number of imputations with the MI approach, the availability of computer packages such as NORM (see Schafer. 1997) minimised the impact that this potential drawback had on the choice between FIML and MI. Instead, the deciding factor was the proportion of missing data *in combination* with the need for maximised statistical power (to increase the likelihood of correctly identifying significant interaction effects) coupled with the fact that the FIML procedure appeared to be provide a solution that was, at the very least, at least as good as the best solution that MI could provide given these constraints (see Table 5 in Graham, Olchowski, & Gilreath, 2007). It was for these reasons that this investigation adopted the FIML rather than the MI missing data estimation procedure.

2.5 Conclusions

This chapter aimed to introduce the research questions of this investigation, their underlying rationale, and the strategy that was used to answer them: a secondary analysis of the EPPE dataset. Following on, the design and sample of the EPPE project were then presented before discussion turned to the instruments that were used

[95] with them being equivalent when used in the same models, and with the imputations used in the MI approaching infinity (Graham, Olchowski, & Gilreath, 2007).

by both the current study and the original EPPE project. Finally, once readers had been guided through the research design and measurement instruments, a rationale for the analytic procedure was presented.

The analysis conducted by this investigation was based upon those that were used by earlier studies which aimed to answer similar research questions (see Section 2.4.1), and also the research design of the EPPE project (see Section 2.2). Multilevel (see Section 2.4.2) Structural Equation Modelling[96] (see Section 2.4.3) was used in a two stage analysis procedure. First, a new approach to the measurement of developmental risk was developed and compared to the widely used method of constructing cumulative indices (Chapter 4). Second, with this measure of risk developed and validated, it was then used to investigate whether pre-school could moderate the impacts of risks on development (protect) and for how long this protective effect could last (Chapter 5).

The subsequent chapters of this thesis go on to present and then discuss the results obtained on the basis of the design, instruments, and analyses described in this chapter. Possible instances of protected cognitive and social abilities at entry to reception were searched for, in which each was hypothesised to be due to an aspect of the early education programme in which each child was enrolled. For each case of significant protection that was found, its longevity as a factor supporting development was then examined. The significantly protected abilities at entry to primary school were followed up in analyses that determined their total impacts (both direct and indirect) on children's future educational attainment and behaviour up until the end of the first and second years of primary school (Key Stage 1). From this analysis, the contribution of early education to vulnerable and resilient developmental pathways could then be investigated.

[96] with missing data imputation

3. RESULTS I: EXPLORATION OF DATA

The purpose of this chapter is to provide the reader with a guide to the preliminary analyses undertaken in this investigation. As the title suggests, this chapter reports on an exploration of those measures that were used in the subsequent Structural Equation Modelling (SEM). To this end, univariate descriptive statistics are presented that detail the means, kurtoses, and skewnesses of these 59 variables to determine the normality of their distributions (all analyses conducted through SPSS).

The chapter then moves on to conduct some simple bivariate and multivariate statistics, again with the purpose of exploring the data prior to the confirmatory analyses undertaken in Chapters 4 and 5 and these analyses mirror the ones that are described above. However, given the volume of variables analysed in this investigation, it was not practical to examine pairwise plots of all combinations of variables to ascertain *linearity* and *homoscedasticity* (the technique advised by Tabacknick and Fidell, 2001) so selected random pairs were examined instead[97]. Again, this is the technique advised by Tabachnick and Fidell (2001). In addition, multivariate outliers (Malahanobis distances) were also examined as a further attempt to ensure that the assumptions of the subsequent SEM were not violated. Finally, bivariate correlations were used in order to determine the patterns in the data that the subsequent SEM would be based upon as well as determining the extent of the multicollinearity that was present. This chapter then concludes with an overview of the findings that were reported and reiterates the procedures that were carried out.

An important decision made at this preliminary stage of the analyses was not to remove those children who demonstrated extreme values on any given single variable (termed univariate outliers). Although this is the technique advised by Tabachnick and Fidell (2001), it was deemed unsuitable due to the substantive focus of this analysis. Because this investigation studied non-normative features that were pertinent to the child and family (i.e. risks), extreme cases were not only likely (e.g. very low birthweight), but also conceptually important for the subsequent inferential analyses. For this reason, it was instead decided to make the estimation of the subsequent Structural Equation Models 'robust' to the otherwise deleterious impacts

[97] Where total possible scatter plots is given by the total combinations of 2 variables from 59 $= {}_nC_k = 59!/(2!(59-2)!) = 1711$

associated with non-normally distributed variables. This was achieved by using the 'Yuan-Bentler T_2' test statistic[98] (Bentler & Yuan, 1999), which L.K. Muthén and Muthén (2004) and Tabachnick and Fidell (2001) have described as returning the most accurate results from SEM when the assumption of normality is violated.

3.1 Risks to Young Children's Development

Table 3.1 presents the distributions of those z-scored variables that were hypothesised to pose a risk to the development of young children and which were considered more proximal to the child than those indicative of parents/the family (see Table 3.2). In addition to presenting the number (N) of valid responses (with maximum N=2857) for each of these variables together with their respective means and the variances, Table 3.1 also presents the distribution of these variables via their values of skewness and kurtosis. Those variables that displayed the greatest divergence from a normal distribution are highlighted in **bold** (insofar as this is possible for dichotomous, non-continuous variables) and usually represented a problem for subsequent SEM as it assumes normality of distribution in the variables that are used within it.

However and as stated above, it was also perfectly valid for there to be an uneven distribution of scores in those displaying non-normality variables due to what it was that they were used to measure. For example, given a representative sample, one would expect there to be an uneven distribution in children regarding who spoke English as an Additional Language (EAL) or who came from an ethnic minority (with these variables being dummy coded against 'White?'). As such, the possible problems that the inclusion of these non-normally distributed variables caused subsequent the SEM was avoided, not by transformation, but my making the SEM more robust to this violation of its assumptions (again see above).

[98] Also robust to the non-independence of the child measures due to their nesting within pre-schools

Table 3.1 Distribution of z-scored child level potential risks (2 d.p.)

	N	Mean	Variance	Skewness	Kurtosis
Boy?	2857	0.01	1.00	-0.08	-1.99
EAL?	2857	-0.09	0.76	**3.04**	**7.26**
Premature?	2788	0.00	1.00	1.81	1.26
Birthweight?	2752	0.01	1.01	-0.57	1.68
No. of siblings?	2786	-0.08	0.85	0.96	1.54
Birth order?	2783	-0.08	0.84	1.47	3.05
Ethnicity,					
Bangladeshi?	2854	-0.03	0.70	**10.55**	**109.36**
Black?	2854	0.02	1.09	**3.60**	**10.94**
Indian?	2854	-0.01	0.91	**7.00**	**46.99**
Pakistani?	2854	-0.13	0.49	**5.93**	**33.14**
Mixed?	2854	0.02	1.06	**3.54**	**10.52**
Other?	2854	0.01	1.06	**5.40**	**27.15**
Any event affected development?	2783	0.00	1.00	0.68	-1.54

Table 3.2 presents the distribution of those z-scored variables that were considered more distal to the child than those presented in Table 3.1 and which were thus more proximal to parents/the family. Like the child level potential risks presented above, these family level risks were found to be broadly normally distributed with the only exception being a dichotomous variable for which non-normality could be expected given a sample that broadly matched the population from which it was drawn. In the case of Table 3.2 and family level potential risks, this variable was whether or not a child came from a single or two parent family, with many more children coming a two parent household (high negative skew). Again, the modification of the subsequent SEM took this violation of the assumption of normality in distribution into account.

Table 3.2 Distribution of z-scored family level potential risks (2 d.p.)

	N	Mean	Variance	Skewness	Kurtosis
Family salary	2178	0.06	1.02	1.19	1.62
Mother's occupational Status	2744	-0.09	0.86	0.97	0.60
Father's occupational Status	2174	-0.06	0.96	0.32	-0.07
Highest Status in family	2781	-0.06	0.96	0.70	0.20
Mother's qualifications	2723	0.07	0.98	0.34	-0.58
Father's qualifications	2073	0.05	0.99	0.22	-0.99
Mother working?	2780	0.06	1.01	0.29	-1.55
Father working?	2183	0.06	0.92	-1.48	0.62
Either parent working?	2178	0.05	0.97	-0.52	-1.34
2 parent family?	2790	0.01	0.84	**-13.03**	**168.55**
Mother's age	2779	0.00	0.98	0.04	1.05
Father's age	2218	-0.01	0.97	0.46	0.56
No. non parental carers	2794	0.06	1.02	0.91	0.31
Home Learning Environment	2748	0.04	0.98	-0.08	-0.17

3.1.1 Bivariate Associations amongst Risks

The first set of descriptive analyses that were conducted in this chapter was an examination of the bivariate relationships within and between child and familial level potential risks along with a graphical examination of a random selection of scatter plots to check the linearity and homoscedasticity of these relationships. After revealing patterns that were both broadly linear and evenly distributed or alternatively, non-existent, simple Pearson's bivariate correlations were then conducted in order to assess the magnitude and significance of these assumed linear relationships.

Table 3.3 presents the correlations that were found amongst the z-scored child level potential risks to young children's development. Aside from some broad differences between ethnic groups, the strongest statistical relationships were those that were found between variables *that one would expect to be related*: Birthweight was strongly associated with a premature birth, and speaking English as an Additional Language was strongly associated with coming from a ethnic background where there was more likely to be a second language spoken. Table 3.3 also indicates the lack of unidimensionality amongst the potential risks as there are many *in*significant

statistical associations. Whilst this would have been a problem for any subsequent *reflective* Confirmatory Factor Analysis (CFA) of the effects of these risks in combination (given that *unidimensionality* is one its assumptions), this was a problem avoided by this investigation as the subsequent CFA relied upon *formative* measurement instead (see Chapter 4).

By contrast to the pattern of association found to exist between child level potential risks that are seen in Table 3.3, Table 3.4 reveals a much greater degree of association between those variables that were hypothesised as posing a familial level of risk to young children's development. Other than the dichotomous variable, '2 parent family?' that was found to be sizably weighted in favour of two parents, nearly all of the other relationships between family level potential risks that are presented in Table 3.4 were found to be significant. Explaining this unidimensionality is the fact that the majority of these family-level risks are in someway related of the concept of Socio-Economic-Status (SES). Commonly measured through parental income, education, and occupational status (e.g. Marmot, 2004; National Center for Educational Statistics, 2008), the majority of variables in Table 3.4 can be seen to offer measures of these. An interesting departure from this trend however is the similar associations (of commonality in significance and to a lesser degree, strength) between those measures of SES and the Home Learning Environment (HLE) that parents provided for their children. Table 3.4 suggests that parents with a higher SES seem to provide a home environment for their child which is more conducive to their learning. Thus the HLE offers a potential means whereby SES (here conceptualised as 'family level risk') can impact young children's development.

Table 3.5 presents the bivariate associations (through correlations) that were found *between* (rather than amongst) the child and family level potential risks to young children's development. Although a wide degree of association can be seen between these measures, these were (when largest) smaller than those found when examining the relationships within each level of risk respectively[99]. Further, although it can be argued that some *child* level measures might be a partial product of those at the

[99] Maximum size of correlations *between* the levels of risk is 0.25 (mother's age and child birth order) compared to 0.43 within the *child* level (EAL and Pakistani) and 0.82 within the *family* level (father's occupational status and highest status in the family).

familial level (e.g. no. of siblings), the potential impacts of these potential risks is much more closely related to the studied child (e.g. their ethnicity, their birthweight, whether they are a younger or older sibling) rather than to the family (e.g. total family salary). The impact that this division of potential risk has upon the subsequent modelling of their developmental effects is explored in the second half of Chapter 4, where two methods of representing the combined effects of risks on development are compared: a single level vs. dual levels (child and familial).

Table 3.3 Correlations amongst z-scored child level potential risks (2 d.p.)

	Event affected dev.?	*Ethnicity,* Other?	Mixed?	Pakistani?	Indian?	Black?	Bangladeshi?	Birth order	No. of siblings	Birth weight	Premature?	EAL?
Boy?	0.03	-0.01	-0.03	-0.01	-0.00	-0.02	**-0.05***	0.02	0.03	**0.09****	0.04	-0.01
EAL?	**-0.06****	**0.29****	-0.03	**0.43****	**0.28****	0.01	**0.29****	**0.05****	**0.05****	**-0.07****	-0.02	
Premature?	0.02	-0.02	0.01	-0.01	0.00	0.02	-0.01	-0.01	0.00	**-0.44****		
Birthweight?	-0.01	-0.02	0.00	**-0.07****	**-0.06****	**-0.07****	**-0.06****	0.03	0.03			
No. of siblings?	**-0.06****	0.03	**-0.04***	**0.05***	0.01	-0.01	0.02	**0.79****				
Birth order?	**-0.10****	0.04	0.00	**0.04***	0.03	**0.04***	0.02					
Ethnicity, Bangladeshi?	-0.02	-0.02	-0.02	-0.02	-0.01	-0.02						
Black?	**-0.07****	**-0.05***	**-0.07****	**-0.04***	-0.04							
Indian?	**-0.06****	-0.03	**-0.04***	-0.02								
Pakistani?	**-0.03***	-0.03	**-0.04***									
Mixed?	0.02	**-0.05***										
Other?	0.01											

*$p<0.05$ **$p<0.01$

Table 3.4 Correlations amongst z-scored familial level potential risks (2 d.p.)

	HLE	No. non parental carers	Father's age	Mother's age	2 parent family?	Either parent working?	Father working?	Mother working?	Father's qualifications	Mother's qualifications	Highest Status in family	Father's Occupational Status	Mother's Occupational Status
Family salary	**0.24****	**0.26****	**0.19****	**0.25****	0.01	**0.69****	**0.31****	**0.35****	**0.49****	**0.52****	**0.52****	**0.50****	**0.46****
Mum occ. Status	**0.30****	**0.27****	**0.14****	**0.29****	**0.04***	**0.32****	**0.23****	**0.30****	**0.42****	**0.50****	**0.79****	**0.47****	
Dad occ. Status	**0.29****	**0.22****	**0.22****	**0.31****	0.03	**0.24****	**0.26****	**0.13****	**0.60****	**0.51****	**0.82****		
High. Family Status?	**0.33****	**0.25****	**0.20****	**0.33****	**0.06****	**0.36****	**0.26****	**0.25****	**0.57****	**0.53****			
Mother's qual.s	**0.33****	**0.24****	**0.20****	**0.28****	0.02	**0.32****	**0.20****	**0.24****	**0.64****				
Father's qual.s	**0.28****	**0.21****	**0.16****	**0.26****	0.03	**0.26****	**0.19****	**0.13****					
Mother working?	**0.13****	**0.26****	**0.08****	**0.13****	0.01	**0.37****	**0.26****						
Father working?	**0.18****	**0.18****	0.01	**0.12****	0.03	**0.39****							
Either parent work?	**0.18****	**0.20****	**0.10****	**0.16****	0.01								
2 parent family?	**0.04***	**0.05****	0.04	**0.04***									
Mother's age	**0.15****	**0.11****	**0.58****										
Father's age	**0.11****	**0.05***											
No. non-parent carers	**0.22****												

*$p<0.05$ **$p<0.01$

Table 3.5 Correlations between z-scored child and familial level potential risks (2 d.p)

	Event affected dev.?	*Ethnicity.* Other?	Mixed?	Pakistani?	Indian?	Black?	Bangladeshi?	Birth order	No. of siblings	Birth weight	Premature?	EAL?	Boy?
Family salary	-0.04	**-0.07****	-0.02	**-0.08****	-0.02	**-0.10****	-0.04	**-0.08****	**-0.08****	**0.09****	-0.01	**-0.12****	0.02
Mum occ. Status	0.03	**-0.08****	0.01	**-0.19****	**-0.06****	**-0.05****	**-0.09****	**-0.15****	**-0.15****	**0.08****	-0.02	**-0.25****	0.00
Dad occ. Status	**0.05***	**-0.05***	0.04	**-0.10****	0.00	**-0.08****	-0.04	**-0.08****	**-0.08****	**0.07****	0.01	**-0.09****	0.02
High. Fam. Status?	-0.02	**-0.07****	0.01	**-0.08****	0.00	**-0.11****	**-0.04***	**-0.10****	**-0.08****	**0.10****	-0.03	**-0.11****	0.01
Mother's qual.s	**0.09****	0.01	0.01	**-0.08****	-0.03	-0.03	-0.03	**-0.12****	**-0.13****	**0.12****	**-0.08****	**-0.05***	-0.01
Father's qual.s	**0.08****	0.03	**0.06***	-0.04	0.00	0.02	0.03	**-0.10****	**-0.10****	**0.07****	-0.04	-0.02	-0.01
Mother working	-0.02	**-0.06****	0.01	**-0.10****	0.00	0.03	**-0.04***	**-0.11****	**-0.19****	**0.06****	-0.03	**-0.15****	**-0.05***
Father working	-0.01	**-0.13****	**-0.08****	**-0.07****	-0.01	**-0.11****	-0.04	**-0.13****	**-0.13****	**0.08****	-0.04	**-0.19****	-0.01
Either parent work	**-0.09****	**-0.10****	**-0.05***	**-0.07****	0.00	**-0.11****	-0.03	**-0.07****	-0.04	**0.10****	-0.01	**-0.12****	0.03
2 parent family	-0.02	**-0.05***	0.02	**-0.04***	0.01	0.01	0.01	0.01	-0.02	0.03	-0.01	-0.03	0.00
Mother's age	**-0.04***	0.01	0.04*	**-0.12****	-0.01	0.02	**-0.04***	**0.25****	**0.15****	**0.05****	0.01	**-0.07****	-0.02
Father's age	-0.04	0.01	0.04	**-0.06****	-0.04	0.03	0.02	**0.21****	**0.12****	**0.05***	0.00	-0.02	-0.01
No. non-parent carers	**0.13****	**-0.07****	0.00	**-0.10****	**-0.04***	-0.03	-0.03	**-0.16****	**-0.15****	**0.04***	0.00	**-0.15****	0.00
HLE	**0.09****	**-0.08****	0.00	**-0.18****	**-0.06****	**-0.08****	**-0.05***	**-0.12****	**-0.12****	**0.08****	**-0.05****	**-0.22****	**-0.17****

*$p<0.05$ **$p<0.01$

3.2 Measurements relating to Pre-School

Table 3.6 presents the distributions of those z-scored variables that this investigation drew upon in providing information about the pre-school and the pre-school experiences of each child in this study. As discussed in Chapter 2, the variables presented in Table 3.6 can be divided into 3 broad categories: quality of processes (global, education, and relationships), quality of structures (characteristics of the manager, staff, and centre), and the duration that children experienced each of these. Unlike the potential risks presented in Section 3.1 however, the variables presented in Table 3.6 can be seen to be much more normally distributed (partly due to there being no dichotomous measures), with the only minor exception being those variables that measured negative relationships between pre-school staff and children (punitiveness, permissiveness, and detachment). For these variables, the positive skew indicates that the majority of children did not attend a pre-school which was commonly characterised by poor relationships between them and their caregivers.

Table 3.6 Distribution of z-scored variables relating to pre-school (2 d.p.)

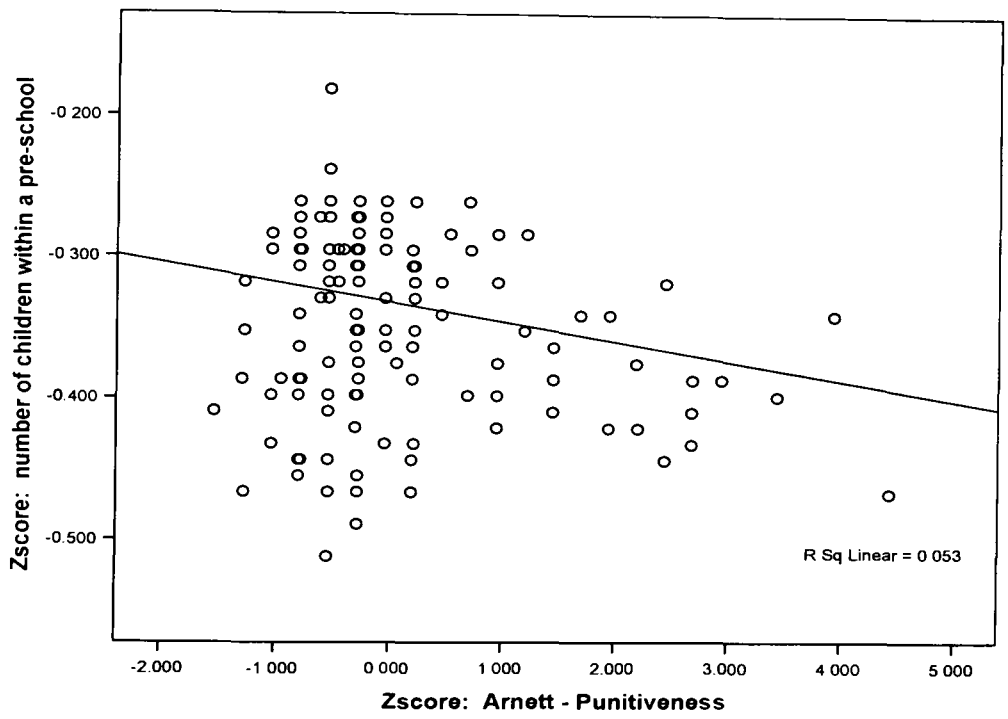
	N	Mean	Variance	Skewness	Kurtosis
Global quality, ECERS-R	2857	0.00	1.00	-0.19	-0.63
Educational quality, ECERS-E	2857	0.00	1.00	0.15	-0.49
Relationship: Positive	2830	0.00	1.00	-0.95	0.86
Punitive	2830	0.00	1.00	1.78	3.51
Permissive	2830	0.00	1.00	1.93	4.60
Detached	2830	0.00	1.00	1.93	4.99
Manager, highest academic qualification	2702	0.00	1.00	-0.60	-0.02
Highest childcare qualification	2702	0.00	1.00	-0.89	0.80
Staff, highest average academic qualification	2544	0.00	1.00	1.24	1.43
Highest average childcare qualification	2552	0.00	I.00	0.18	-0.85
Staff, average age	2504	0.00	1.00	1.58	2.75
No. of staff	2831	0.00	1.00	1.42	2.68
No. of children	2857	-0.33	0.00[100]	-0.43	-0.38
Duration of Attendance	2715	0.00	1.00	1.18	1.05

[100] Actual variance ≠ 0.00. Actual variance = 0.004 (3 d.p.)

3.2.1 Bivariate Associations amongst Qualities and Duration

When examining the bivariate associations amongst those variables that related to pre-school (or children's experiences of pre-school), the first set of descriptive analyses undertaken was the graphical inspection of a random selection of potential risks through scatter plots in order to ascertain linearity and homoscedasticity in these relationships. Although there was some small evidence suggesting heteroscedasticity in some of the relationships (e.g. Figure 3.1), because the subsequent analyses examined each quality individually (in order to investigate the variation in protection across qualities), the nature of the relationships amongst them was not central to the analyses of this investigation.

Figure 3.1 Heteroscedasticity in the relationship between the number of children within a pre-school and the punitiveness of the care they received



Although the subsequent SEM was not dependant upon the relationships between the measures relating to pre-school, these were still of importance when it came to discussing the results (see Chapter 6) as protective factors that co-occurred might be able to offer greater protection to the child. To this end, Table 3.7 presents the Pearson's correlations between each of the measures relating to pre-school and reveals a high degree of association between them (e.g. the relationship between global and educational quality). Additionally and perhaps importantly, children who attended pre-school for a longer duration were also more likely to have attended a pre-school of lower quality and were in the care of, on average, older and less qualified staff.

Table 3.7 Correlations amongst z-scored variables relating to pre-school (2 d.p.)

	Duration of attendance	No. of children	No. of staff	*Staff*, average age	Highest average childcare qualification	Highest average academic qualification	*Manager*, highest childcare qualification	Highest academic qualification	*Relationship*, Detached	Permissive	Punitive	Positive	*Educational Quality*, ECERS-E
Global, ECERS-R	**-0.23****	**0.48****	**0.19****	**0.06****	0.03	0.00	**0.48****	**0.45****	**-0.50****	**-0.30****	**-0.37****	**0.61****	**0.78****
Education, ECERS-E	**-0.29****	**0.54****	**0.15****	**0.16****	-0.02	-0.04	**0.58****	**0.59****	**-0.48****	**-0.29****	**-0.30****	**0.61****	
Relationship: Positive	**-0.21****	**0.40****	**0.13****	**0.09****	**-0.06****	-0.02	**0.40****	**0.42****	**-0.69****	**-0.49****	**-0.56****		
Punitive	**0.12****	**-0.23****	**-0.09****	**-0.08****	**0.09****	**0.05***	**-0.18****	**-0.26****	**0.53****	**0.18****			
Permissive	**0.13****	**-0.27****	**0.05***	**-0.04**	**0.13****	**0.04***	**-0.25****	**-0.18****	**0.65****				
Detached	**0.18****	**-0.33****	**-0.07****	**-0.14****	**0.08****	**0.05****	**-0.29****	**-0.28****					
Manager, highest academic qualification	**-0.42****	**0.06****	**0.15****	**0.10****	**-0.05***	-0.02	0.88**						
highest childcare qualification	**-0.48****	**0.56****	**0.10****	**0.10****	-0.01	0.04							
Staff, highest average academic qualification	**-0.10****	**0.12****	**0.05***	**0.16****	**0.68****								
highest average childcare qual.	-0.03	**0.10****	**0.16****	**0.09****									
average age	**-0.18****	**0.19****	**0.29****										
No. of staff	**0.20****	**0.15****											
No. of children	**-0.42****												

*$p<0.05$ **$p<0.01$

3.3 Developmental Measures

Table 3.8 presents the distributions of the z-scored variables that measured the cognitive skills and development of young children between their beginning pre-school at mean age 3 years, to the end of Key Stage 1 when they were at the end of their second year of primary school (age 7). Although the variables presented in Table 3.8 are clearly quite normally distributed, for those variables that were less so (writing and mathematics in Year 2), the negative skewness in their distributions indicates a trend towards better writing and mathematics. Furthermore, this negative skewness is a tendency that Table 3.8 shows as increasing over time with General Cognitive Ability (GCA) at entry to pre-school being almost unskewed and unkurtocic, before the subsequent measurements of cognitive abilities can be seen to become gradually less and less normal. This indicates that there were increasingly fewer children displaying less than average abilities over time which boded well for the possible detection of pre-school protective factors.

Table 3.8 Distribution of z-scored variables measuring cognitive development (2 d.p.)

	N	Mean	Variance	Skewness	Kurtosis
Pre-school entry, GCA	2764	0.00	1.00	0.02	0.27
Pre-school exit, GCA	2574	0.07	0.93	-0.26	0.55
Primary Year 1,					
Reading	2464	0.05	0.99	0.14	0.12
Mathematics	2455	0.06	0.93	-1.01	0.73
Primary Year 2,					
Reading	2437	0.06	0.92	-1.28	1.58
Writing	2374	0.05	0.93	-2.03	3.75
Mathematics	2392	0.05	0.94	-1.73	4.46

Table 3.9 serves to compliment Table 3.8 in that it presents the distributions of the z-scored measures of the same young children's social/behavioural measures over the same period. Again, like Table 3.8, the variables presented in Table 3.9 can be seen to be relatively normally distributed (no skewness higher than 2.2 for example) with the exception being found in measures of conduct problems assessed once children had begun primary school. Like the pattern observed with children's writing and mathematics in Year 2 though, the directionality of these distributions (positive skew) indicates that there was a tendency for fewer children to display these problems. Furthermore, this relationship can also be seen (although to a lesser extent) in the

other measures taken during primary school and again, this bodes well for the possibility of detecting a protective effect of pre-school as a protective effect would manifest itself in this manner.

Table 3.9 Distribution of z-scored variables measuring social/behavioural development (2 d.p.)

	N	Mean	Variance	Skewness	Kurtosis
Pre-school entry,					
Co-operation and conformity	2842	0.00	I.00	-0.59	-0.31
Peer sociability	2843	0.00	1.00	-0.50	-0.43
Confidence	2843	0.00	1.00	-0.73	-0.12
Anti-social	2839	0.00	1.00	1.31	1.16
Worried/upset	2842	0.00	1.00	0.77	0.09
Pre-school exit,					
Self regulation	2562	0.05	0.97	-0.48	-0.26
Anti-social/worried	2567	0.00	1.01	0.96	0.38
Primary Year 1,					
Emotional symptoms	2390	-0.03	0.96	1.37	1.42
Conduct problems	2378	0.00	1.00	2.17	5.19
Hyperactivity	2393	-0.02	1.01	0.68	-0.61
Peer problems	2395	-0.03	0.97	1.36	1.44
Pro-social	2393	0.02	1.00	-0.70	-0.26
Primary Year 2,					
Emotional Symptoms	2373	-0.01	0.99	1.50	2.08
Conduct problems	2374	0.00	0.98	2.20	5.08
Hyperactivity	2374	0.00	1.01	0.78	-0.35
Peer problems	2374	-0.02	0.97	1.70	2.98
Pro-social	2372	0.01	0.99	-0.79	-0.22

3.3.1 Bivariate Associations amongst Measures of Development

As with the similar analyses already reported, the first stage of the examination of the bivariate relationships that were shared amongst the variables presented in Tables 3.8 and 3.9 was a graphical examination of random selections of pairs of variables through scatter plots. As before, the relative normality of the distributions of the variables contributed to the relative homoscedasticity that was observed in the seemingly linear relationships that were identified.

Table 3.10 presents the bivariate Pearson's correlation coefficients between each of the measures of cognitive development that were studied in this investigation.

Perhaps unsurprisingly, the strongest relationships were found between those variables measured at the same point in time (e.g. Year 2 reading and writing) and those variables that measured the same theoretical concept (e.g. General Cognitive Ability, GCA).

Table 3.10 Correlations amongst z-scored variables measuring cognitive development (2 d.p.)

	Primary Year 2, Mathematics	Writing	Reading	*Primary Year 1,* Mathematics	Reading	*Pre-school exit* GCA
Pre-school entry GCA	**0.43****	**0.41****	**0.47****	**0.46****	**0.37****	**0.70****
Pre-school exit GCA	**0.56****	**0.50****	**0.58****	**0.59****	**0.45****	
Primary Year 1, Reading	**0.53****	**0.52****	**0.63****	**0.57****		
Mathematics	**0.65****	**0.58****	**0.63****			
Primary Year 2, Reading	**0.70****	**0.81****				
Writing	**0.65****					

*$p<0.05$ **$p<0.01$

Like the correlations presented in Table 3.10, the correlations presented in Table 3.11 present the simple bivariate linear associations that were found between measures of children's development between their entry to pre-school and the end of the second year of primary school (end of Key Stage 1). However, unlike Table 3.10, the relationships presented in Table 3.11 are those that were found between measures of young children's social/behavioural development. Despite this difference in the domain of development, the same trend of high association between measures over time and between those measuring similar concepts can once again be observed. For example, hyperactivity in primary school years 1 and 2 are highly correlated (0.62, $p<0.001$) whereas the highest correlation found between measures taken at entry to pre-school and hyperactivity in Year 2 was less than half the size than was found for pre-school entry Co-Operation and Conformity (0.34, $p<0.001$).

Table 3.11 Correlations amongst z-scored variables measuring social/behavioural development (2 d.p.)

	Primary Year 2, Pro-social	Peer problems	Hyperactivity	Conduct problems	Emotional symptoms	*Primary Year 1,* Pro-social	Peer problems	Hyperactivity	Conduct problems	Emotional symptoms	*Pre-school exit,* Anti-social/worried	Self regulation	*Pre-school entry,* Worried/upset	Anti-social	Confidence	Peer sociability
Pre-school entry, Co-op. & conform.	**0.25****	**-0.19****	**-0.34****	**-0.25****	**-0.07****	**0.28****	**-0.19****	**-0.34****	**-0.28****	**-0.09****	**-0.31****	**0.39****	**-0.50****	**-0.45****	**0.40****	**0.50****
Peer sociability	**0.16****	**-0.14****	**-0.11****	**-0.04***	**-0.10****	**0.17****	**-0.16****	**-0.11****	**-0.06****	**-0.13****	-0.03	**0.21****	**-0.14****	**0.04***	**0.70****	
Confidence	**0.13****	**-0.09****	**-0.09****	-0.01	**-0.07****	**0.12****	**-0.12****	**-0.08****	-0.03	**-0.14****	**0.05***	**0.16****	**-0.07****	**0.07****		
Anti-social	**-0.15****	**0.12****	**0.23****	**0.25****	0.02	**-0.13****	**0.05***	**0.20****	**0.23****	0.00	**0.30****	**-0.19****	**0.51****			
Worried/upset	**-0.14****	**0.13****	**0.20****	**0.17****	**0.06****	**-0.15****	**0.10****	**0.19****	**0.21****	**0.09****	**0.24****	**-0.21****				
Pre-school exit, Self regulation	**0.32****	**-0.26****	**-0.48****	**-0.30****	**-0.09****	**0.36****	**-0.24****	**-0.53****	**-0.36****	**-0.10****	**-0.54****					
Anti-social/worried	**-0.26****	**0.21****	**0.35****	**0.35****	**0.07****	**-0.28****	**0.15****	**0.37****	**0.39****	**0.05***						
Primary Year 1, Emotional sympt.	-0.04	**0.14****	0.03	0.00	**0.26****	**-0.10****	**0.32****	**0.16****	**0.15****							
Conduct problems	**-0.39****	**0.29****	**0.48****	**0.52****	**0.05***	**-0.58****	**0.35****	**0.59****								
Hyperactivity	**-0.41****	**0.28****	**0.62****	**0.41****	**0.07****	**-0.57****	**0.33****									
Peer problems	**-0.22****	**0.36****	**0.24****	**0.20****	**0.13****	**-0.40****										
Pro-social	**0.44****	**-0.24****	**-0.40****	**-0.35****	**-0.06***											
Primary Year 2, Emotional Sympt.	**-0.15****	**0.40****	**0.21****	**0.18****												
Conduct problems	**-0.59****	**0.43****	**0.59****													
Hyperactivity	**-0.58****	**0.38****														
Peer problems	**-0.45****															

*$p<0.05$ **$p<0.01$

Unlike the correlations presented in tables 3.10 and 3.11, those presented in Table 3.12 are those that were found *between* the two domains of young children's development. However, despite this cross domain comparison, there is still a high degree of correlation between the measures presented in Table 3.12. Furthermore, the trend of greater association between measures taken at the same time can still be observed and is seen in those measures taken at entry to pre-school and those taken at the end of primary Year 2. In both cases, there is a modest trend for the measures of cognitive and social development to be more closely associated when measuring development at the same age. This suggested that there maybe a slight overlap between the patterns of cognitive and social development which might affect the patterns of risk and protection that were subsequently investigated.

Table 3.12 Correlations between z-scored variables measuring cognitive and social/behavioural development (2 d.p.)

	Pre-school entry GCA	*Pre-school exit* GCA	*Primary Year 1,* Reading	Mathematics	*Primary Year 2,* Reading	Writing	Mathematics
Pre-school entry, Co-op.& conformity	**0.30****	**0.28****	**0.20****	**0.24****	**0.26****	**0.25****	**0.25****
Peer sociability	**0.29****	**0.23****	**0.17****	**0.19****	**0.19****	**0.20****	**0.17****
Confidence	**0.28****	**0.26****	**0.18****	**0.22****	**0.21****	**0.20****	**0.17****
Anti-social	-0.04	**-0.06****	-0.02	-0.01	**-0.06****	**-0.08****	**-0.07****
Worried/upset	**-0.07****	**-0.08****	**-0.06****	**-0.06****	**-0.09****	**-0.09****	**-0.08****
Pre-school exit, Self regulation	**0.39****	**0.46****	**0.31****	**0.42****	**0.43****	**0.39****	**0.41****
Anti-social/worried	**-0.12****	**-0.14****	**-0.07****	**-0.14****	**-0.16****	**-0.15****	**-0.15****
Primary Year 1, Emotional symptoms	**-0.08****	**-0.09****	**-0.14****	**-0.16****	**-0.16****	**-0.15****	**-0.16****
Conduct problems	**-0.17****	**-0.20****	**-0.15****	**-0.21****	**-0.27****	**-0.26****	**-0.23****
Hyperactivity	**-0.03****	**-0.35****	**-0.35****	**-0.42****	**-0.46****	**-0.43****	**-0.42****
Peer problems	**-0.15****	**-0.16****	**-0.13****	**-0.17****	**-0.19****	**-0.20****	**-0.18****
Pro-social	**0.18****	**0.20****	**0.17****	**0.25****	**0.24****	**0.24****	**0.22****
Primary Year 2, Emotional symptoms	**-0.10****	**-0.12****	**-0.13****	**-0.14****	**-0.17****	**-0.18****	**-0.21****
Conduct problems	**-0.14****	**-0.16****	**-0.13****	**-0.16****	**-0.25****	**-0.23****	**-0.23****
Hyperactivity	**-0.28****	**-0.33****	**-0.32****	**-0.37****	**-0.46****	**-0.44****	**-0.41****
Peer problems	**-0.16****	**-0.18****	**-.014****	**-0.16****	**-0.20****	**-0.22****	**-0.21****
Pro-social	**0.17****	**0.19****	**0.16****	**0.19****	**0.24****	**0.24****	**0.22****

*$p<0.05$ **$p<0.01$

3.4 Risks, Pre-schools, and Development

So far, this chapter has presented independent univariate and bivariate statistics for each of the three categories of variables that were studied in this investigation (potential risks, features of pre-school, and measures of psychological development). The purpose of this section of the chapter is to take these earlier bivariate examinations a step further by examining those that were found *between* these categories. To this end, the correlational analyses that have been examined so far are repeated[101] revealing bivariate linear relationships between risks and development, risk and pre-school, and pre-school and development. Before this however, significant ($p<0.001$) multivariate outliers were first detected and removed.

Table 3.13 presents the case numbers and Mahalanobis distances of the 19 children who were identified as significant outliers in this investigation and whom were thus excluded from further analysis. However, it is acknowledged that the exclusion of these cases might be argued against, given that the aim of this thesis was the exploration of those displaying unusually high (due to risks) development (thus resilient) and that such cases are likely to be multivariate outliers due to their combination of these variables (risks and development). Nevertheless, it was decided that because their exclusion only represented a drop in sample size of 0.7%, the possible impacts of their omission from further analyses was likely to be very small indeed.

[101] In addition to the graphical examination of random selections of scatter plots, although these are no longer reported due to the repeated findings of general linearity and homoscedasticity.

Table 3.13 Significant multivariate outliers and the case numbers of the children who were excluded from further analyses in this investigation[102]

Mahalanobis Distance (χ^2)	Case Number
106.37	1696
106.53	3624
106.94	413
107.46	3819
107.59	450
110.19	3814
110.68	2528
111.23	3827
115.64	2279
119.82	2441
128.10	2377
133.79	2206
142.53	2105
148.93	3833
198.75	612
210.24	2028
210.37	1021
211.76	2691
222.74	1697

3.4.1 Bivariate Associations between Risks and Development

Table 3.14 reveals the linear bivariate relationships that Pearson's correlations identified as existing between child-level potential risks and the measures of children's cognitive and social behavioural development that were studied in this investigation. Understanding the patterns that are present in the simple relationships that are presented in this table (and in that following, Table 3.15) was especially important for this investigation as they formed the basis of all of the subsequent SEM analyses as well as their assumptions. For example, Table 3.14 demonstrates that the significant impacts of some risks varied in magnitude as the timing between their measurement (at entry to pre-school) and the various measures of development increased. This can be seen most clearly for speaking English as an Additional Language (EAL) where the deleterious impact of this variable upon both cognitive

[102] Where: The degrees of freedom = the number of variables, in this case 59. The accepted level of probability is $p<0.001$. The corresponding critical value for χ^2 is then ≈ 99.61 (2.d.p.; see Tabachnick and Fidell, 2001).

and social development lessened as the child gained increasing exposure to the English language over time. Whilst the impacts are largest during the pre-school period, the magnitude of these can be seen to fall once children began primary school. This trend is also consistent across to those variables recording ethnicity, where a similar (albeit inconsistent) trend can be seen in the effects of coming from an ethnic minority group. For children from Pakistani, Bangladeshi, and Indian families, the small negative impacts this background has, on average, upon developmental measures during pre-school lessens over time and in the case of the average Indian child, this can even be seen to be reversed when it comes to writing ability at the end of the second year of primary school.

The variation in the impacts of risks by the time-point of measured development can also be seen in the various impacts associated with a child's gender (although this relationship is not as clear as speaking EAL). However, unlike the pattern found for EAL, Table 3.14 shows a very slight tendency for boys to, on average, manifest increasing problems in their development as time progressed. These variations can be seen most strongly in the measures of social/behavioural development where the gender divide can be seen as increasing in many of the behaviours that were measured. Because the impacts of risks upon development was so central to this investigation and its research questions, the variation in the impacts of risks (such as gender and EAL) over time strongly influenced the subsequent statistical modelling that was undertaken and this is discussed further in Chapter 5.

The pattern of variation that can be seen in the significant impacts of child level risks is one that together with the differential impacts of risks across the domains of development can also be found in the impacts of the family level risks that are illustrated in Table 3.15. In particular, the developmental impacts of having a greater number of non-parental carers can be seen to fall over time for both cognitive and social/behavioural skills. Furthermore, the occupational statuses of each child's parents can also be seen to have a diminishing impact on cognitive skills as children grew older. However, the fact that this latter trend can be more clearly observed for cognitive rather than social/behavioural development is indicative of the large variation in the impact of risks that can be seen between the two domains of development.

Table 3.15 reveals that individual familial risks demonstrated impacts upon the cognitive skills of young children that were much more consistent than those upon social/behavioural development and that these were also commonly of greater magnitude. Although the possibility of a methodological effect cannot be ruled out, this pattern can be seen to be consistent across the impacts of each of the risks as well as in the timing of each of the measures of development. This variation in the impact of risks provides support for the subsequent bifurcation of the analyses where separate risk effects were specified for each of the domains of young children's development (cognitive risks vs. social/behavioural risks).

Table 3.14 Correlations between z-scored child-level potential risks and measures of cognitive and social/behavioural development (2 d.p.)

	Boy?	EAL?	Premature?	Birth weight	No. of siblings	Birth order	*Ethnicity,* bangladeshi	black	indian	pakistani	mixed	other	Event affected dev.?
Pre-school entry, GCA	**-0.10****	**-0.24****	**-0.07****	**0.14****	**-0.14****	**-0.14****	**-0.09****	**-0.11****	**-0.06****	**-0.18****	-0.03	**-0.07****	**0.05***
Pre-school exit, GCA	**-0.08****	**-0.23****	**-0.08****	**0.17****	**-0.15****	**-0.13****	**-0.08****	**-0.07****	**-0.04**	**-0.19****	-0.02	**-0.07****	0.01
Primary Year 1, Reading	**-0.06****	**-0.11****	-0.04	**0.10****	**-0.10****	**-0.12****	-0.03	-0.01	0.01	**-0.08****	0.01	-0.04	0.01
Mathematics	**-0.05***	**-0.12****	**-0.07****	**0.15****	**-0.09****	**-0.10****	-0.02	-0.03	-0.02	**-0.09****	-0.01	**-0.06****	0.00
Primary Year 2, Reading	**-0.12****	**-0.10****	**-0.07****	**0.12****	**-0.11****	**-0.15****	-0.01	-0.01	0.03	**-0.06****	-0.03	**-0.04***	-0.01
Writing	**-0.14****	**-0.07****	**-0.07****	**0.12****	**-0.11****	**-0.15****	0.00	-0.01	**0.05***	-0.03	**-0.04***	**-0.06****	-0.03
Mathematics	0.01	**-0.10****	**-0.09****	**0.15****	**-0.06****	**-0.08****	-0.03	**-0.04***	0.04	**-0.05***	**-0.04***	-0.03	0.00
Pre-school entry, Co-op.& conformity	**-0.15****	**-0.17****	**-0.06****	**0.05****	**-0.04***	**-0.05****	-0.03	-0.04	-0.02	**-0.08****	-0.02	**-0.08****	0.00
Peer sociability	**-0.11****	**-0.16****	**-0.05***	**0.05***	**-0.14****	**-0.12****	-0.03	0.00	**-0.06****	**-0.10****	0.01	**-0.05****	0.01
Confidence	**-0.08****	**-0.13****	-0.01	0.02	**-0.11****	**-0.10****	-0.01	-0.01	**-0.04***	**-0.09****	0.02	-0.03	0.02
Anti-social	0.01	**0.04***	-0.01	-0.01	**-0.08****	**-0.07****	0.01	**0.11****	0.02	0.02	**0.05***	0.02	0.01
Worried/upset	0.01	0.03	0.00	-0.02	-0.04	-0.03	0.00	**0.04***	-0.02	0.00	**0.04***	-0.01	0.02
Pre-school exit, Self regulation	**-0.21****	**-0.07****	**-0.09****	**0.11****	-0.02	-0.02	-0.02	-0.01	-0.01	**-0.05****	0.00	-0.03	-0.01
Anti-social/worried	**0.06****	0.02	**0.04***	-0.02	**-0.07****	**-0.07****	-0.02	0.02	-0.02	-0.04	0.03	**0.06****	0.01
Primary Year 1, Emotional symptoms	-0.04	-0.01	-0.02	0.00	0.02	0.03	0.02	-0.02	-0.01	0.02	0.02	0.01	0.03
Conduct problems	**0.17****	**0.05***	**0.05***	**-0.05***	0.01	0.04	0.03	**0.04***	-0.01	0.01	0.02	**0.05***	0.04
Hyperactivity	**0.27****	0.03	**0.09****	**-0.09****	0.01	0.03	0.00	0.02	-0.02	0.02	0.02	0.02	**0.04***
Peer problems	**0.08****	0.04	0.01	**-0.06****	**0.05***	0.04	0.00	0.01	0.00	**0.08****	-0.01	0.02	**0.07****
Pro-social	**-0.24****	-0.03	-0.04	**0.05***	-0.03	**-0.04***	-0.02	-0.01	0.04	**-0.04***	-0.02	**-0.04***	-0.04
Primary Year 2, Emotional symptoms	-0.04	**-0.04***	0.02	**-0.04***	0.00	0.01	-0.01	-0.01	-0.01	**-0.04***	0.00	0.01	0.02
Conduct problems	**0.16****	0.02	**0.06****	**-0.06****	-0.02	0.01	-0.02	**0.05***	-0.02	0.00	-0.01	**0.07****	0.03
Hyperactivity	**0.26****	0.00	**0.09****	**-0.11****	-0.04	0.02	-0.04	0.03	-0.03	0.01	0.02	**0.05***	0.04
Peer problems	**0.05***	0.01	**0.04***	**-0.05***	-0.02	0.01	0.00	0.00	0.02	0.01	0.01	-0.01	**0.05***
Pro-social	**0.26****	-0.01	-0.03	**0.05***	0.04	-0.01	0.03	-0.03	0.01	0.00	-0.01	-0.02	**-0.04***

$*p<0.05$ $**p<0.01$

Table 3.15 Correlations between z-scored familial-level potential risks and measures of cognitive and social/behavioural development (2 d.p.)

	Family salary	Mother Occ. Status	Father Occ. Status	Highest family status	Mother qual.s	Father qual.s	Mother in work?	Father in work?	Either in work?	2 parent family	Mother age	Father age	No. of carers	HLE
Pre-school entry, GCA	**0.32****	**0.34****	**0.33****	**0.35****	**0.36****	**0.32****	**0.18****	**0.21****	**0.25****	0.02	**0.18****	**0.11****	**0.26****	**0.39****
Pre-school exit, GCA	**0.38****	**0.37****	**0.35****	**0.40****	**0.40****	**0.33****	**0.20****	**0.22****	**0.28****	0.01	**0.22****	**0.12****	**0.21****	**0.37****
Primary Year 1, Reading	**0.26****	**0.25****	**0.22****	**0.26****	**0.25****	**0.25****	**0.14****	**0.17****	**0.20****	0.01	**0.11****	**0.09****	**0.08****	**0.25****
Mathematics	**0.29****	**0.28****	**0.26****	**0.31****	**0.29****	**0.25****	**0.16****	**0.18****	**0.24****	0.00	**0.13****	**0.11****	**0.13****	**0.28****
Primary Year 2, Reading	**0.29****	**0.28****	**0.27****	**0.30****	**0.32****	**0.31****	**0.16****	**0.20****	**0.27****	0.00	**0.11****	**0.08****	**0.13****	**0.32****
Writing	**0.25****	**0.22****	**0.23****	**0.26****	**0.27****	**0.26****	**0.16****	**0.19****	**0.24****	-0.01	**0.08****	**0.06***	**0.13****	**0.27****
Mathematics	**0.25****	**0.21****	**0.23****	**0.25****	**0.27****	**0.26****	**0.15****	**0.16****	**0.21****	0.00	**0.10****	**0.07****	**0.12****	**0.25****
Pre-school entry, Co-op.& conformity	**0.12****	**0.16****	**0.10****	**0.15****	**0.12****	**0.07****	**0.09****	**0.12****	**0.09****	0.01	**0.07****	**0.03**	**0.09****	**0.21****
Peer sociability	**0.10****	**0.15****	**0.05***	**0.10****	**0.08****	**0.05***	**0.14****	**0.07****	**0.07****	0.03	**0.04***	**-0.04***	**0.08****	**0.16****
Confidence	**0.13****	**0.17****	**0.11****	**0.15****	**0.14****	**0.08****	**0.11****	**0.06****	**0.07****	0.01	**0.06****	**-0.02**	**0.07****	**0.18****
Anti-social	-0.00	-0.01	**-0.05***	-0.03	-0.03	-0.01	0.03	**-0.06****	-0.03	0.01	-0.03	-0.03	-0.02	**-0.08****
Worried/upset	0.01	-0.02	-0.02	-0.03	-0.02	0.01	0.02	**-0.06****	-0.02	-0.01	0.00	-0.01	-0.02	-0.03
Pre-school exit, Self regulation	**0.14****	**0.16****	**0.15****	**0.19****	**0.19****	**0.18****	**0.07****	**0.08****	**0.12****	0.02	**0.10****	0.01	**0.07****	**0.25****
Anti-social/worried	-0.03	-0.04	-0.04	**-0.06****	**-0.08****	**-0.06***	**-0.04***	-0.02	**-0.08****	-0.02	**-0.06****	-0.01	0.00	**-0.09****
Primary Year 1, Emotional symptoms	**-0.07****	**-0.05***	**-0.07****	**-0.06****	**-0.04***	-0.03	**-0.05***	-0.04	**-0.08****	**-0.05***	-0.03	0.01	-0.03	-0.01
Conduct problems	**-0.11****	**-0.11****	**-0.13****	**-0.15****	**-0.15****	**-0.10****	**-0.06****	**-0.10****	**-0.12****	0.01	**-0.09****	**-0.05***	-0.03	**-0.13****
Hyperactivity	**-0.13****	**-0.13****	**-0.15****	**-0.18****	**-0.18****	**-0.17****	**-0.07****	**-0.10****	**-0.14****	0.01	**-0.10****	-0.03	-0.04	**-0.20****
Peer problems	**-0.05***	**-0.05***	**-0.05***	**-0.10****	**-0.04**	-0.02	**-0.05***	**-0.05***	**-0.07****	**-0.06****	-0.01	0.04	-0.02	**-0.08****
Pro-social	**0.07****	**0.07****	**0.08****	**0.13****	**0.10****	**0.09****	**0.06****	**0.06****	**0.07****	0.01	**0.06****	-0.01	0.03	**0.14****
Primary Year 2, Emotional symptoms	**-0.09****	-0.04	**-0.06****	**-0.06****	**-0.05***	-0.04	**-0.08****	**-0.05****	**-0.08****	0.00	-0.02	-0.03	-0.02	**-0.04***
Conduct problems	**-0.08****	**-0.10****	**-0.08****	**-0.13****	**-0.14****	**-0.11****	-0.03	**-0.09****	**-0.10****	0.02	**-0.10****	-0.04	-0.03	**-0.12****
Hyperactivity	**-0.15****	**-0.14****	**-0.17****	**-0.18****	**-0.18****	**-0.20****	**-0.04***	**-0.11****	**-0.14****	-0.01	**-0.13****	**-0.06***	**-0.05***	**-0.19****
Peer problems	**-0.09****	**-0.04***	**-0.06***	**-0.08****	**-0.08****	**-0.08****	**-0.05***	**-0.08****	**-0.11****	-0.01	-0.03	0.02	-0.02	**-0.08****
Pro-social	**0.09****	**0.06****	**0.06****	**0.08****	**0.11****	**0.10****	0.02	**0.06***	**0.09****	0.03	**0.08****	0.03	0.01	**0.12****

*$p<0.05$ **$p<0.01$

3.4.2 Bivariate Associations between Risks and Pre-School Variables

Table 3.16 illustrates the simple (no accounting for nested structure) bivariate linear associations that were found between the z-scored child-level potential risks to development and the z-scored measures that were related to the quality of pre-schools and children's duration of attendance. Amongst the inconsistent patterns in the relationships revealed in this Table, the largest variations can be seen to have been encountered by those children from ethnic minorities. Although the dummy variables measuring these were also associated with an increased risk to development (see Table 3.14 and Section 3.4.1), Table 3.16 reveals that these same variables were also indicative of greater process quality in pre-school care. Furthermore, the relationship that these ethnicity variables shared with speaking English as an Additional Language (EAL: see Table 3.3) is also apparent here as speaking EAL was associated with a greater process quality of care as well.

The fact that Table 3.16 revealed that some developmental risks were indicative of both lesser development as well as greater process quality in the pre-school care that they received boded well for the future detection of pre-school protecting development. Although some risks proved themselves to have deleterious effects upon the development of young children, some of these risks also showed themselves to be associated with higher quality care in pre-school, variables that Section 3.4.3 shows to be associated with improved development. The placement of high risk children within hypothetically highly beneficial pre-schools is exactly that which would be required for pre-school to demonstrate its ability to protect development from the impacts of risks.

Although an inconsistent pattern of relationship between child-level risks and measures of pre-school was expected due to the inconsistent relationships that were found *amongst* these risk measuring variables, this degree of inconsistently was not expected in the relationships found for family-level risks that are observed in Table 3.17. However, although these risk variables were very highly inter-correlated (see Table 3.4), this high degree of association was not found to be extended to their relationship with the structures and qualities of the pre-schools that were investigated in this study. Instead, an inconsistent pattern of association was again found with

relationships being identified that were of a similar magnitude to those found with child level risks (at maximum, r≈0.12).

Nonetheless, unlike the directionality of the relationships that were observed between child-level developmental risks and the qualities of pre-school (Table 3.16) a less consistent trend can be seen in risk-quality relationships when family-level risks were examined (Table 3.17). Whilst Table 3.16 revealed that it was common for child-level developmental risks to be associated with *greater* degrees of quality, the correlations of Table 3.17 reveal that it was also common for risks to development to have deleterious effects upon the quality of the care that children experienced. For example, although *greater* family salary and mother occupational status were associated with *lower* overall and educational quality, a better Home Learning Environment (HLE) was associated with a parallel improvement in the quality of pre-school care that a child would be likely to experience. This inconsistent relationship between family level risk and developmentally beneficial higher quality pre-school suggests that it might be harder for pre-school quality to protect development from the impacts of family level risk. Because greater developmental risks also served as risk to pre-school quality, so it would be harder for children experiencing these risks to gain access to developmentally beneficial (see Table 3.18) high quality pre-school.

Table 3.16 Correlations between z-scored child-level potential risks and variables relating to pre-school (2 d.p.)

	Boy?	EAL?	premature?	birth weight	no of siblings	birth order	*Ethnicity*, bangladeshi	black	indian	pakistani	mixed	other	Any event affected dev.?
Global Quality, ECERS-R	-0.03	0.02	0.00	-0.04	0.01	**0.06****	0.03	**0.08****	0.03	0.01	0.00	0.03	0.00
Educational Quality, ECERS-E	-0.02	**0.09****	0.03	**-0.04***	**0.04***	**0.07****	**0.05****	**0.08****	0.00	-0.03	**0.04***	**0.12****	0.03
Relationship, Positive	0.00	**0.05***	0.03	-0.02	0.02	0.04	**0.06****	**0.12****	0.03	**-0.05****	0.04	**0.04***	**-0.05****
Punitive	0.00	**-0.04***	-0.03	0.02	0.02	**-0.05***	-0.02	**-0.11****	**-0.04***	0.01	**-0.07****	**-0.05***	**0.06****
Permissive	-0.01	-0.04	0.02	-0.03	0.01	0.01	0.01	**-0.05****	**-0.05***	0.01	-0.01	-0.01	**0.06****
Detached	0.01	**-0.07****	0.00	0.00	-0.03	**-0.07****	**-0.05****	**-0.14****	**-0.05****	0.01	**-0.05****	**-0.07****	**0.04***
Manager, highest academic qualification	0.00	**0.08****	**0.04***	-0.02	**0.06****	**0.06****	0.01	0.04	-0.04	0.02	0.01	**0.12****	**0.04***
Highest childcare qualification	-0.01	**0.05***	0.02	-0.02	**0.07****	**0.07****	0.01	0.02	-0.02	-0.01	-0.03	**0.08****	0.02
Staff, highest average academic qualification	-0.01	-0.02	**0.05****	-0.03	0.02	0.02	0.01	**-0.06****	-0.03	0.01	**-0.05***	-0.01	-0.01
Highest average childcare qualification	-0.02	-0.02	**0.06****	-0.02	-0.02	0.02	0.02	-0.02	**-0.05***	-0.01	-0.04	-0.02	0.01
Average age	0.02	**0.08****	0.02	-0.03	0.03	**0.04***	**0.05***	0.03	0.04	**-0.04***	0.00	**0.21****	-0.01
No. of staff	-0.03	**0.08****	0.04	**-0.04***	**-0.06****	-0.02	0.02	**0.14****	0.03	-0.03	**0.08****	**0.17****	**0.09****
No. of children	0.01	**0.10****	-0.01	0.01	**0.04***	**0.08***	0.05*	0.03	**0.05***	-0.01	0.03	**0.08****	0.01
Duration of attendance	-0.02	**-0.06****	0.01	0.00	**-0.12****	**-0.11****	-0.05*	-0.01	0.01	**-0.04***	0.02	-0.02	0.01

$*p<0.05$ $**p<0.01$

Table 3.17 Correlations between z-scored family-level potential risks and variables relating to pre-school (2 d.p.)

	Family salary	Mother Occ. Status	Father Occ. Status	Highest family status	Mother qual.s	Father qual.s	Mother in work?	Father in work?	Either in work?	2 parent family	Mother age	Father age	No. of carers	HLE
Global Quality, ECERS-R	**-0.05***	**-0.05***	-0.00	-0.03	**-0.05****	0.03	-0.01	**-0.06****	**-0.06****	-0.01	0.01	0.01	**0.06****	0.02
Educational Quality, ECERS-E	**-0.06****	**-0.05***	0.03	0.00	-0.01	**0.05***	**-0.08****	**-0.11****	**-0.09****	-0.04	**0.05***	**0.05***	**0.05****	**0.04***
Relationship, Positive	0.01	-0.01	0.03	0.02	0.02	**0.07****	-0.02	**-0.07****	**-0.05***	-0.02	**0.05****	0.03	**0.06****	**0.06****
Punitive	**-0.07****	**-0.05***	**0.07****	**-0.07****	**-0.05****	**-0.09****	-0.01	0.04	-0.01	0.02	**-0.07****	**-0.05****	**-0.04***	-0.03
Permissive	**-0.05***	-0.02	-0.02	**-0.05****	**-0.06****	**-0.05***	0.01	-0.01	-0.02	-0.01	**-0.04***	0.01	**-0.08****	-0.03
Detached	0.00	0.01	-0.02	-0.03	-0.03	**-0.07****	0.03	**0.06***	**0.06****	0.01	**-0.05***	-0.01	-0.02	-0.02
Manager, highest academic qualification	0.00	**-0.05****	0.04	0.00	-0.01	**0.06****	**-0.09****	**-0.09****	**-0.04***	0.00	**0.04***	**0.05***	**0.12****	**0.05****
Highest childcare qualification	-0.01	**-0.05***	0.03	0.01	-0.02	0.02	**-0.09****	**-0.07****	**-0.05***	0.01	0.04	0.03	**0.12****	**0.06****
Staff, highest average academic qualification	**-0.08****	-0.04	-0.02	-0.01	**-0.06****	-0.03	-0.04	0.01	-0.03	0.00	-0.02	-0.03	-0.01	0.00
Highest average childcare qualification	**-0.05***	0.01	0.03	0.02	-0.01	0.00	-0.01	0.03	-0.02	-0.03	0.02	0.02	-0.02	0.04
Average age	**-0.12****	**-0.05***	**-0.07****	**-0.05***	**-0.06****	**-0.08****	-0.04	**-0.07****	**-0.05***	**-0.05***	**-0.05***	-0.04	-0.01	**-0.05***
No. of staff	0.03	0.02	**0.08****	0.02	**0.06****	**0.09****	**0.06****	-0.02	**-0.05***	-0.03	**0.04***	**0.04***	-0.02	0.02
No. of children	**-0.08****	**-0.08****	-0.03	-0.02	**-0.05****	-0.02	**-0.09****	**-0.08****	**-0.06****	-0.03	0.00	-0.03	**0.07****	**0.05***
Duration of attendance	**0.22****	**0.17****	**0.14****	**0.13****	**0.17****	**0.12****	**0.24****	**0.07****	**0.12****	0.01	**0.08****	**0.08****	**-0.15****	0.02

**p<0.05 **p<0.01*

3.4.3 Bivariate Associations between Pre-School Variables and Development

Table 3.18 presents the simple bivariate relationships that were found between measures of children's cognitive and social development (from ~3 to 7) and measures assessing the quality of, and duration of attendance at, the pre-schools that these children attended. However, as with the relationships previously presented between developmental risks and quality (see Tables 3.16 and 3.17), the Pearson's correlations presented in Table 3.18 do not correct for the nested structure of children within pre-schools so the caution must be taken in interpreting the relationships they reveal.

One of the most surprising patterns of relationships revealed in Table 3.18 is that some measures of quality (notable the qualifications of managers) seem to have a counter-intuitive relationship with children's development. That is to say, as quality increased, so a parallel observation can be seen in declining levels of development. However, this surprising association supported the greater in depth multivariate analyses that follow (chapters 4 and 5) as finding such a counter-intuitive pattern warranted further investigation as correlation can never be taken as implying causation. Nonetheless, the previous simple bivariate relationships examined in this chapter provide some initial hypotheses offering explanation. For example, given that some family level risks (e.g. fathers' qualifications) promoted greater pre-school qualities (such as managers' qualifications, see Table 3.17), the counter-intuitive relationships presented in Table 3.18 could be a product of risk factors influencing the quality that children experienced rather than a causal relationship between quality and development itself. In other words, because there was a chance that children at greater risk could find themselves in lower quality pre-schools, so children from these pre-schools may go onto display lower than average levels of development due solely to the risks that placed them in these pre-schools in the first place.

So although Table 3.18 presents many instances of pre-school qualities promoting development, the fact that there are also counter-intuitive hindrances suggests caution over their interpretation and both supports and necessitates the SEM that now follow; statistical controls could be modelled that facilitated greater validity in the results that were obtained.

Table 3.18 Correlations between z-scored variables relating to pre-school and measures of cognitive and social/behavioural development (2 d.p.)

	Global Quality ECERS-R	*Educational Quality* ECERS-E	*Relationship* Positive	Punitive	Permissive	Detached	*Manager* highest ac. qual.	Highest cc. qual	*Staff* highest av. ac. aual.	Highest av. cc. qual.	Average age	No. of staff	No. of children	Duration
Pre-school entry, GCA	0.02	0.00	**0.04***	**-0.05***	**-0.10****	**-0.05***	**0.05***	**0.06****	-0.03	0.00	**-0.05***	-0.03	-0.01	0.03
Pre-school exit, GCA	-0.02	-0.01	0.02	**-0.05***	**-0.10****	**-0.05***	**-0.05***	-0.03	-0.03	0.00	**-0.07****	0.00	**-0.05****	**0.14****
Primary Year 1, Reading	0.01	-0.01	0.03	-0.04	0.01	0.02	**-0.09****	**-0.07****	0.00	-0.03	**-0.10****	0.04	**-0.06****	**0.16****
Mathematics	-0.04	**-0.05****	0.01	-0.04	-0.04	0.00	**-0.08****	**-0.07****	0.02	0.04	**-0.05***	0.00	**-0.05****	**0.15****
Primary Year 2, Reading	0.01	-0.02	0.04	-0.02	**-0.06****	-0.03	**-0.07****	**-0.05***	-0.02	-0.01	**-0.07****	-0.03	**-0.05***	**0.11****
Writing	0.03	-0.02	0.03	-0.02	**-0.05***	-0.02	**-0.07****	**-0.05***	0.00	-0.01	**-0.05***	-0.03	-0.04	**0.09****
Mathematics	0.01	-0.03	0.00	-0.02	**-0.04***	-0.01	**-0.08****	**-0.06****	-0.01	-0.01	**-0.06***	0.00	**-0.04***	**0.12****
Pre-school entry, Co-op.& conformity	**0.06****	0.01	**0.08****	**-0.06***	**-0.05***	**-0.06****	0.02	**0.06****	**-0.08****	**-0.04***	**-0.11****	**-0.04***	-0.01	-0.02
Peer sociability	0.01	**-0.06****	0.02	-0.03	-0.04	-0.02	**-0.05****	**-0.05***	**-0.08****	**-0.07****	**-0.05***	0.01	**-0.08****	**0.09****
Confidence	0.01	-0.02	**0.04***	**-0.06****	0.03	-0.03	-0.03	**-0.05****	**-0.08****	-0.02	0.01	**0.06****	**-0.06****	**0.10****
Anti-social	-0.01	**-0.04***	**-0.05***	-0.00	0.02	0.02	**0.09****	**-0.12****	-0.01	-0.02	**0.04***	**0.07****	**-0.04***	**0.09****
Worried/upset	-0.01	-0.02	-0.02	0.03	**0.04***	**0.04***	**0.07****	**-0.10****	-0.02	-0.02	0.02	**0.04***	-0.03	**0.11****
Pre-school exit, Self regulation	0.03	0.04	**0.09****	**-0.07****	**-0.09****	**-0.07****	0.04	**0.05****	-0.02	0.00	-0.02	-0.01	0.02	0.03
Anti-social/worried	**-0.07****	-0.03	**-0.04***	**0.04***	0.02	0.03	-0.03	**-0.06****	0.02	0.01	0.01	**0.06****	-0.02	**0.06****
Primary Year 1, Emotional symptoms	-0.01	0.00	**-0.06****	0.03	0.04	0.04	-0.01	-0.03	0.01	0.02	0.03	0.01	0.02	-0.01
Conduct problems	-0.02	-0.01	-0.03	0.02	0.02	0.04	-0.04	**-0.07****	-0.03	-0.01	0.03	**0.07****	0.00	0.02
Hyperactivity	-0.03	-0.04	**-0.05***	0.03	**0.05***	**0.05***	0.00	-0.03	-0.02	-0.02	**0.04***	**0.06****	-0.03	0.01
Peer problems	-0.04	-0.02	**-0.08****	0.03	**0.07****	**0.08****	-0.03	**-0.07****	-0.02	0.03	0.03	0.01	0.00	0.01
Pro-social	0.02	0.00	0.03	-0.01	-0.03	**-0.04***	0.02	**0.05***	0.01	0.01	-0.02	-0.03	0.00	-0.03
Primary Year 2, Emotional symptoms	0.01	0.00	-0.04	0.02	**0.07****	**0.06****	-0.01	-0.01	0.02	**0.07****	0.00	-0.02	0.02	-0.03
Conduct problems	0.00	-0.01	-0.02	-0.02	0.03	0.02	0.00	-0.02	0.00	0.02	0.03	**0.05***	0.02	0.03
Hyperactivity	0.01	0.01	-0.02	0.01	**0.04***	0.03	0.03	0.01	-0.01	0.02	**0.05***	0.04	0.02	-0.03
Peer problems	0.00	-0.01	-0.01	-0.02	0.04	0.03	-0.04	**-0.07****	-0.01	0.02	-0.03	0.01	0.02	0.04
Pro-social	-0.01	-0.03	-0.01	0.01	0.04	0.01	-0.03	-0.01	0.03	-0.02	0.00	**-0.07****	-0.03	-0.03

$*p<0.05$ $**p<0.01$

3.5 Conclusions

This chapter presented an examination of the characteristics and simple bivariate relationships between each of the manifest variables that were analysed in this investigation. To this end, the various categories of variables within this study were examined and patterns both amongst and between these were revealed. At the same time however, because the relationships examined in this chapter failed to control for the influence of other variables, the patterns they revealed merely provided an initial picture of the relationships that the following SEM would build upon.

Important patterns and trends found by this chapter included:

- A greater unidimensionality in family level risks (SES analogous) than child level risks suggesting a reflective CFA would have been inappropriate.
- A greater unidimensionality *amongst* each level of risk than *between* them suggesting validity to their separation.
- Longer durations of pre-school were more likely to be found for those children experiencing lower quality care.
- There was a slight overlap between the development of social and cognitive skills suggesting protection might work across both these domains.
- The impacts of risks varied according to the timing of the measure of development. For example, EAL and parental occupational status had their biggest impacts when children were young but the behaviour of boys grew increasingly worse.
- Higher child level (rather than family level) risks were associated with greater quality of pre-school care and education suggesting a greater opportunity for quality to protect against this type of risk.

The final act of data cleaning that was undertaken and is reported by the chapter was an assessment of the *multicollinearity* between variables. This was achieved by examining the bivariate correlation tables that can be found throughout this chapter. Tabachnick and Fidell (2001) advise that multicollinearity can be concluded when two variables are, "*very highly correlated (say, 0.90 and above)...*" and the correlations reported in this chapter are all less than 0.90[103].

[103] Singularity is not examined here as Tabachnick and Fidell (2001) advise the detection method of, "*...running your main analysis to see if the computer balks.*"

4. RESULTS II: RISKS *IN FOCUS*: OVERARCHING RISKS TO DEVELOPMENT

This chapter presents a series of Structural Equation Models (SEM) that were constructed to develop and test a new approach to the measurement of combined risks to young children's development. Based on the criticisms that have been levelled at the frequently used Cumulative Indices (e.g. Burchinal, Roberts, Hooper, & Zeisel, 2000) and developing the work of Kleine (2006), Confirmatory Factor Analysis (CFA) using formative measurement is an alternative that: a) did not require data to be discarded via the dichotomisation of continuous risks, and b) allowed the contribution of each risk to vary in its indication of a combined measure. This newly developed factor analysis approach was then compared to the Cumulative Index that was developed by the EPPE project (their 'Index of Multiple Disadvantage'), and the predictive validity of both was established through SEM that examined their impacts on children's cognitive and social skills from entry (at mean age 36 months) to exit of pre-school (at mean age 58 months).

This exploratory work is then built upon and extended by the bifurcation of combined risks by ecological level (child and familial) that was designed to capture the *relative importance* of each level to children's development in line with ecological systems theories (e.g. Bronfenbrenner, 1979). As with the previous analyses, the predictive validity of this division was examined by comparing the magnitude of the developmental impacts of a single factor solution to that of an alternative two-level solution. The chapter then concludes by restating the rationale that lay behind both analyses that were reported, summarises the results that are presented, and reveals the conclusions that may be drawn from these.

4.1 Confirmatory Factor Analyses

This analysis was designed to test whether Confirmatory Factor Analysis using formative measurement could produce a valid alternative to a Cumulative Index in measuring combined risk. For validation, alternative *latent composite* measures were compared to a Cumulative Index created from the same risks and both approaches were used to predict the cognitive and social/behavioural development of young children between the ages of 36 and 58 months (the pre-school period, at entry to and at exit). Two separate composite measures were created to test the validity of two of the assumptions implicit in the creation of Cumulative Indices: first, that both ordinal

and continuous measures may be dichotomised, and second, that these dichotomies may then be tallied. If the composite measures demonstrated greater predictive power of children's development than the Cumulative Index, then the use of such measures would be validated for use in subsequent analyses both here and in other future. In summary, this section aimed to answer two research questions:

1) Do confirmatory factor analyses that use formative measurement yield factor scores that are comparable with the measures derived from Cumulative Indices?

2) As the factor analysis strategy becomes increasingly differentiated from the Cumulative Index procedure, do the alternative measures of combined risk display greater predictive power of children's cognitive and social/behavioural development?

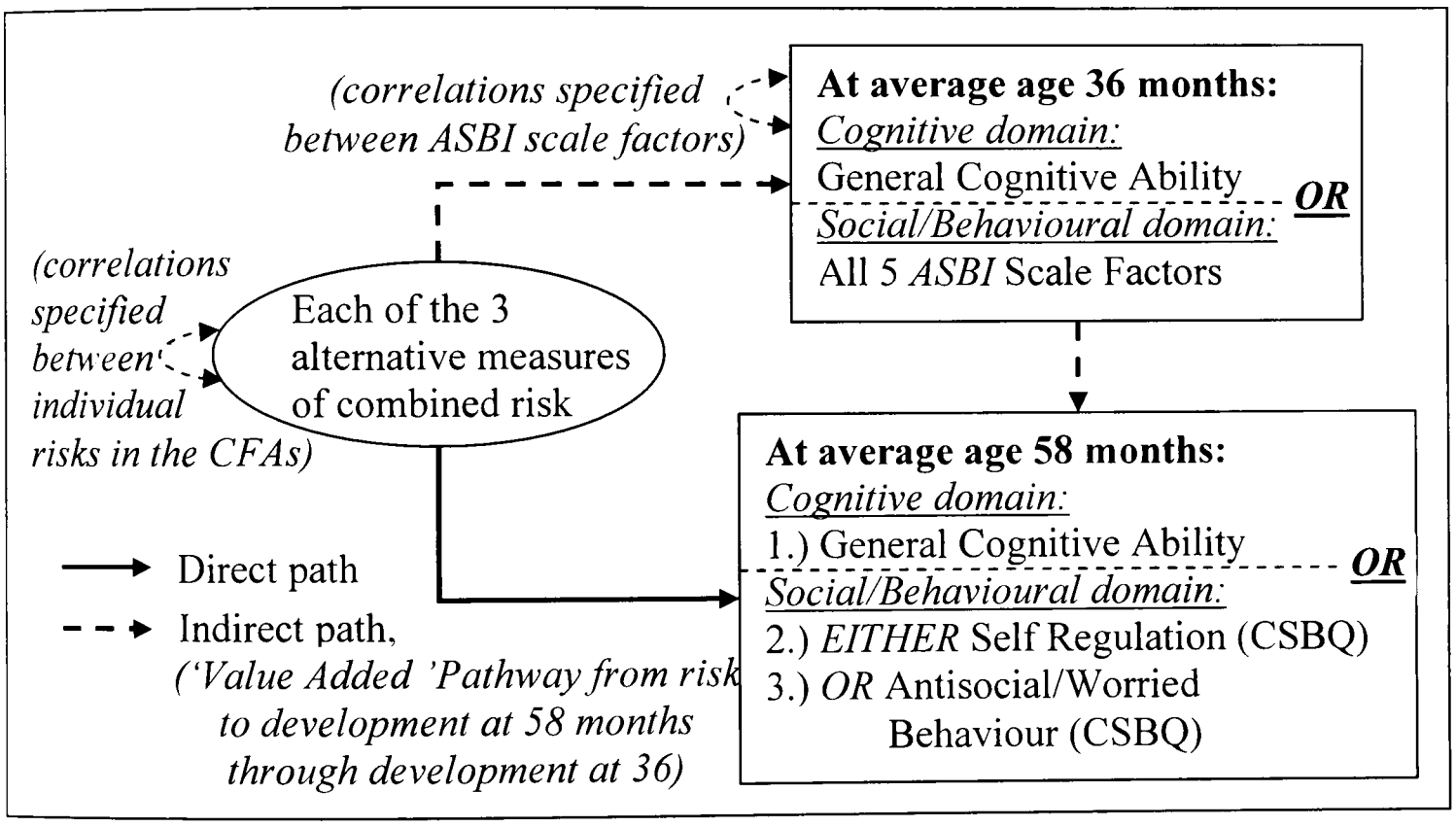
In answering these questions, the first CFA measure of combined risk used the same dichotomised risks as the Cumulative Index but theorised them to be *causes* of a continuous (rather than ordinal) and *latent* composite (rather than an accumulative risk). The second measure also followed this procedure but rather than use dichotomous risks instead maintained original ordinal or continuous scales were possible (see Table 2.12). The first of these composite measures was created to test the assumption of summation that is implicit to Cumulative Indices, whilst the second composite then additionally tested the validity of dichotomising previously ordinal data. In summary, the three tested measures of combined risk were:

Method (1): The original Cumulative Risk measure as used in the EPPE studies
Method (2): A latent composite measure created from the same dichotomies as (1)
Method (3): A latent composite measure developed from the ordinal/continuous (where possible) and dichotomous risks that were used in procedures (1) and (2)

The Confirmatory Factor Analyses were carried out using the Mplus statistical software (L. K. Muthén & Muthén, 2004) where the procedures for specifying formative measurement have been outlined by the authors (B. O. Muthén, 2006). Each set of factor scores were computed separately and, along with the Cumulative

Index, specified as predictors in the development of children's cognitive and social/behavioural abilities in three independent and separate path models (see Figure 4.1) where correlations controlled for the overlap of individual risks and the overlap between measures of social behavioural development at mean age 36 months (for these see Chapter 3). Finally, correlations were employed once again, but this time to investigate the similarity of each of the alternative methods within the context of each of the three developmental abilities that were assessed at mean age 58 months (General Cognitive Abilities, Self Regulation, Antisocial/worried behaviour).

Figure 4.1 *Stylised* Representation of the 9 Structural Equation Models tested in the Combined Risk Comparison Analyses[104]

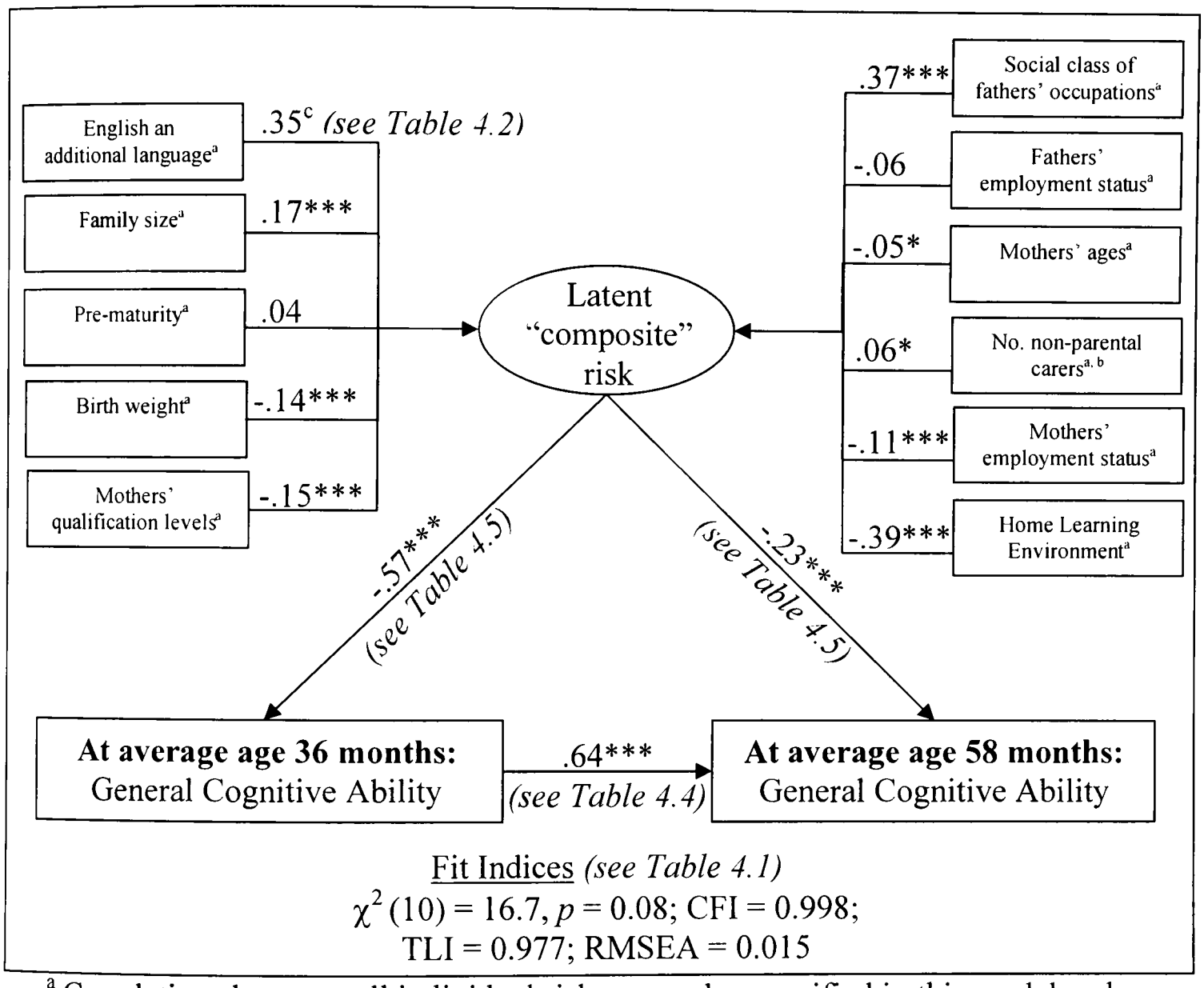


The following sections of this chapter report on 1) the assumptions that were accepted in the nine SEM models that were tested; 2) how well the SEM featuring the latent composites (Methods 2 and 3) fitted the data in which they were specified; 3) the factor loadings of each of the individual risks to the latent composites (again with reference to Methods 2 and 3); 4) variations between the three alternative measures of combined risk in how these impacted development at ages 36 and 58 months. However, the results from the nine distinct SEM are presented alongside one another to aid in comparisons rather than in separate sections. Figure 4.2 is a graphical

[104] 3 methods of measuring combined risk that were each tested in a SEM featuring 1 of 3 measures at exit from pre-school. Either: General Cognitive Ability, Self Regulation, or Anti-social/Worried Behaviour. This gave 3x3 sets of SEM.

representation of the results from just one of the nine SEM models and is included in order to emphasise that the results have come from separate SEM models. Figure 4.2 guides the reader through the results of this section, serves to clarify the nature of the analyses conducted in this section, and presents where these results can also be found in the sections and tables below.

Figure 4.2 The impact of the combination of risks via latent "composite" to the General Cognitive Ability of young children at average ages 36 and 58 months[105]



[a] Correlations between all individual risks were also specified in this model and can be found in Chapter 3 *(see Tables 3.3 - 3.5)*

[b] *"Number of non-parental carers"* was referred to as 'Family Structure' in the original EPPE HLE (see Sammons, Taggart, et al, 2002)

[c] Unstandardardised factor loadings set to 1 so there is no returned significance level

*$p < .05$ **$p < .01$ ***$p < .001$

[105] Using ordinal and dichotomous child level risks

4.1.1 Assumptions of the tested Structural Equation Models

Underpinning the Structural Equation Models that were tested in both sections of this chapter are assumptions that were made and accepted either on the basis of previous studies, or obliged to be accepted due to the modelling procedures that were used. In order for the analyses, modelling procedures, and results to be clearly understood and their validity made apparent, each assumption is now presented and discussed. The aim of this section of the chapter is to familiarise readers with the assumptions that lay behind the following analyses and results. Discussion of the impacts of these assumptions upon the validity of the results is returned to in Chapter 6 (Discussion and Conclusions).

The first assumption made in these analyses was that it was valid to conduct independent investigations into each domain of children's development. Obliged by the technical difficulties of running a CFA using formative measurement, validity was assumed despite the separate analyses omitting cross domain effects over time (such as the impact of cognitive skills on subsequent social/behavioural development). In turn, by not modelling these developmental paths, the ecological validity of the conclusions that are prompted by these analyses is brought into question. However, the assumption of valid results is maintained due to other benefits to validity that were conferred by the use of the CFA technique and which are explored and demonstrated in the analyses reported in this chapter.

The other major assumption that is present in the following analyses is one that, although obliged by the technique of CFA using formative measurement, is also appropriate to the pre-existing literature investigating risk and resilience in development. The assumption is that a combined measure of risk will always be relative to that which it is hypothesised to impact (termed *'relative risk'* by the NICHD, 2000a) and this is appropriate to the pre-existing literature as risks need not combine in a consistent way to have a consistent impact upon varying outcomes. Furthermore, the appropriateness of this relativity is actually obliged by the CFA technique that is employed here as a formatively indicated latent variable (in this case combined risk) is always dependent upon that which it impacts (in this case development). For subsequent analyses, the consequence of this assumption is that although the same specification of a combined risk can be used within both domains

of development, the differing developmental outcomes change the relative contributions of the individual risks (the factor loadings).

The assumption of *relativity* in the measurement of combined risk was one beneficial to this study as it contributed further *sensitivity* to the practice of measuring combined risk that was the aim of this chapter. By example, the first half of this chapter (Section 4.1) aimed to increase the sensitivity of the measurement of combined risk by developing an alternative to Cumulative Indices whilst the second (Section 4.2) aimed to make this new measure of combined risk sensitive to the differing origins of risks (child or family). The additional and unavoidable sensitivity that was obliged by the CFA procedure further benefited this overarching theme of sensitivity in measurement by rendering the measurement of combined risk sensitive to that which it predicted (in this case the differing developmental domains).

Leading on from the assumption of relativity, the final assumption of the modelling presented in this chapter concerns the developmental timeframe that was examined. Despite measures of development being taken at 4 time points, entry and exit from pre-school and at the end of years 1 and 2 of Primary, only the pre-school period was examined here. This omission of the Primary school measures of development was assumed to be beneficial to the analyses for two reasons: first because every risk was measured during the pre-school period *alone* and second, because the developmental impacts of risks were shown to vary over time (e.g. EAL and child gender, see Chapter 3). This second reason was important because the measures of combined risk were always relative to that which they predicted and so modelling the impacts of these upon Primary school development would have led to measures were *less sensitive* to the developmental stage during which the individual risks were measured (that of pre-school). In other words, in order to keep the measurement of combined risk sensitive to the timeframe in which individual risks were measured (pre-school), the impacts of combined risks upon Primary school development had to be omitted.

The consequence of limiting the breadth of these analyses to the pre-school period and individual domains was however confounded: although the modelling of some important theoretical relationships was excluded on the basis of the statistical technique employed, this same technique also contributed towards a sensitivity in

measurement that previous methods have lacked (e.g. cumulative indices). As such, the technique of CFA using formative measurement can be seen to oblige the acceptance of assumptions that can be both beneficial and deleterious to the validity of the results that it returns. Despite this, no analysis is ever without drawbacks and it was the aim of this thesis to improve upon, rather that create a perfect alternative to, that which had be conducted before.

4.1.2 Indices of Model Fit

Table 4.1 displays the six sets of fit indices that were returned from the two CFA procedures that were used in conjunction with the three developmental outcome measures at exit from pre-school when children were of mean age 58 months[106]. Each of these fit indices indicated excellent model fit and this is a conclusion based upon: The insignificant results of the Chi-Square Test (see Byrne, 1989); the close to upper limit values (close to 1) returned from both the Comparative Fit Index (CFI, Bentler, 1990) and the Tucker-Lewis Index (TLI, Bentler & Bonett, 1980); and the value of the Root Mean Square Error of Approximation (RMSEA) statistic that lay within the range deemed as indicating acceptable model fit (see M.W. Browne & Cudeck, 1993). Additionally, whilst the Confirmatory Factor Analysis using dichotomised risks returned slightly better model fit across each measure, these differences were only ever small. Finally, although good model fit does not validate any subsequent findings, the fit indices of Table 4.1 do indicate that the models were able to accurately represent the original data.

[106] 2 alternative measures of combined risk x 3 outcomes measures at exit from pre-school = 6 sets of fit indices. No fit indices are associated with the 3 path analyses examining Cumulative Indices (the remaining 3 models that make up the 9 reported in this chapter).

Table 4.1 Model fit of each Confirmatory Factor Analyses that used formative measurement

s of model fit	**Cognitive Development** Latent composites:		**Social Development** Latent composites: With Self Regulation at 58 months		**Social Development** Latent composites: With Anti-social/Worried Behaviour at 58 months	
	Using dichotomous risks	Using ordinal and dichotomous risks	Using dichotomous risks	Using ordinal and dichotomous risks	Using dichotomous risks	Using ordinal and dichotomous risks
-Square Test Model Fit	12.2	16.7	140.0	164.8	129.5	150.5
'ees of freedom	*9*	*10*	*45*	*50*	*45*	*50*
P-value	*0.20*	*0.08*	*0.00*	*0.00*	*0.00*	*0.00*
mparative Fit ex (CFI)	0.999	0.998	0.983	0.980	0.985	0.982
:ker-Lewis ex (TLI)	0.997	0.995	0.972	0.968	0.975	0.971
ɔt Mean ıare Error of proximation MSEA)	0.011	0.015	0.027	0.028	0.026	0.027
Probability RMSEA <= .05	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*

4.1.3 Factor Loadings

Table 4.2 presents the standardised factor loading of each risk that was theorised to contribute to a latent composite that attempted to represent the total effect of these in combination within the context of young children's cognitive development. However, the third potential risk, 'Pre-maturity or Low birth weight' was operationalised in a manner different to the others: when the latent composite was indicated by dichotomies, this risk was represented by a *single* dichotomous variable. Alternatively, when the combined latent risk variable was represented by ordinal variables (were possible), 'Pre-maturity or Low birth weight' was a risk that was then represented by *both* variables with a correlation co-efficient specified between them ($r = -0.43$, $p < .001$ which approximately matches that of the simple Pearson's correlation between these variables reported in the previous chapter in Table 3.3).

Table 4.2 Standardised factor loadings of individual risks to cognitive development during pre-school

	Potential Risks. *Standardised factor loadings*	Dichotomised Risks	Ordinal and Dichotomous Risks
Child Variables			
1[b]	First language (EAL)	**.42**[a]	**.35**[a]
2[c]	(Large) family size	**.17*** **	**.17*** **
3 [b] [c]	Pre-maturity OR	**.12*** **	.04
	(Low) birth weight		**-.14*** **
Parent Variables			
4[c]	Mothers' qualification levels	**-.26*** **	**-.15*** **
5[c]	Social class of fathers' occupations	**.23*** **	**.37*** **
6[b]	Fathers' employment status	**-.15*** **	-.06
7[c]	Mothers' ages	.05	**-.05***
8[b]	Household structure *(no. non-parental carers)*	**.09****	**.06***
9[b]	Mothers' employment status	**-.14*** **	**-.11*** **
Home Environment Variables			
10[c]	Home Learning Environment	**-.34*** **	**-.39*** **

[a] Unstandardardised factor loadings set to 1 for model convergence so there is no returned significance level

[b] Measure originally used in dichotomous form

[c] Measure originally used in ordinal form

*$p < .05$ **$p < .01$ ***$p < .001$

In general, the majority of the 11 risks that were chosen by the EPPE investigation to form a Cumulative Index were also found to be significant causal factors of the latent composites. Furthermore, this was found whether the individual risks were included in ordinal or in dichotomous forms. However, Table 4.2 also reveals a disparity between the weightings of these risks. For example, factor loadings were found to range from a statistically insignificant 0.04 for pre-maturity to highly significant 0.39 for the Home Learning Environment, a loading nearly 10 times that found for a pre-mature birth. This large variation between the weightings of individual risks is in stark contrast to the assumption of the Cumulative Index procedure: that individual risks contribute equally to one another.

The factor loadings shown in Table 4.2 also allow for a comparison to be made between the impacts on measurement that were associated with dichotomising. When individual risks were dichotomised from a previously ordinal scale, there was no consistent effect on the relationship between individual and combined risks. For example, while the factor loading of 'social class of father's occupation' increased with dichotomisation, that of 'large' family was unchanged. Such differences signify that the effect of dichotomising might depend upon the nature of the original risks, although investigating the possibility of such a systematic relationship is beyond the scope of this chapter and thesis.

Table 4.3 mirrors Table 4.2 in that it presents the standardised factor loadings of risks that were theorised to contribute to a latent composite that attempted to represent the total effect of these in combination. However, unlike Table 4.2, the risk factor loadings presented in Table 4.3 are in the context of young children's social/behavioural development, and more specifically, in the context of each of the independently examined social skills that were measured at age 58 months. Again, the method of measuring pre-maturity or low birth weight remained constant so as the results remained as comparable both within and between domains as possible.

The results presented in Table 4.3 differ noticeably both between the social skills that were examined at mean age 58 months and to those presented in Table 4.2 where the majority of risks were found to contribute significantly to a combined measure of risk. Furthermore, what patterns can be seen within Table 4.3 and in comparison to those presented in Table 4.2 are also inconsistent. For example, whilst the sizes of the contributions made by speaking English as an Additional Language (EAL) were similar across both the cognitive and social/behavioural domains and these contributions always dropped when other measures were included in ordinal form. By contrast, all of these EAL consistent relationships are completely lacking when examining the contributions associated with the social class of a father's occupation.

Table 4.3 Standardised factor loadings of individual risks to social/behavioural development during pre-school

Potential Risks. *Standardised factor loadings*		With Self Regulation at 58 months		With Anti-social/Worried Behaviour at 58 months	
		Dichotomised Risks	Ordinal and Dichotomous Risks	Dichotomised Risks	Ordinal and Dichotomous Risks
Child Variables					
1[b]	First language (EAL)	**.40[a]**	**.30[a]**	**.48[a]**	**.42[a]**
2[c]	Large family	**.14***	.11	**.20****	**.19****
3 [b]	Pre-maturity OR	**.25*****	**.18****	**.21****	**.20****
[c]	Low birth weight		-.06		.04
Parent Variables					
4[c]	Mothers' qualification levels	**-.22****	**-.14***	-.14	-.09
5[c]	Social class of fathers' occupations	.12	**.16***	.09	.09
6[b]	Fathers' employment status	-.06	.00	-.06	-.03
7[c]	Mothers' ages	.08	-.08	.00	-.10
8[b]	Household structure *(no. non-parental carers)*	.07	.07	.06	.08
9[b]	Mothers' employment status	**-.19****	**-.15***	**-.24****	**-.20****
Home Environment Variables					
10[c]	Home Learning Environment	**-.50*****	**-.64*****	**-.45*****	**-.58*****

[a] Unstandardardised factor loadings set to 1 for model convergence so there is no returned significance level

[b] Measure originally used in dichotomous form

[c] Measure originally used in ordinal form

*$p < .05$ **$p < .01$ ***$p < .001$

Comparing Tables 4.2 and 4.3 reveals large disparities in the relative impacts of risks within and between each domain of development and between the trends that were found to be associated with using dichotomous or ordinal (where possible) risks. This high degree of variation supports not only the bifurcation of the analyses by developmental domain but also the division of analysis by outcome measure at exit from pre-school. For each of the three sets of comparisons analyses revealed in Tables 4.2 and 4.3, both consistent and varying trends can be seen which would not have been detected had only a single large analyses been conducted, or even a single analyses per developmental domain. The further exploration of these possible

relationships and whether or not they are systematic is however, beyond the scope and aims of this investigation and thesis.

4.1.4 Predicting Cognitive Development at Entry to Reception

When the three alternative methods for measuring combined risk were used to predict children's cognitive development at the average ages of 36 and 58 months, a systematic difference between the measures was identified: As the method for representing combined risk became increasingly different from the cumulative index procedure, the statistical relationship between combined risk and cognitive development became stronger. Furthermore, this difference was found over and above the *'value added pathways'* (Table 4.4) of the estimated regression co-efficients between the General Cognitive Abilities of the young children at 36 and 58 months of age. These systematic increases were found both in the size of the standardised regression coefficients and in the amount of explained variance (see Table 4.5).

Table 4.4 Associations between cognitive development at 36 and 58 months

Predicting General Cognitive Ability at mean age 58 months from General Cognitive Ability at mean age 36 months: *value added pathway*	Standardised Regression Coefficient (β)	Standard Error (SE)	Explained variance (r^2)
Cumulative risk Index	**0.69*****	.02	0.55
Latent composite from dichotomous risks	**0.68*****	.02	0.57
Latent composite from ordinal and dichotomous risks	**0.64*****	.02	0.57

****p* < .001

Table 4.5 Impact of each alternative risk on young children's cognitive development during pre-school

Predicting General Cognitive Ability	Mean Age 36 months			Mean Age 58 months		
	Standardised regression coefficient (β)	Standard Error	Total explained variance (r^2)	Standardised regression coefficient (β)	Standard Error	Total explained variance (r^2)
Cumulative risk Index	**-0.46*** **	.17	0.21	**-0.17*** **	.16	0.55
Latent composite from dichotomous risks	**-0.51*** **	.84	0.26	**-0.19*** **	.42	0.57
Latent composite from ordinal and dichotomous risks	**-0.57*** **	.80	0.32	**-0.23*** **	.40	0.57

****p < .001*

For interpretation of the results it is important to note the disparity between the *absolute sizes* of both the regression co-efficients and the proportions of variance explained across the two time periods. This discrepancy stems from the necessity to include General Cognitive Ability at 36 months as a predictor of the same ability 22 months later for a valid interpretation of the results (producing a 'progress model'). Tables 4.4 and 4.5 show that, based upon this progression model, there remained an effect of combined risk on children's GCA at 58 months even when controlling for the earlier level of this same ability. In addition, the systematic differences between the methods of measuring combined risk also remained; there was an increase in the absolute values of the standardised regression coefficients and amount of explained variance.

Similarity of Measures

The results of the above Confirmatory Factor Analyses revealed the impact of making fewer assumptions in measuring the combined risk to cognitive development. The factor analysis that produced a measure of risk least similar to that of the Cumulative Index ($r = 0.84$, $p<0.01$) was the analysis that made the fewest same assumptions. Perhaps coincidentally, the 'middle ground' alternative was found to be as similar to the Cumulative Index as it was to the method with greatest predictive power of cognitive development (in both cases: $r = 0.91$, $p<0.01$).

4.1.5 Predicting Social/Behavioural Development at Entry to Reception

Table 4.6 clarifies the relationships shared between measures of children's social/behavioural development during pre-school that were presented in the simple bivariate correlations of Table 3.11. Whilst these previously presented statistical relationships took no account of the confounding effects of other significant tertiary variables, the relationships presented in Table 4.6 so in that they take into account any relationship found between the measures at 36 months. As such, the results presented in the two tables differ from one another in that there are fewer significant relationships presented in Table 4.6 and that these reveal that children's Co-Operation and Conformity at entry to pre-school was of central importance for both Self Regulation and Anti-social/Worried Behaviour when children left at mean age 58 months.

On top of and in addition to the impacts of social/behavioural measures between themselves that are revealed in Table 4.6, Table 4.7 reveals relationships between the method used to measure combined risk and children's social/behavioural development during pre-school that is similar to that found for the development of General Cognitive Ability. As well as for Self Regulation at 58 months, and for Co-Operation and Conformity. Peer Sociability, and Confidence at mean age 36 months, as the method of measuring combined risk made fewer assumptions concerning how risks 'worked together', so the impact of the resulting combined measure of risk increased in magnitude. However, unlike the relationship observed in Table 4.5 concerning cognitive development, Table 4.7 reveals this to be a much less consistent trend whereby the systematic increases lessened or disappeared when the social/behavioural measures assessed negative behaviours. At the same time however, this effect could also be merely reflecting the relatively small sizes of the relationships that were found for negative behaviours in the first place (where max β=0.07) compared to those found for behaviours that were more positive (where max β=-0.26). It appears that as the relationship between a measure of combined risk and measure of development becomes more sizeable, so the benefits of making fewer assumptions concerning the interplay of risks become increasingly manifest.

Table 4.6 Predicting social/behavioural abilities at mean age 58 months from those abilities at mean age 36 months: *value added pathways*

Social/behavioural measures at mean age 58 months. *(CSBQ Factors)*	Social/behaviour measures at mean age 36 months. *(ASBI Factors)* Co-operation & Conformity	Peer Sociability	Confidence	Anti-social Behaviour	Worried/Upset Behaviour
Predicting Self Regulation at 58 months					
1) Cumulative risk index					
Standardised Regression Coefficient (β)	**0.32*** **	0.02	0.00	-0.03	-0.02
Standard Error (SE)	0.03	0.03	0.03	0.02	0.02
Total Explained Variance (r^2)			0.17		
2) Latent composite from dichotomous risks					
β	**0.32*** **	0.02	0.00	-0.03	-0.02
SE	0.03	0.03	0.03	0.02	0.02
r^2			0.17		
3) Latent composite from ordinal and dichotomous risks					
β	**0.30*** **	0.02	-0.01	-0.03	-0.03
SE	0.03	0.03	0.03	0.02	0.02
r^2			0.18		
Predicting Anti-social/Worried Behaviour at 58 months					
(1) Cumulative risk index					
β	**-0.30*** **	0.03	**0.15*** **	**0.13*** **	0.04
SE	0.03	0.03	0.03	0.02	0.02
r^2			0.15		
(2) Latent composite from dichotomous risks					
β	**-0.30*** **	0.03	**0.15*** **	**0.13*** **	0.04
SE	0.03	0.03	0.03	0.02	0.02
r^2			0.15		
(3) Latent composite from ordinal and dichotomous risks					
β	**-0.30*** **	0.03	**0.15*** **	**0.13*** **	0.04
SE	0.03	0.03	0.03	0.02	0.02
r^2			0.15		

****p <.001*

Table 4.7 Impact of each alternative measure of combined risk on young children's social/behavioural development during pre-school

	Predicting Social/behaviour measures at mean age 36 months. *(ASBI Factors)*					Predicting Social/behavioural measures at mean age 58 months. *(CSBQ Factors)*
	Co-operation & Conformity	Peer Sociability	Confidence	Anti-social Behaviour	Worried/Upset Behaviour	
Self Regulation at 58 months						
pact of Cumulative risk Index						
ndardised Regression fficient (β)	**-0.22*** **	**-0.20*** **	**-0.18*** **	**0.05***	0.03	**-0.14*** **
lard Error (SE)	0.01	0.01	0.01	0.01	0.01	0.01
Explained riance (r^2)	0.05	0.04	0.03	0.00	0.00	0.17
pact of Latent composite from dichotomous risks						
β	**-0.25*** **	**-0.22*** **	**-0.19*** **	**0.07****	**0.05***	**-0.15*** **
SE	0.06	0.06	0.05	0.03	0.03	0.04
r^2	0.06	0.05	0.04	0.01	0.00	0.17
ıpact of Latent composite from ordinal and dichotomous risks						
β	**-0.26*** **	**-0.22*** **	**-0.22*** **	**0.06****	0.03	**-0.19*** **
SE	0.06	0.05	0.05	0.03	0.02	0.04
r^2	0.07	0.05	0.05	0.00	0.00	0.18
Anti-social/Worried Behaviour at 58 months						
ıpact of Cumulative risk Index						
β	**-0.22*** **	**-0.20*** **	**-0.19*** **	**0.05***	0.03	**0.05***
SE	0.01	0.01	0.01	0.01	0.01	0.01
r^2	0.05	0.04	0.03	0.00	0.00	0.15
npact of Latent composite from dichotomous risks						
β	**-0.25*** **	**-0.23*** **	**-0.20*** **	**0.06****	0.04	0.04
SE	0.06	0.06	0.05	0.04	0.05	0.04
r^2	0.06	0.05	0.04	0.00	0.00	0.15
npact of Latent composite from ordinal and dichotomous risks						
β	**-0.26*** **	**-0.24*** **	**-0.22*** **	**0.05***	0.03	0.04
SE	0.06	0.06	0.05	0.03	0.03	0.03
r^2	0.07	0.06	0.05	0.00	0.00	0.15

$*p < .05$ $**p < .01$ $***p < .001$

As was the case when interpreting the impacts of risks upon young children's cognitive development, caution must be taken when interpreting the impacts of combined risk upon social behaviours at the exit from pre-school. In particular, it

must be remembered that the impacts of combined risk that are illustrated in Table 4.7 are those that were found *above and beyond* the impacts of social behavioural measures at mean age 36 months (see Figure 4.1). Given this statistical control over the earlier levels of development, the magnitude of the risk effects upon Self Regulation at pre-school exit are revealed to be surprisingly similar (compared to GCA, see Table 4.5) to those found upon measures of social behaviours at pre-school entry. This suggests that combined risk maybe having an effect upon self regulation that is unrelated to either earlier levels of social/behaviour development or the previous impacts of risk upon these. By contrast, the opposite relationship can be seen for anti-social/worried behaviour where only very small effects of combined risk remained after controlling for earlier levels of development and the effects of risk. This strong disparity in relationships supports the division of the analyses by the pre-school exit outcome measures rather than developmental domain alone, or even with no division at all.

Similarity of Measures

Despite the above results slightly departing from those found for General Cognitive Ability (GCA) during pre-school, the patterns seen in the similarity of these measures remained the same. As in the analyses examining cognitive development, as the tested CFA measure made fewer assumptions than that of the Cumulative Index, so its similarity to the Index lessened. The correlations between the Cumulative Index and the CFA that used the same dichotomies were: 0.89 for Self Regulation ($p<0.01$) and 0.87 for Anti-social/Worried Behaviour ($p<0.01$). By contrast, the correlations between the Cumulative Index and the CFA that used ordinal and continuous measures fell to 0.80 ($p<0.01$) for both developmental measures at exit from pre-school. This trend of declining similarity is confirmed by the correlations that were found between the two CFA alternatives: these were larger than those that were found to be shared between the Cumulative Index and the least similar alternative (that which made fewest same assumptions). For Self Regulation, the association between the two CFA measures was 0.87 ($p<0.01$) and for Anti-social/Worried Behaviour it was 0.90 ($p<0.01$)[107].

[107] All correlations being Pearson Correlation Co-efficients: 'r'.

4.2 Multiple Levels of Risks

Given that the first half of this chapter (Section 4.1) found that there were significant benefits to making fewer assumptions regarding how developmental risks 'work together' when estimating their effects in combination, this second section aimed to build upon this. To this end, the analyses that were undertaken and which are reported here attempted to develop a measure of combined risk that integrated the methods detailed in the previous section together with a substantively driven division of risks according to their ecological levels (proximal to the child or to the family). However, because the analyses now reported incorporated those of the previous section, the same CFA methods were reused and were adaptations of those illustrated in Figures 4.1 and 4.2.

The analyses reported in this section consisted of 3 sets of statistical comparisons (each featuring 2 alternative models) where each set concentrated on either cognitive (1) or social development with either self regulation (2) or anti-social/worried behaviour (3) at exit from pre-school. Within each of these comparisons, each of the alternative models used a CFA procedure with either a single or dual combined measure of risk where each of the dual risks was specific to either children or to their families. These comparisons were designed to identify the effects of incorporating an ecological perspective to the measurement of combined risk using formative CFA. Ideally, modelling dual levels of developmental risk would reveal substantively important relationships between the measures of combined risk and children's development that would have otherwise been missed by the single risk alternative.

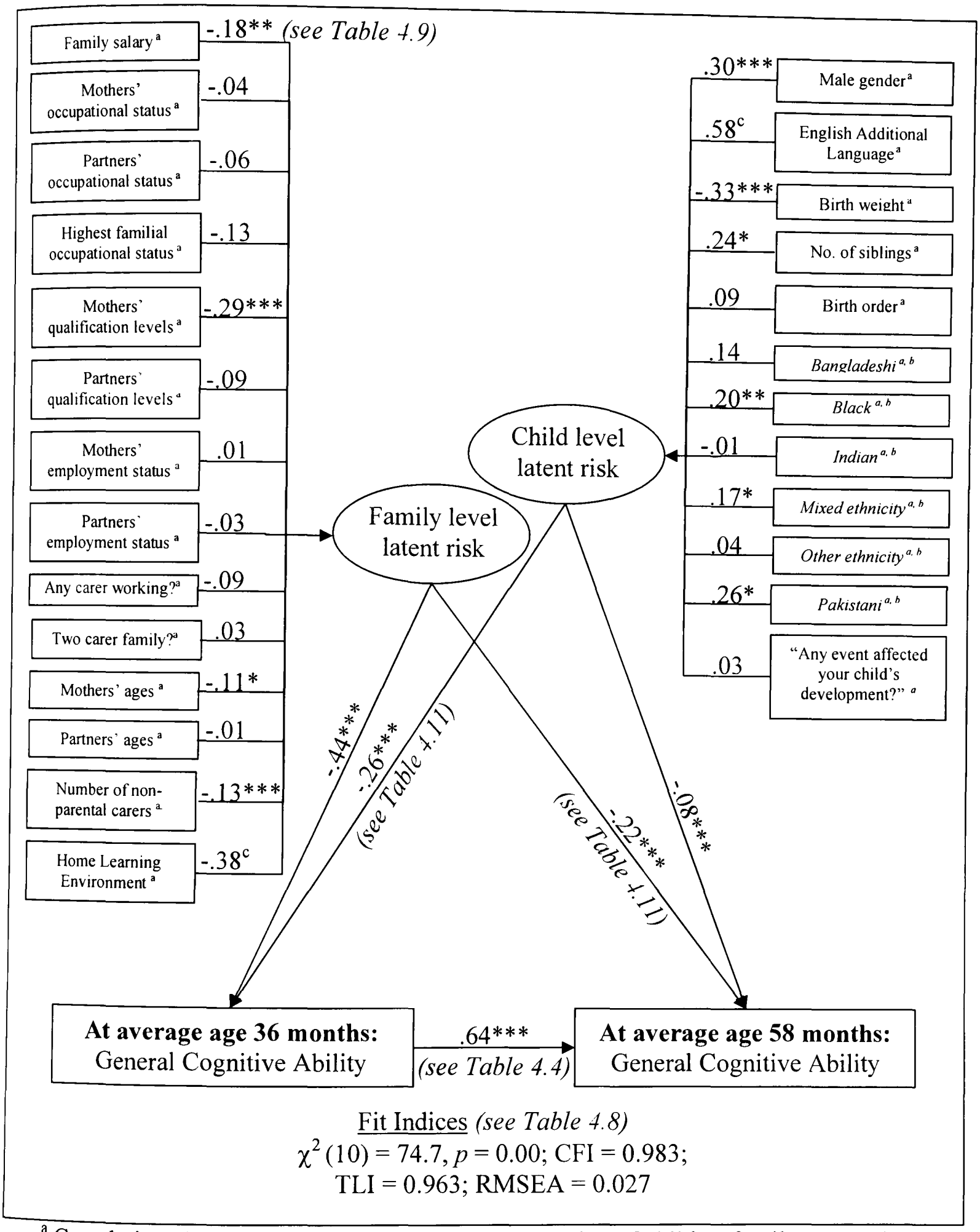
Despite this section using the same methods and analyses to that which preceded, it also differed in that it examined a different set of individual risks. In the previous section, the risks that were examined were those that were used in the Index of Multiple Disadvantage (IMD), a measure created by the authors of the original EPPE project. Whilst it was valid to reanalyse just these in assessing how best to represent the effects of risks in combination, the EPPE project measured a greater number of risks than were included in the IMD. As such, the analysis of a greater quantity of risks (21 rather than 11) was carried out on the premise that deriving a combined measure of risk based on this greater amount would have implicitly greater ecological validity than one that was based on fewer. Simultaneously however, the risks in the

IMD prompted the removal of the dichotomous question "pre-mature birth?" on the basis that the risk associated with this would be partially captured in a child's birthweight and that these were merged in the EPPE project. The full list of the variables and their contributions to measures of combined at exit from pre-school can be seen in Tables 4.9 and 4.10 and these are presented after consideration is first given to the fit indices of the statistical models (see Table 4.8).

Prior to the consideration of fit indices, Figure 4.3 illustrates the simultaneous estimation of child and family level latent combined risks[108] and the impact of both upon the General Cognitive Ability of young children at the averages ages of 36 and 58 months. Figure 4.3 demonstrates both the statistical modelling that is reported in this Section as well as where the comparisons between the three separately estimated models can be found in the subsequent subsections of this chapter. This is accomplished by directing the reader to where the illustrated fit indices, factor loadings, and regression coefficients can be found in the subsequent tables.

[108] Note, no correlation was specified between the latent risk composites as the individual risks which formed these (via, "formative measurement", see Chapter 2, Section 2.4.3) were themselves correlated

Figure 4.3 The impact of dual combinations of risks (child and familial) to the General Cognitive Ability of young children at average ages 36 and 58 months[109]



[a] Correlations between all individual risks (irrespective of child or family) were also specified in this model and can be found in Chapter 3 (see Tables 3.3 - 3.5)

[b] Six dummy-coded *'ethnic minority'* dichotomies in reference to category *'White'*

[109] Using ordinal and dichotomous child level risks

[c] Unstandardardised factor loadings set to 1 so there is no returned significance level

*$p < .05$ **$p < .01$ ***$p < .001$

4.2.1 Indices of Model Fit

Table 4.8 reveals the fit indices of the six models that were analysed in this part of the investigation. Although all models were found to display excellent model fit, the indices of Table 4.8 nevertheless reveal systematic differences between the single and dual level approaches to the measurement of combined risk. Regardless of the developmental outcome at 58 months or the domain of development under investigation, modelling dual levels of risk led to consistently higher indices of fit. In turn, this indicated that modelling separate combinations of risks was a solution that was better suited to representing the variances and co-variances that were present in the data.

Table 4.8 Model fit of the Confirmatory Factor Analyses that tested multiple levels of combined risk to development

	Social Development Latent composites:		**Cognitive Development** Latent composites: With Self Regulation at 58 months		With Anti-social / Worried Behaviour at 58 months	
Tests of model fit	With a single level of risk	With dual levels of risk	With a single level of risk	With dual levels of risk	With a single level of risk	With dual levels of risk
1. Chi-Square Test of Model Fit	79.7	74.7	313.5	275.4	295.9	252.3
degrees of freedom	*25*	*24*	*125*	*120*	*125*	*120*
P-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
2. Comparative Fit Index	0.982	0.983	0.969	0.974	0.971	0.977
3. Tucker-Lewis Index	0.961	0.963	0.957	0.963	0.960	0.968
4. Root Mean Square Error of Approximation	0.028	0.027	0.023	0.021	0.022	0.020
Probability RMSEA <= 0.05	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*

4.2.2 Factor Loadings

Table 4.9 presents the factor loadings that were associated with the single and dual models of combined risk predicting General Cognitive Ability at entry to, and exit from, pre-school. Of the significances and weightings that were associated with each

risk, the impact of modelling dual levels of risk is revealed. For each of the significant risks that are highlighted in **bold** in Table 4.9, the relative contribution of each of these to a latent combined measure can be seen to increase when dual levels of risk were estimated. Furthermore, these increases in factor loadings varied considerably between each of the levels of risk such that the increase in the factor loadings of the familial level risks was much smaller than those of the child level risks. It appeared that whist the notional division of risks by their ecological levels had universal implications for all significant factor loadings; these are also systematically differentiated across the ecological levels which offers immediate support for the division of risks.

In summary, Table 4.9 shows that, regardless of the representation of combined risk as either one level or two, there was a consistency to those risks which were significant predictors of a combined measure. For risks proximal to the child these included: being a boy, speaking English as an additional language, lower birth weight, having a greater number of siblings, and belonging to a black, Pakistani, or mixed ethnic group. Conversely, for risks *distal* to the child and more proximal to the family, significant predictors included: lower total family salary, lower maternal qualifications and age, a greater number of non-parental home carers, and a poorer quality Home Learning Environment.

As a brief aside and pre-empting discussion of the analyses that investigated social development, many of the significant individual risks to cognitive development were consistent across this domain as well. These included: being a boy, speaking English as an additional language, lower birth weight, belonging to a black ethnic group, lower mothers' qualifications and ages, and a poorer quality Home Learning Environment. At the same time however, there were also risks that were specific to not only a single domain, but also some that were specific to the measure of development at exit from pre-school at mean age 58 months.

Table 4.9 Standardised factor loadings of potential risks to cognitive development for both single and dual levels of combined risk

	Potential Risk Factors. *Standardised factor loadings*	With a single level of risk	With dual levels of risk
Child Variables			
1	Male gender	**0.12*** **	**0.30*** **
2	English an Additional Language?	**0.24*** **	**0.58**[a]
3	Birth weight	**-0.15*** **	**-0.33*** **
4	No. of siblings	**0.12****	**0.24***
5	Birth order	0.02	0.09
6a	Bangladeshi? *(all 6 dummy coded -*	0.06	0.14
6b	Black? *against 'White?')*	**0.08****	**0.20****
6c	Indian?	-0.01	-0.01
6d	Mixed ethnicity?	**0.07****	**0.17***
6e	Other ethnicity?	0.02	0.04
6f	Pakistani?	**0.12*** **	**0.26***
7	"Any event affected your child's development?"	0.02	0.03
Family Variables			
1	Family salary	**-0.14****	**-0.18****
2	Mother's occupational status	-0.03	-0.04
3	Partner's occupational status	-0.05	-0.06
4	"Highest status in family?"	-0.10	-0.13
5	Mother's qualifications	**-0.23*** **	**-0.29*** **
6	Partner's qualifications	-0.07	-0.09
7	"Mother working?"	0.02	0.01
8	"Partner working?"	-0.03	-0.03
9	"Either parent working?"	-0.07	-0.09
10	"Two parent family?"	0.02	0.03
11	Mother's age	**-0.08***	**-0.11***
12	Partner's age	-0.01	-0.01
13	No. of non-parental carers	**-0.11*** **	**-0.13*** **
14	Home Learning Environment	**-0.31**[a]	**-0.38**[a]

[a] Unstandardardised factor loadings set to 1 for model convergence so there is no returned significance level

*$*p < .05$ **$p < .01$ ***$p < .001$*

The results that are shown in Table 4.10 support those of Table 4.9 by presenting the risk comparisons that were conducted on young children's social (rather than cognitive) development with either self regulation or anti-social/worried behaviour at

exit from pre-school (at ~58 months). As with the results of the cognitive analyses, the results of Table 4.10 indicate that modelling dual risks led to noticeable increases in size of the factor loadings that were associated with child level risks. However, there are noticeable differences in the magnitude of the factor loadings associated with these risks relative to the developmental measure at 58 months. For example, whilst a child's gender had a bigger impact upon the combined risk to their self regulation than their anti-social/worried behaviour, this relationship was reversed for speaking English as an additional language. Such findings warrant not only the contextualisation of risks by developmental domain, but taking this a step further, by the contextualisation of risks by developmental outcome. Table 4.10 shows that altering even a single measure of development can alter the nature of a combined risk when it is derived from a CFA procedure using formative measurement.

A further noticeable difference between the results that are presented in Tables 4.9 and 4.10 are the varying effects that modelling dual levels of risks had on the factor loadings associated with family level risks. Whilst these were consistently similar to those of child level risks when examining cognitive development, this was not the case for social development. For self regulation, the effects of measuring two levels of risk are similar to those observed for cognitive development and GCA but for anti-social/worried behaviour, a different pattern can be observed. Despite only differing from the self regulation analyses in the replacement of this single variable, Table 4.10 shows that this led to a previously unobserved effect of occasionally reducing the significance and magnitude of the contribution of a risk (i.e. family salary, "mother working"). This disparity in the consequences of modelling combined risk as either single or dual levels further evidences the sensitivity of the CFA approach to modelling a risk that is relative to the developmental outcome which it predicts. Unlike a Cumulative Risk alternative, the CFA approach makes fewer assumptions concerning the structure of a combined risk measure across varying developmental outcomes; in the CFA approach these are permitted to vary.

Table 4.10 Standardised factor loadings of potential risks to social/behavioural development for both single and dual levels of combined risk

	Potential Risk Factors. *Standardised factor loadings*	With **Self Regulation** at 58 months		With **Anti-social / Worried Behaviour** at 58 months	
		With a single level of risk	With dual levels of risk	With a single level of risk	With dual levels of risk
Child Variables					
1	Male gender	**0.50*** **	**0.80*** **	**0.41*** **	**0.60*** **
2	English Additional Language?	**0.24*** **	**0.43**[a]	**0.34*** **	**0.53**[a]
3	Birth weight	**-0.19*** **	**-0.33****	-0.10	**-0.20***
4	No. of siblings	0.04	0.13	0.06	0.27
5	Birth order	0.07	0.15	0.13	0.24
6a	Bangladeshi? *(all 6 dummy coded against 'White?')*	-0.03	-0.03	-0.07	-0.05
6b	Black?	-0.05	**-0.18***	-0.04	**-0.20***
6c	Indian?	-0.03	-0.08	-0.01	-0.03
6d	Mixed ethnicity?	0.00	-0.01	0.01	-0.03
6e	Other ethnicity?	0.04	0.07	0.08	0.09
6f	Pakistani?	0.01	-0.02	-0.01	0.00
7	"Any event affected your child's development?"	0.02	0.03	0.00	0.00
Family Variables					
1	Family salary	-0.13	-0.18	**-0.23***	-0.23
2	Mother's occupational status	-0.06	-0.03	-0.10	-0.05
3	Partner's occupational status	0.06	0.03	0.09	0.02
4	"Highest status in family?"	-0.21	-0.31	-0.21	-0.31
5	Mother's qualifications	**-0.13***	**-0.24***	-0.10	**-0.24***
6	Partner's qualifications	0.02	0.06	0.16	**0.27***
7	"Mother working?"	-0.07	-0.03	**-0.16***	-0.13
8	"Partner working?"	0.06	0.09	0.05	0.07
9	"Either parent working?"	-0.02	-0.04	0.08	0.00
10	"Two parent family?"	-0.00	0.03	-0.01	0.04
11	Mother's age	**-0.16***	**-0.23***	**-0.18***	**-0.26***
12	Partner's age	**0.17***	**0.22***	**0.18***	**0.22***
13	No. of non-parental carers	0.04	0.07	0.05	0.10
14	Home Learning Environment	**-0.42**[a]	**-0.63**[a]	**-0.40**[a]	**-0.65**[a]

[a] Unstandardardised factor loadings set to 1 for model convergence so there is no returned significance level

*$p < .05$ **$p < .01$ ***$p < .001$

4.2.3 Predicting Cognitive Development at Entry to, and Exit from, Pre-school

The results that are presented in Table 4.11 complement those of Table 4.9 where modelling dual rather than single levels of combined risks increased the magnitudes of the contributions that were associated with each significant risk. Table 4.11 shows that although the bifurcation of combined risk did not increase the power of the statistical analysis to predict children's development (constant total explained variances), it nonetheless differentiated the origins of the risk effect by ecological level. When modelling dual levels of combined risk, it was the family level risk that had the biggest impact upon children's cognitive skills even whilst controlling for its earlier impacts and the impacts of development on itself over time (value added, see Figure 4.1).

Although neither the child nor familial levels of combined risk had impacts that were equal in magnitude to the single level of risk, if one were to add their effects, then a larger overall effect would result (in terms of β). Conversely, the fact that the effects of child level combined risk plus family level combined risk are not equal to that of the single level of risk indicates a degree of overlap between the two measures. This is perhaps unsurprising given that some of the individual risks (notably ethnicity) were likely to be indicative of not only the child but also their family. Although one could argue that such variables should have been specified as risks at both levels, including them as indicative of primarily the child or the child's family more accurately reflected the nature of the questions themselves and was preferable to assuming that the characteristics of a child had to have been matched by their parent(s). For example, it could be possible for a child's ethnicity to differ from its parents by the descriptive labels that parents chose to adopt ("mixed" or "other" for example) or, alternatively, if the child was raised in a non-nuclear family (step-parent/s) or adopted.

Table 4.11 Impact of each method of measuring the combined risk to young children's cognitive development during pre-school

	At Mean Age 36 months			At Mean Age 58 months		
Predicting General Cognitive Ability (GCA)	Standardised regression coefficient (β)	Standard Error	Total explained variance (r^2)	Standardised regression coefficient (β)	Standard Error	Total explained variance (r^2)
With a single level of risk	**-0.57*** **	0.02	0.32	**-0.26*** **	0.01	0.56
With dual levels of risk						
Child level	**-0.26*** **	0.03	0.32	**-0.08*** **	0.01	0.56
Familial level	**-0.44*** **	0.02		**-0.22*** **	0.01	

4.2.4 Predicting Social and Behavioural Development at Entry to, and Exit from, Pre-school

Although Table 4.12 differs in its means of presenting results, it nevertheless serves as the counterpart to Table 4.11 in that it compares the effects of modelling different levels of risk but with a focus on social/behavioural development. Mirroring the trend in the results that was observed in the formative factor loadings (Tables 4.9 and 4.10), the results of Table 4.12 are both consistent with, and yet also different from, those that were found for cognitive development and that are illustrated in Table 4.11. The pattern of results is similar in two ways: first, that regardless of the number of latent risks, the total percentage of explained variance does not increase; and second, that when the single level of risk was broken down into two levels, differential impacts of child and familial levels of risk can be seen.

At the same time however, Table 4.11 also indicates an effect of bifurcating the single level of combined risk that was not observed in the cognitive analyses. The significant impact of familial level risk to anti-social (at 36 months) and anti-social/worried behaviour (at 58 months) was lost when these effects were combined with those of the child level risk. Not only does modelling a single level of risk appear to mask important differences between the contributions of child and family level risks, but it also appears to mask the significant effects of risks when only one of the two levels is significant.

Table 4.12 Impact of each method of measuring the combined risk to young children's social/behavioural development during pre-school

ting social / oural skills	At Mean Age 36 months. *ASBI Factors* Co-operation & Conformity	Peer Sociability	Confidence	Anti-social Behaviour	Worried/Upset Behaviour	At Mean Age 58 months. *CSBQ Factor*
Self Regulation at 58 months:						
single level of risk:						
l Explained ariance (r^2)	0.08	0.06	0.06	0.00	0.00	0.21
tandardised Regression efficient (β)	**-0.29*** **	**-0.25*** **	**-0.24*** **	0.04	0.03	**-0.27*** **
ıdard Error (SE)	0.02	0.01	0.01	0.01	0.01	0.01
ual levels of risk:						
r^2	0.08	0.06	0.06	0.01	0.00	0.21
Child level						
β	**-0.18*** **	**-0.17*** **	**-0.11*** **	-0.03	0.01	**-0.15*** **
SE	0.02	0.02	0.02	0.01	0.01	0.02
ımilial level						
β	**-0.19*** **	**-0.14*** **	**-0.20*** **	**0.07** **	0.02	**-0.19*** **
SE	0.02	0.02	0.02	0.01	0.01	0.02
Anti-social/Worried Behaviour at 58 months:						
ı single level of risk:						
r^2	0.09	0.07	0.07	0.00	0.00	0.15
β	**-0.29*** **	**-0.27*** **	**-0.25*** **	0.03	0.02	0.04
SE	0.02	0.02	0.01	0.01	0.01	0.01
dual levels of risk:						
r^2	0.08	0.07	0.07	0.01	0.00	0.15
Child level						
β	**-0.16*** **	**-0.20*** **	**-0.12*** **	-0.05	-0.01	-0.03
SE	0.03	0.03	0.02	0.02	0.01	0.01
'amilial level						
β	**-0.19*** **	**-0.14*** **	**-0.20*** **	**0.07** **	-0.03	**0.08*** **
SE	0.02	0.02	0.02	0.02	0.01	0.02

4.3 Conclusions

This chapter presented a systematic exploration into the assumptions that underpin the statistical method traditionally used to represent the effects of developmental risks in combination, that of the Cumulative Risk Index. Through comparing a Cumulative Index of risks against the previously undocumented alternative of Confirmatory Factor Analysis using formative measurement, differences were found that favoured

the factor analysis. The factor analysis procedure demonstrated greater predictive power of young children's cognitive and social development while it systematically tested (through omission) two of the assumptions implicit in cumulative risk indices. In turn, these were that it is valid and reliable to dichotomise risks that are measured on an ordinal or continuous scale, and that individual dichotomous risks may be summed together to produce a reliable measure of their effects in combination.

After the two assumptions implicit to Cumulative Indices were tested and shown to be unreliable and misleading in their effects, this chapter then took the examination of combined risks a stage further by testing the assumption that it was valid to omit the ecological levels that individual risks pertained towards. Based on the findings of the first half of this chapter (Section 4.1), the second made use of the same analytic framework to conduct comparisons that examined the impacts of modelling a single level, or dual levels of combined risk where each level corresponded to a different ecological level (child or familial). Results indicated that modelling a single level of risk masked systematic variations between the two levels not only in their contributions to children's development, but also between the individual risks that formed the combined measures as well.

In summary, the purpose of this chapter was to explore the methodology that lies at the heart of much of the research that investigates vulnerable and resilient developmental pathways. Because determining resilience is reliant upon first establishing the nature and effects of risk, so problems with the pre-existing methodology of measuring the effects of risks in combination had to first be overcome. The results of this chapter serve as the foundation upon which an attempt can be made to ascertain whether or not programs of early education can facilitate resilience to the combined impacts of developmental risks. By utilising a new and hopefully improved approach to the measurement of these risks in combination, a more reliable examination of early education promoting resilience can be conducted.

5. RESULTS III: CAN QUALITIES OF PRE-SCHOOL PROTECT DEVELOPMENT?

This chapter is divided into two sections which present the results of separate and distinct analyses that, when taken together, mutually inform one another and serve to answer the central research questions of this thesis. The first of these sections and analyses (Section 5.1) draws upon the findings of Chapter 4 and examines whether the qualities of pre-school/early education can mitigate the impacts of *child* and *familial* levels risks to both the *cognitive* and *social/behavioural* skills of young children at exit from pre-school/entry to reception. This section also examines the impacts that risks and their moderation have upon subsequent within-domain developmental pathways during Key Stage 1. However, because the effects of risks are conceptualised as being distinct for different domains of development, Section 5.1 conducts *independent* examinations of first young children's cognitive abilities, and then subsequently also their social/behavioural skills.

The second section of this chapter (Section 5.2) builds upon the first with the sole examination of young children's developmental pathways and the impacts of their abilities at entry to reception. It extends the first by conducting a new analysis that *simultaneously* examines *both* cognitive *and* social/behavioural pathways and also their influence upon one another over time (entry to pre-school to end of Key Stage 1). Although omitting the previously specified impacts of risks, this analysis complements that of the first section by being a more comprehensive examination of developmental pathways than was possible when simultaneously modelling the effects of combined latent risks and their interaction with the qualities of pre-school. Taken together, the analysis conducted in these two sections examines the impacts of domain-specific developmental risks (Section 5.1), the mitigation of their effects during the pre-school period (Section 5.1), and consequences that both have for subsequent developmental pathways (sections 5.1 and 5.2).

5.1 Protection at Entry to Reception

The separate effects of independently tested combined *familial* and *child* level risks to children's skills and abilities at entry to reception were hypothesised to be moderated by the qualities of the pre-schools that they attended. Based on the findings of previous research it was assumed that the greater the process and structural qualities of pre-school, the smaller would be the impact of risks upon cognitive and social

abilities. If evidence of such moderation was found, then this would support a conclusion that for young children who had developed in the context of significant developmental risks, their skills and abilities were *protected* against rather than limited due to their *vulnerability*. In turn, any evidence of protection would suggest that these young 'at-risk' children had shown *resilience* to the impact of risks that would have, on average, otherwise impaired their development.

Extending these hypotheses to developmental pathways during Key Stage 1, if significant developmental risks during the pre-school period were found to remain detrimental to key skills at entry to reception, then these risks were likely to promote vulnerability in subsequent developmental pathways. Furthermore, if pre-schools were found to mitigate these impacts, then this provides evidence that protecting developmental abilities at entry to primary school (reception) can foster subsequent resilience in children whose development had been at risk.

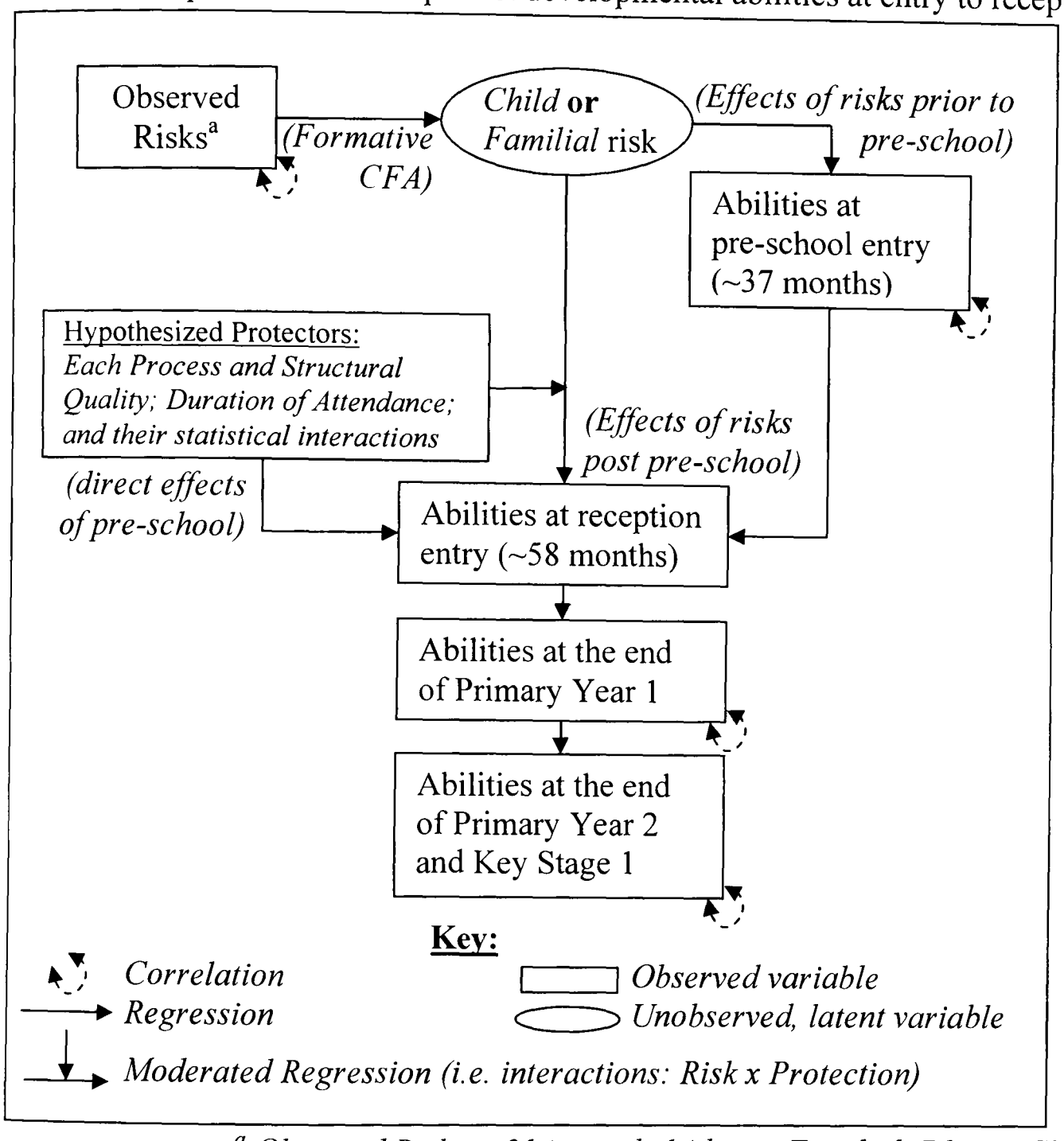
5.1.1 Initial Models

This section details a set of analyses that were shaped by several considerations which originated from the research literature on resilience together with the nature of this investigation and its dataset. Discussed earlier, previous studies of risk and resilience led this investigation to derive combined measures of risk (Chapter 4, Section 4.1) and differentiate them according to their ecological levels (Chapter 4, Section 4.2). Following on, the analyses reported in this fifth chapter documents the identification of protected development via statistically significant multiplicative interaction terms of the form: *Risk x Protection.*

The analyses documented in this chapter were shaped by the project design of the original EPPE project and the data that it gathered. This included the need to control for the effects of children being nested within pre-schools, missing data imputation as attrition is a particular problem for longitudinal studies (Goldstein, 1979), and the explicit adoption of a developmental perspective. The last of these, the developmental perspective, was achieved by the analyses taking into account: a) children's skills and abilities when they entered the EPPE project, and b) the impacts that risks might already have already had prior to the children starting pre-school. In designing an analysis that represented these considerations, aggregated Structural Equation Models

(SEM) were developed and used to test each of the hypotheses of risk moderation (see Figure 5.1).

Figure 5.1 *Stylised* path diagram illustrating the Structural Equation Models used to establish whether pre-school could protect developmental abilities at entry to reception



[a] *Observed Risks = 21 in total; 14 being Familial, 7 being Child.*

Figure 5.1 presents a stylised representation of the analyses that were used in this investigation and which were tested using the Mplus statistical software package (L. K. Muthén & Muthén, 2004). Structural Equation Models (SEM) were specified to examine the relationships between combined latent risks, the independent developments of children's cognitive and social abilities, and the quality and duration of attendance at pre-school. A series of analyses were conducted in which each measure of quality was independently examined to determine whether it was able to significantly moderate the effects of each of the combined risks within separate

domains of development. In addition, duration of attendance was also tested alongside the measures of quality, both as a risk moderator and as a moderator of any effects of quality. In testing the hypotheses of moderation, three multiplicative statistical interaction terms were used that took the forms: *quality x risk; duration x risk;* and *(quality x duration) x risk.*

Despite the repeated analyses (Figure 5.1) varying the examined risks, developmental domains, and the measured aspects of pre-schools, the relationships between these differed in their consistency across the models. Whilst risks and the aspects of pre-school had impacts upon reception entry developmental abilities that varied by each of the qualities, there were also more consistent relationships. These included the formative risk factor loadings, the impacts of risks to development at entry to pre-school, and the impact of developmental abilities upon these same abilities later in time. This disparity in the consistency or otherwise of the relationships that were measured in this series of analyses makes it necessary to divide the presentation of results into two parts: *'pre-school quality invariant'* and *'pre-school quality variant'* relationships. Each of these is presented in turn after discussion first turns to the assumptions of the Structural Equation Models that were accepted in this series of analyses and consideration is paid to the fit indices of the tested statistical models.

Assumptions of the tested Structural Equation Models

Underpinning the SEM that were tested in the analyses of this chapter and illustrated in Figure 5.1 are assumptions that were accepted either on the basis of previous studies, or obliged to be accepted due to the statistical modelling procedures that were used. In order for the analyses, modelling procedures, and thus results to be clearly understood and validated, it is important that each assumption be presented and discussed. The aim of this section of the chapter is to summarise the assumptions that underpinned the analyses. Discussion of the impacts of these assumptions upon the validity of the results is returned to in Chapter 6 (Discussion and Conclusions).

The primary set of assumptions and compromises that were accepted by this series of analyses are the same as those that were presented in Chapter 4 due to the CFA risk analyses of this previous chapter being built upon here. To this end, the first of the repeated assumption made by these analyses was that it remained valid to conduct

independent analyses into each domain of children's development that omitted cross domain effects in development effects over time. Although the negative impact that this has upon the ecological validity of the results remains partially mitigated by the benefits to validity brought about by the CFA technique, the analyses of this fifth chapter further mitigates this limitation in two ways. First, it was necessary to independently test each interaction effect (due to the complexity of their statistical modelling) and this would have compartmentalised the analyses anyway to achieve the same negative impact upon ecological validity. Second, the final part of this chapter (Section 5.2) addresses the lack of cross domain developmental effects with a focus upon these alone. Although this separate analysis does not provide a perfect solution, it does provide this chapter with a means of establishing the importance of the protective effects that are identified for subsequent developmental pathways. The stronger the impact of reception entry abilities upon development during Key Stage 1, then the more important it becomes to protect these abilities such that children display resilience.

However, the provision of further evidence to support the compartmentalisation of the analyses undertaken in this chapter does not completly mitigate the drawbacks associated with this statistical strategy, and is itself open to criticism. Namely, it could be argued that instead of testing each aspect of pre-school quality in separate analyses, a valid alternative would have been to specify a latent construct of 'pre-school quality' and have it reflected in the 13 separate measurements of quality that were taken. However, specifying such a construct would have been theoretically inappropriate due to the running theme present throughout this thesis - conceptually driven methodological sensitivity to the substantive research questions. Creating a latent construct of 'pre-school quality' would not only have provided a less sensitive measurement of quality, but subsequently also hindered the likelihood of detecting whether quality could protect development. This is based upon the fact that a more generic measure of quality would have obliged protective effects to have been consistent across its component indicators; it would not have been possible to then detect any variation in protection that was offered by different qualities.

Another assumption carried over into these analyses from the CFA procedures that were documented in Chapter 4 was the relativity of the combined risk measures.

Whilst this relativity is beneficial when differentiating the nature of risks according to developmental domain and outcome (thereby increasing the sensitivity of measurement), for this chapter it is also detrimental in that it limited the variables that could be specified as partially dependent upon the risks. Because combined risk was conceptualised as being specific to development and specifying development as dependent upon risks shaped the risk measures, so specifying non-developmental measures as also dependent upon the risks would not only have changed the structure of the combined risks, but also made them less specific to children's development itself. As such, the analyses illustrated in Figure 5.1 contains no estimate of whether the quality of the pre-schools that the children were enrolled in was predicted by the risks that the children experienced (potentially, '*risk-activated protection*' Masten and Powell, 2003). At the same time however and given the paucity of previous research, it must be remembered that the aim of this investigation was to establish whether pre-school could protect, *not* the means by which this might occur, *nor* unraveling the processes behind this. To have specified such questions would have been to presume that there was a protective relationship in the first place.

Returning to the assumption that it was valid to conduct repeated SEM in these analyses rather the testing of a single model, it is accepted that an ideal analysis would have simultaneously included all: 6 latent risks; 14 measures of pre-school; and 24 measures of young children's cognitive and social development. Further, such a model would also have tested all of the 2 and 3 way latent interaction effects between risk and pre-school and included these in the single model as well. However, such an analysis was completely unfeasible given the statistical sensitivity of interaction effects; the complexity of specifying the CFA combined risks; and the compounded complication of testing interaction effects that featured these latent combined risks. Although this serves as partial justification of the compartmentalisation of the analyses[110], it is acknowledged that this division could also distort fit indices. However, the very specification of latent interaction terms (*latent combined risks x observed pre-school qualities*) prevented the calculation of absolute fit indices (e.g. the CFI) and the validity of the risk measurement part of the model (the CFA

[110] Including the separate estimation of each level of risk rather than the simultaneous estimation of *child* and *familial* as in Chapter 4, Section 4.2.

approach to risk measurement) had already been explored and demonstrated earlier in this work (see Chapter 4).

The final assumption carried over from Chapter 4 again concerns the relativity of the risk measurement but is an assumption that was accepted on the basis of the research literature rather than a compromise obliged by the analytic techniques employed. Despite measures of development being included from mean ages 3 to 7, risks were only specified as impacting development during attendance at pre-school. The reasons for this were twofold. First, there was no repeated measurement of theoretically time and child-age varying risks (e.g. what constitutes a good Home Learning Environment for different aged children?). Second, the impacts of some individual risks were shown to vary over time (e.g. EAL and child gender, see Chapter 3) and the specification of a combined risk as impacting an increasing period of development (e.g. ages 3 to 7 rather than 3 to 4½) would have ignored these time varying impacts.

Despite the assumptions and compromises that were accepted or that were obliged to be accepted by the analyses of this chapter, the analyses illustrated in Figure 5.1 were designed to be "fit for their purpose" which was to investigate whether pre-school quality could protect development and thus contribute to resilience in the developmental trajectories of young children. Although the separate testing of different measures of quality and developmental domains allowed for the variation in this quality to be explored, this was a subsidiary aim of this investigation. Furthermore, many of the criticisms that could be levelled at the analyses of Figure 5.1 concern research questions which are dependent upon there being protective effects in the first place. For example, although it is undeniably of conceptual importance to establish the extent to which protection is activated by risks, or the pre-school mechanisms that underlie higher quality, both of these questions lay beyond the scope of this study. In fact, such questions provide direction for future research, a topic that is returned to in Chapter 6.

Fit Indices of the tested Structural Equation Models

Although Structural Equation Modelling typically involves estimating how closely the statistical models fit their data (e.g. the Comparative Fit Index, CFI; Bentler, 1990), it was not always possible to obtain these indices in this series of analyses. When *latent* interaction terms were statistically examined (i.e. *latent* risk x *observed* aspect of pre-school) the Mplus package was unable to calculate fit indices other than those that are used solely for differentiating alternative models (e.g. the Akaike Information Criterion (AIC; Akaike, 1974). Because of this limited availability of fit indices, there was a lack of empirical evidence to rely upon in determining how successful a given model was for replicating the data that was used within it (when modelling latent interactions). However, the use of these indices as an indicator of model validity has also been cautioned against by Kenny (2008) and this supports the argument that a lack of fit indices does not necessarily prohibit an interpretation of the results that were obtained.

Table 5.1 presents the fit indices of the Structural Equation Models that were specified to test the initial impacts of combined risks on development and to reveal their compositional structures. Analysing the fit of these initial models prior to simultaneously considering the effects of pre-school partially served to offset the lack of fit indices once latent interaction terms were introduced. The results in Table 5.1 reveal that the same statistical model (illustrated in Figure 5.1) was able to accurately replicate the data that were used within it even when different domains of development were being statistically examined.

Examining the fit indices of Table 5.1, the CFI was consistently identified as being close to its upper limit of 1 (0.99 for both), as was the Tucker-Lewis Index (0.98, 0.97; TLI, Bentler, 1990). Both of these results suggest a high degree of model fit between the hypothesised models and the patterns in the data that was used to test them. At the same time, the Root Mean Square Error of Approximation (RMSEA) was found to lie within a range that has also been associated with a high degree of model fit (0.025, 0.031; see M. W. Browne & Cudeck, 1993).

Table 5.1 Model fit indices for the Structural Equation Models including only developmental abilities and developmental risks

Tests of model fit	Examining only **Child** level combined risks			Examining only **Familial** level combined risks		
	In the Cognitive Model	In the Self Regulation Model	In the Antisocial Behaviour Model	In the Cognitive Model	In the Self Regulation Model	In the Antisocial Behaviour Model
1. Chi-Square Test of Model Fit	2274.50	150.74	134.05	47.81	119.66	118.91
degrees of freedom	*25*	*55*	*55*	*13*	*65*	*65*
P-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
2. Comparative Fit Index (CFI)	0.99	0.98	0.98	0.99	0.99	0.99
3. Tucker-Lewis Index (TLI)	0.98	0.97	0.97	0.97	0.98	0.98
4. Root Mean Square Error of Approximation (RMSEA)	0.025	0.025	0.020	0.031	0.017	0.017

Pre-school Quality *In*variant Formative Factor Loadings of Individual Potential Risks.

Table 5.2 reveals the individual formative factor loadings of each of the variables that was theorised to be a potential risk to young children's development. Whilst some individual risk factors were found to be significant across both developmental domains and for all measures of development taken at entry to reception (e.g. birthweight), others were instead limited to just one of the domains (e.g. number of siblings) or for one outcome at entry to reception (e.g. whether or not a mother was working). In addition to this differential risk composition across developmental domains, Table 5.2 also reveals sizeable differences between the individual contributions of each risk to their respective combined measure. For example, Home Learning Environments made sizeable contributions (relatively large standardised beta regression coefficients) to the overall level of developmental risk that was specific to the family. By comparison, variables indicative of SES (salary, education, occupational levels) made contributions that were consistently smaller in their magnitudes. This particular differentiation in size of contribution indicated that for children's development, it was what parents did, rather than who parents were, that was of greatest importance for their children's development (see also Melhuish, Sylva, Sammons, Siraj-Blatchford, Taggart, Phan, and Malin, 2008).

Table 5.2 Potential child and family level risks to cognitive and social/behavioural development: Standardised factor loadings

Measures indicating possible risks to Developmental Skills and Abilities	Factor Loadings (*standardised βs*) In the Cognitive Models	In the Self Regulation Models	In the Antisocial Behaviour Models
Child level Measures			
Male gender	**0.28*****	**0.73*****	**0.59*****
English additional language?	**0.48**[a]	**0.45**[a]	**0.55**[a]
Birth weight	**-0.37*****	**-0.34*****	**-0.21***
No. of siblings	**0.25****	0.16	0.25
Birth order	0.12	0.14	0.19
Bangladeshi?	**0.12***	0.00	-0.01
Black?	**0.25*****	-0.03	-0.02
Indian?	0.01	-0.04	-0.01
Mixed ethnicity?	**0.14****	0.01	0.02
Other ethnicity?	0.09	0.10	**0.13***
Pakistani?	**0.31****	0.09	0.10
"Any event affected your child`s development?"	-0.03	0.00	-0.01
Familial Level Measures			
Family salary	**-0.17****	-0.17	**-0.25***
Mother's occupational status	**-0.19****	-0.19	-0.28
Partner`s occupational status	-0.10	0.06	0.06
"Highest status in family?"	-0.01	-0.14	-0.10
Mother`s qualifications	**-0.25*****	**-0.17***	-0.14
Partner's qualifications	0.00	0.06	**0.24***[b]
"Mother working?"	-0.02	-0.13	**-0.23****
"Partner working?"	**-0.09***	0.02	0.00
"Either parent working?"	-0.08	0.01	0.09
"Two parent family?"	0.02	0.00	0.00
Mother's age	-0.08	**-0.17***	-0.18
Partner's age	0.02	**0.21***[b]	**0.24***
No. of non-parental carers	**-0.14*****	0.04	0.04
Home Learning Environment	**-0.45**[a]	**-0.69**[a]	**-0.68**[a]

$*p < .05$ $**p < .01$ $***p < .001$

[a] *Unstandardised factor loadings set to 1 so there is no returned significance*

b Counter-intuitive perhaps due to tight controls over the other potential risk effects

Pre-school Quality *In*variant Impacts of Combined Risks to Development at Entry to Pre-school

The results revealed in Table 5.2 cannot be described as presenting the contributions of significant risks to development solely on the basis of this table. Because this study did not conceptualise individual measures to be risks in isolation from one another, the impacts of these measures must be examined *in combination* in order to determine whether they constituted risks to development. Tables 5.3 and 5.4 reveal the impacts of the combined levels of risks to children's development at entry to pre-school[111]. Both tables reveal that the combined measures of risk had large and statistically significant deleterious effects upon both cognitive and social/behavioural development when children entered pre-school at the mean age of 36 months.

However, the magnitudes of the relationships between risks and development at entry to pre-school (Tables 5.3 and 5.4) were not consistent across the two domains: combined risks had much larger effects upon young children's cognitive rather than social development. Whilst the largest of all the significant impacts was that of familial level combined risk lowering the average level of General Cognitive Ability (GCA; $\beta = -0.53$, $p<0.001$), the smallest was again found for this level of risk, but instead led to a slight increase in the average amount of anti-social behaviour ($\beta = +0.06$, $p<0.05$). Furthermore, this variation in effects across the developmental domains is also reflected in the proportions of variance (r^2) that were explained by the combined risks. Larger effects between measures of combined risks led to larger proportions of variance being explained which varied from 27% (familial risk and GCA) to 0.00% (2 d.p.; familial risk and anti-social behaviour).

Table 5.3 Impacts of child and familial levels of combined risk to young children's cognitive development at *entry* to pre-school

General Cognitive Ability (GCA) at mean age 36 months	Standardised regression coefficient (β)	Standard Error (SE)	Total explained variance (r^2)
Child level	**-0.38*** **	*0.04*	*0.15*
Familial level	**-0.53*** **	*0.02*	*0.27*

*$p < .05$ **$p < .01$ ***$p < .001$

[111] Tables 5.3 and 5.4 present partial results of 6 models: each level of risk (2) relative to each of the 3 developmental measures assessed at entry to reception. These are the same models as in Table 5.1

Focussing on the impacts of child and family level combined risks to young children's social/behavioural development; Table 5.4 illustrates substantial variation across each of the five ASBI factors that were measured when children entered pre-school. Whilst the largest effects of both levels of risk were found upon Co-operation & Conformity, Peer Sociability, and Confidence, the smallest were upon Anti-social and Worried/Upset Behaviour. Furthermore, these were effects that were found regardless of the social behavioural measure modelled at exit from pre-school and which were approximately equal in magnitude regardless of the level of the combined risk that was examined. This equality was in stark contrast to the impacts of the combined risks to GCA at entry to reception where familial risk had a much larger effect that found for child. Such differentiation suggests that it is cognitive rather than social/behavioural development that is more greatly influenced by the social background of the family.

Table 5.4 Impacts of child and family levels of combined risk to young children's social/behavioural development at *entry* to pre-school

	Predicting social/behavioural skills **at mean age 36 months**. *(ASBI Factors)*				
	Co-operation & Conformity	Peer Sociability	Confidence	Anti-social Behaviour	Worried/Upset Behaviour
In the statistical models examining Self Regulation (at 58 months):					
Child level					
β	**-0.23*** **	**-0.22*** **	**-0.17*** **	0.01	0.02
SE	*0.03*	*0.03*	*0.03*	*0.02*	*0.01*
r^2	*0.05*	*0.05*	*0.03*	*0.00*	*0.00*
Familial level					
β	**-0.24*** **	**-0.20*** **	**-0.23*** **	**0.06***	0.02
SE	*0.02*	*0.02*	*0.02*	*0.02*	*0.02*
r^2	*0.06*	*0.04*	*0.05*	*0.00*	*0.00*
In the statistical models examining Anti-social/Worried Behaviour (at 58 months):					
Child level					
β	**-0.23*** **	**-0.24*** **	**-0.18*** **	0.00	0.01
SE	*0.04*	*0.03*	*0.02*	*0.02*	*0.02*
r^2	*0.05*	*0.06*	*0.03*	*0.00*	*0.00*
Familial level					
β	**-0.24*** **	**-0.22*** **	**-0.24*** **	0.05	0.02
SE	*0.02*	*0.02*	*0.02*	*0.02*	*0.02*
r^2	*0.06*	*0.05*	*0.06*	*0.00*	*0.00*

*$p < .05$ **$p < .01$ ***$p < .001$

Pre-school quality *In*variant Impacts of developmental abilities upon themselves over time

The final sets of pre-school quality invariant relationships that are now presented concern the relationships that were shared between measures of development over time. Figure 5.1 illustrates these as the impacts of: developmental measures at entry to pre-school upon those at exit (Table 5.5); those at exit upon those at the end of the first year of primary school (Table 5.6); and those at the end of the first year of primary school upon those at the end of the second (Table 5.7; end of Key Stage 1). However, because this thesis postulated that pre-school would have effects upon developmental *pathways*, the *direct* relationships between developmental measures that can be seen in Figure 5.1 are complemented by those that are *indirect*. In particular, because pre-school quality was hypothesised to protect measures of development at exit from pre-school, so measuring the *total* impact[112] of these abilities upon those that followed provided a more accurate assessment of the extent to which Early Education could contribute to vulnerable and resilient developmental pathways.

Table 5.5 presents the direct effects of developmental measures that were assessed at entry to pre-school upon those that were assessed at exit and which were obtained from the baseline SEM whose fit indices were reported in Table 5.1. Because the analyses reported in this section examined young children's cognitive and social/behavioural development in separate and independent models, cross developmental domain effects are omitted[113]. Furthermore, total percentages of variance (r^2) are also omitted because these values changed as the impacts of each quality of pre-school were simultaneously modelled on these same developmental outcomes.

Table 5.5 reveals strong statistical relationships between the measures of development over the two time points, with the level of risk that was under examination having only relatively small impacts on the sizes of the relationships. However, the magnitudes of these relationships are also more apparent in the cognitive rather than social/behavioural domains wherein only co-operation and conformity at pre-school

[112] Total impact = direct impacts + indirect impacts. See Chapter 2, Figure 2.5.
[113] These are also expanded upon in Section 5.2 which focuses especially on developmental pathways between developmental domains and longitudinal impacts

entry had an effect on *both* self regulation *and* anti-social worried behaviour at pre-school exit.

Table 5.5 Developmental domain specific impacts of developmental measures on themselves: entry to pre-school predicting exit from pre-school / entry to reception

Predictors: developmental measures at entry to pre-school (~36 months)	Predicted: developmental measures at exit from pre-school (~58 months). *(Standardised βs)*					
	GCA		Self-Regulation		Anti-social/Worried	
	Under Child risk	Under Familial risk	Under Child risk	Under Familial risk	Under Child risk	Under Familial risk
General Cognitive Ability (GCA)	**0.67*** **	**0.59*** **				
Standard Error (SE)	*0.02*	*0.02*				
Co-operation & Conformity			**0.32*** **	**0.31*** **	**-0.31*** **	**-0.30*** **
SE			*0.03*	*0.03*	*0.03*	*0.03*
Peer Sociability			0.01	0.02	0.02	0.03
SE			*0.03*	*0.03*	*0.03*	*0.03*
Confidence			0.01	-0.02	**-0.15*** **	**-0.16*** **
SE			*0.03*	*0.03*	*0.03*	*0.03*
Anti-social Behaviour			0.04	0.03	**0.13*** **	**0.13*** **
SE			*0.02*	*0.02*	*0.03*	*0.03*
Worried/Upset Behaviour			0.02	0.03	0.04	0.04
SE			*0.02*	*0.02*	*0.02*	*0.03*

*$p < .05$ **$p < .01$ ***$p < .001$

Following on from the within-domain relationships that were shared between measures of young children's development at pre-school entry and exit (Table 5.5), Table 5.6 presents the direct effects of development at exit from pre-school upon measures of development taken at the end of the children's first year of primary school (illustrate in Figure 5.1). However, unlike the results presented in Table 5.5, those presented in Table 5.6 present the mean effects that were found across each independently examined level of combined risk. This decision was arrived at given the relative equality of the pairs of relationships that were observed in Table 5.5, and so as to avoid the unnecessary repetition of reporting each and every relationship twice[114].

[114] This method of reporting results (averaging the results of the child and family models) is used throughout this sub-Section (Section 5.1.1.5) and can also be found in Tables 5.7 and 5.8.

Table 5.6 shows how important levels of development at exit from pre-school were found to be for predicting those at the end of year 1 of primary school. Regardless of the domain of development or the type of social skill under examination, each of the measures of development at exit from pre-school was found to have a significant effect upon measures of development (within the same domain) at the end of children's first year of primary school. However, there was also noticeable variation in the relationships that were shared between the measures of young children's social/behavioural development. Self regulation at exit from pre-school had stronger impacts upon all measures of social skills and behaviours at the end of year 1 than did anti-social/worried behaviour (barring conduct problems). Furthermore, these relationships were reflected in the proportions of variance that were explained in each of the outcome measures, with self regulation explaining up to 29% of the variance in young children's behaviour (in this case, hyperactivity).

Table 5.6 Development at exit from pre-school impacting development at the end of primary year 1: Within-domain direct effects (Risk model averaged)

Measures of development taken at: *Exit from pre-school*	Outcome at End of primary year 1	Direct Effect *(standardised βs)*	Standard Error *(SE)*	Total % variance explained *(r^2)*
General Cognitive Ability (GCA)				
	Reading	**0.47*** **	0.02	23%
	Mathematics	**0.61*** **	0.02	37%
Self-Regulation				
	Emotional Symptoms	**-0.10*** **	0.02	1%
	Conduct Problems	**-0.36*** **	0.02	13%
	Hyperactivity	**-0.54*** **	0.02	29%
	Peer Problems	**-0.25*** **	0.02	6%
	Prosocial Behaviour	**0.36*** **	0.02	13%
Anti-social/Worried Behaviour				
	Emotional Symptoms	**0.05***	0.02	0%
	Conduct Problems	**0.40*** **	0.03	16%
	Hyperactivity	**0.38*** **	0.02	15%
	Peer Problems	**0.15*** **	0.02	2%
	Prosocial Behaviour	**-0.29*** **	0.03	8%

*$p < .05$ **$p < .01$ ***$p < .001$

The results presented in Table 5.7 complement those of Table 5.6 in that they present the *total* effects of measures of development taken at exit from pre-school upon those taken at the end of year 2 of primary school (at the end of Key Stage 1). Total rather

than direct effects were estimated and reported on the assumption that any effect would occur through altering intermediary levels of development which the EPPE study measured at the end of primary year 1. Referring back to Figure 5.1, the total effects of pre-school exit abilities upon those at the end of year 2 are therefore the sum of: a) all pre-school exit effects upon development at the end of year 1, and b) all year 1 effects upon development at year 2. Table 5.7 reveals the impacts of measures of development taken at exit from pre-school upon development at the end of primary year 2 to be broadly similar to those upon development a year earlier (at the end of year 1). This finding indicates the importance of levels of development at exit from pre-school: they demonstrate sizeable effects upon within-domain development until the end of Key Stage 1 at least.

Table 5.7 Development at exit from pre-school impacting development at the end of primary year 2: Within-domain total effects (Risk model averaged)

Measures of development taken at: *Exit from Pre-school*	Outcome at End of primary year 2	Total Effect *(standardised βs)*	Standard Error *(SE)*	Total % variance explained *(r^2)*
General Cognitive Ability (GCA)				
	Reading	**0.44*** **	0.02	51%
	Writing	**0.39*** **	0.02	40%
	Mathematics	**0.43*** **	0.02	47%
Self-Regulation				
	Emotional Symptoms	**-0.05*** **	0.01	8%
	Conduct Problems	**-0.25*** **	0.02	31%
	Hyperactivity	**-0.35*** **	0.02	42%
	Peer Problems	**-0.17*** **	0.02	17%
	Prosocial Behaviour	**0.25*** **	0.01	25%
Anti-social Worried Behaviour				
	Emotional Symptoms	**0.03***	0.01	8%
	Conduct Problems	**0.24*** **	0.02	31%
	Hyperactivity	**0.27*** **	0.02	42%
	Peer Problems	**0.14*** **	0.01	17%
	Prosocial Behaviour	**-0.20*** **	0.02	25%

*$p < .05$ **$p < .01$ ***$p < .001$

Table 5.8 illustrates the direct relationships that were shared between measures of development at the ends of years 1 and 2 of primary school and that underlay the total effects of pre-school exit abilities upon those at the end of Key Stage 1. Aside from the sizeable effects of measures of cognitive development upon themselves over time,

Table 5.8 also reveals notable disparities between the relationships that were shared between different measures of young children's social development over time. In particular, whilst emotional symptoms predicted only themselves, prosocial behaviour was associated with all measures of subsequent social development (other that peer problems). Further, the behaviours that were most strongly associated with previous levels of social development were children's hyperactivity and conduct problems. These behaviours proved dependent upon more aspects of children's earlier social development than were prosocial behaviours or displaying emotional symptoms. As such, it appears that conduct problems and hyperactivity at the end of Key Stage 1 might provide better proxy measures of children's previous social development.

As a brief aside, it is no mistake that the same values of the *total* proportions of variance (r^2) are repeatedly presented in Tables 5.7 and 5.8. The Mplus statistical software returns only these values and not the proportions of variance that are uniquely explained by each predictor of an outcome. As a result, it was not possible to evaluate the relative explanatory strengths of each indirect pathway that was included in Table 5.7, nor separate these from the direct effects of development that were estimated between the first and second years of primary school.

The pre-school quality *in*variant relationships that were shared between measures of development over time and which were presented in this section (5.1.1.5) serve to contextualise the pre-school quality *varying* relationships that are subsequently reported. In particular, the importance of pre-school exit levels of development (evidenced in Tables 5.7 and 5.8) suggests that protecting these skills from the impacts of risks is vitally important for subsequent cognitive and social development. Because these measures of development share such strong relationships with those that follow, protecting them from the impacts of risks provides evidence of the contribution that early education can have to young children's subsequent vulnerable and resilient developmental pathways.

Table 5.8 Development at the end of primary year 1 impacting development at the end of primary year 2: Within domain direct effects[115]

Measures of development taken at: *End of primary year 1*	Outcome at End of primary year 2	Direct Effect *(standardised βs)*	Standard Error *(SE)*	Total % variance explained *(r^2)*
Reading				
	Reading	**0.39*** **	0.02	51%
	Writing	**0.29*** **	0.02	40%
	Mathematics	**0.24*** **	0.02	47%
Mathematics				
	Reading	**0.42*** **	0.02	51%
	Writing	**0.42*** **	0.03	40%
	Mathematics	**0.52*** **	0.03	47%
Emotional Symptoms				
	Emotional Symptoms	**0.25*** **	0.03	8%
	Conduct Problems	-0.02	0.03	31%
	Hyperactivity	0.02	0.03	42%
	Peer Problems	0.05	0.03	17%
	Prosocial Behaviour	-0.02	0.03	25%
Conduct Problems				
	Emotional Symptoms	**-0.10*** **	0.02	8%
	Conduct Problems	**0.44*** **	0.04	31%
	Hyperactivity	**0.16*** **	0.03	42%
	Peer Problems	0.02	0.02	17%
	Prosocial Behaviour	-0.01	0.03	25%
Hyperactivity				
	Emotional Symptoms	**-0.09*** **	0.02	8%
	Conduct Problems	**0.17*** **	0.02	31%
	Hyperactivity	**0.53*** **	0.02	42%
	Peer Problems	0.03	0.02	17%
	Prosocial Behaviour	0.00	0.03	25%
Peer Problems				
	Emotional Symptoms	0.02	0.02	8%
	Conduct Problems	**0.15*** **	0.03	31%
	Hyperactivity	**0.10*** **	0.03	42%
	Peer Problems	**0.28*** **	0.03	17%
	Prosocial Behaviour	0.01	0.03	25%
Prosocial Behaviour				
	Emotional Symptoms	**0.04***	0.02	8%
	Conduct Problems	**-0.14*** **	0.03	31%
	Hyperactivity	**-0.20*** **	0.03	42%
	Peer Problems	-0.03	0.02	17%
	Prosocial Behaviour	**0.25*** **	0.03	25%

*$p < .05$ **$p < .01$ ***$p < .001$

[115] Results averaged across the child and familial levels of risk and for social development, also averaged over the separate models examining self-regulation and anti-social/worried behaviour at pre-school exit

5.1.2 Pre-school Quality *Varying* Impacts of Risks and Pre-school Process Qualities upon Young Children's Development at Entry to Reception

This section and the one that follows (Section 5.1.3) document and illustrate the mitigating role that qualities of pre-school can have upon the impacts of risks to young children's development at exit from pre-school. To this end, each of the 13 qualities of pre-school had their direct and risk moderating effects estimated upon each of the 3 measures of development that were assessed at exit from pre-school and for each level of risk (child and familial). 5 separate *types* of SEM were constructed for each of the 5 combinations of these and included: only the direct effects (1); direct effects plus the *risk x quality* interaction (2); direct effects plus the *risk x duration* interaction (3); direct effects plus the *quality x duration* interaction (4); and direct effects plus the 3-way interaction between *risk, quality, and duration* (5). As mentioned earlier, although it is acknowledged that the division of these analyses was not an ideal solution, it was nonetheless obliged by the complexities inherent to the methods that were used to measure combined risks and their moderation. Any potential deterioration in the validity of the results through this division of analyses is also partially mitigated by: the improvements made to measuring combined risks (see Chapter 4); the varieties of the qualities that were examined; and the statistical sensitivity of the analytical procedures that were used.

Table 5.9 presents a summary of the significant instances of protection that were evidenced as due to the process qualities of pre-school in this series of analyses (see Appendix 8 for the 26 pages and tables that provide full numeric results). Process qualities of pre-school can be seen to have offered more frequent instances of protection when the risk to development originated from the child rather than from their family. Furthermore, process qualities were found to be able to offer partial protection to General Cognitive Abilities (GCA) at exit from pre-school that systematically differed from that which it offered to social skills. Whilst pre-school process qualities were able to offer protection even when the duration of attendance was short, the same was not the case for self regulation and anti-social/worried behaviour.

Table 5.9 Significant 2 and 3-Way (*with Duration*) Interactions of Developmental Risks with Process Qualities of Pre-school Impacting Measures of Development taken at Exit from Pre-School at mean age 58 months

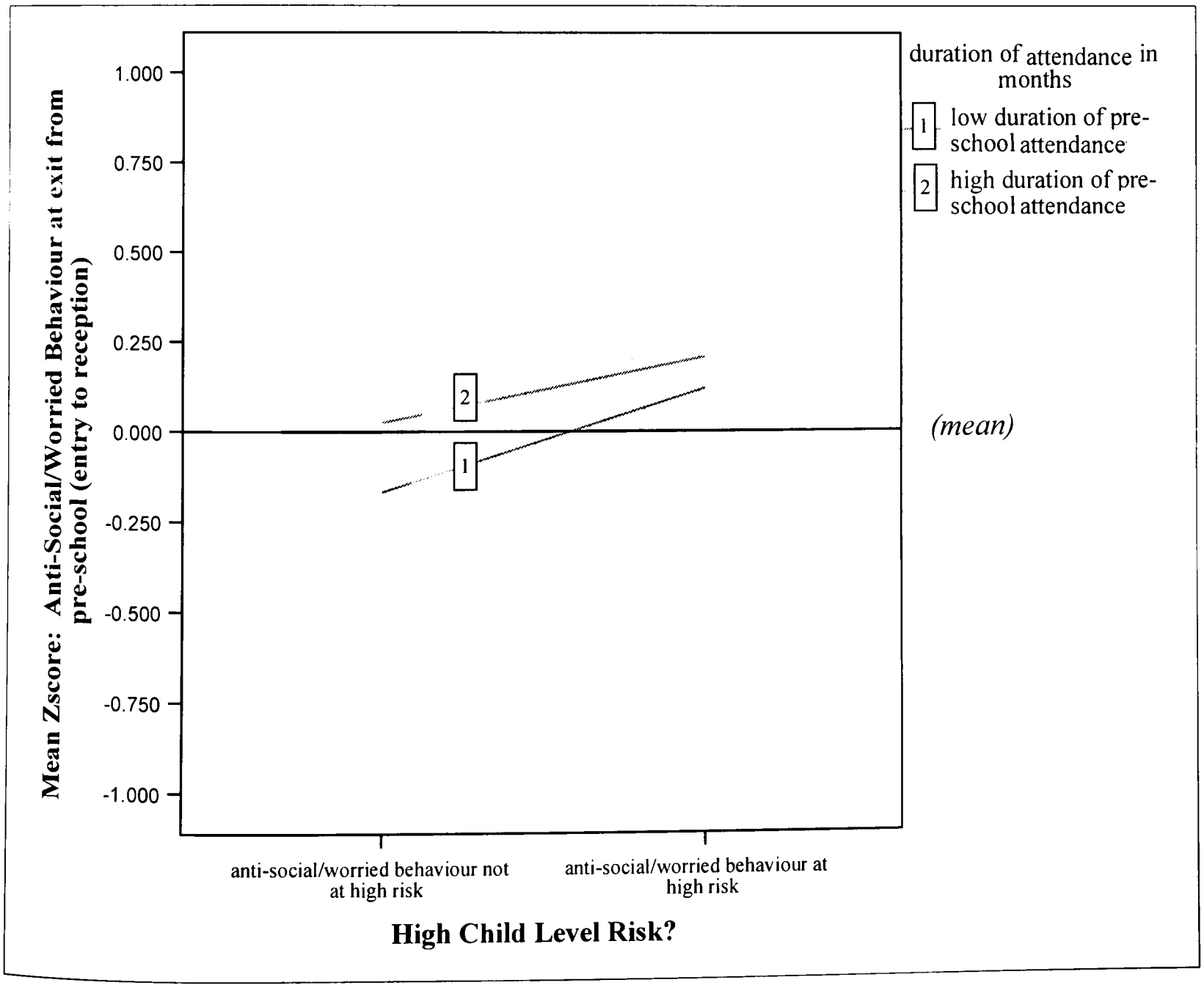
Combined Latent Risk	Process Quality of Pre-school	Developmental Outcome at Exit from Pre-School: General Cognitive Ability	Self Regulation	Anti-Social / Worried Behaviour
Child Level	Positive Relationship	2-Way*	3-Way**	3-Way***
	Punitiveness		3-Way***	
	Permissiveness			
	Detachment	2-Way*	3-Way**	3-Way**
	Global Quality			
	Educational Quality	2-Way*		3-Way*
	Duration			*2-Way**
Family Level	Positive Relationship			
	Punitiveness			
	Permissiveness			
	Detachment			
	Global Quality	2-Way***		
	Educational Quality	2-Way**		
	Duration			

*$p < .05$ **$p < .01$ ***$p < .001$

Each of the statistically significant interactions of risk with aspect of pre-school that is illustrated in Table 5.9 is now presented in graphical form as this is the easiest way to interpret the relationships that they reveal. Line graphs are used with measures of development on the y-axes (as they are the dependant variables) and with measures of combined risks on the x-axes (as they are the predictor variables). The interactions of risks with aspects of pre-school (quality and/or duration) are revealed by plotting multiple lines of the impacts of risk upon measures of development at exit from pre-school. To facilitate easy graphical interpretation, aspects of pre-school are dichotomised into 'very high' and 'very low' groups by using ± 1 standard deviation cut-offs. To further ease interpretation, the measures of combined risk are also dichotomised, but due to the substantive interests of this thesis, the cut-offs used were ≥ +1 standard deviation or < +1 standard deviation. Thus, the line graphs of significant interaction effects that are now presented reveal the effects of very high and low aspects of pre-school (± 1 s.d.) upon very high or not very high levels of combined risk (<+1≥ s.d.) to young children's development.

The first significant moderation of developmental risk to be discussed in this chapter is one that concerns neither a process nor structural quality of pre-school. Table 5.9 reveals that the duration of attendance at pre-school (in months) significantly moderated the impacts of child level risk upon anti-social/worried behaviour at exit from pre-school ($\beta=0.04$, $p<0.05$). Figure 5.2 reveals that attending pre-school over a longer period of months altered the impact of child-level risk upon children's anti-social/worried behaviour such that *higher durations* of attendance led to significantly *greater impacts* of child-level risk to anti-social/worried behaviour. In other words, when both duration and risk were very low, anti-social/worried behaviour demonstrated a tendency to be below average, but if either duration or risk was high, then this was associated with above average levels of this behaviour (relative to the behaviours of the entire sample of children).

Figure 5.2 Impact of child-level risk to anti-social/worried behaviour at exit from pre-school varying by duration of attendance

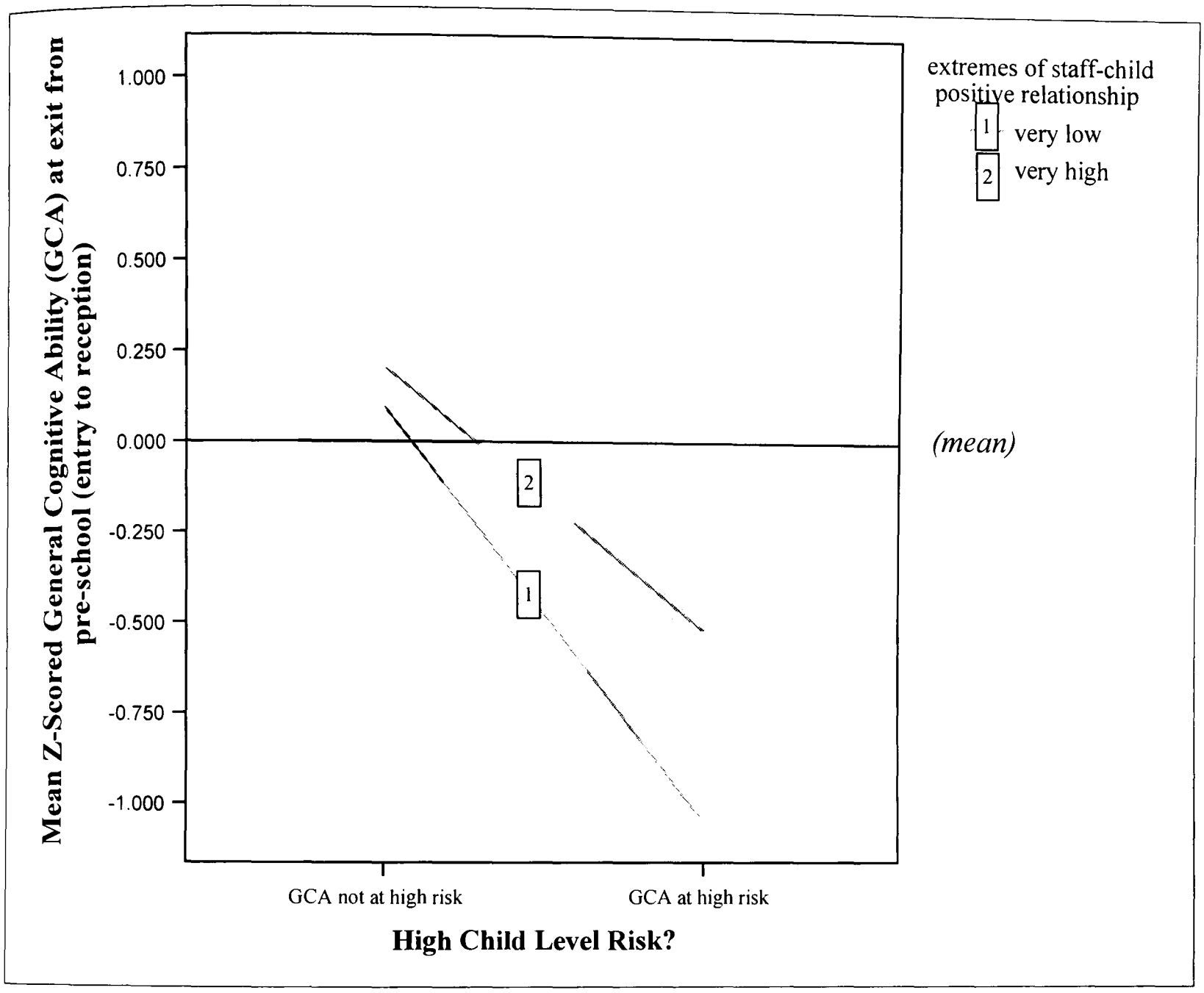


Referring back to Table 5.9, the relationship illustrated in Figure 5.2 is crucial for the correct interpretation of whether *qualities* of pre-school could protect against the effects of child-level risk to anti-social/worried behaviour at exit from pre-school. Although the global quality of pre-schools and the positive and detached relationships of the staff with children within them were found to offer protection to young children's anti-social/worried behaviour, these relationships were only ever found when duration of pre-school was taken into account. As such, when these quality-as-protection relationships are subsequently discussed, the relationship of Figure 5.2 will be apparent; longer durations of attendance will lower the protective impacts of higher pre-school quality for anti-social/worried behaviour.

Positive Relationships

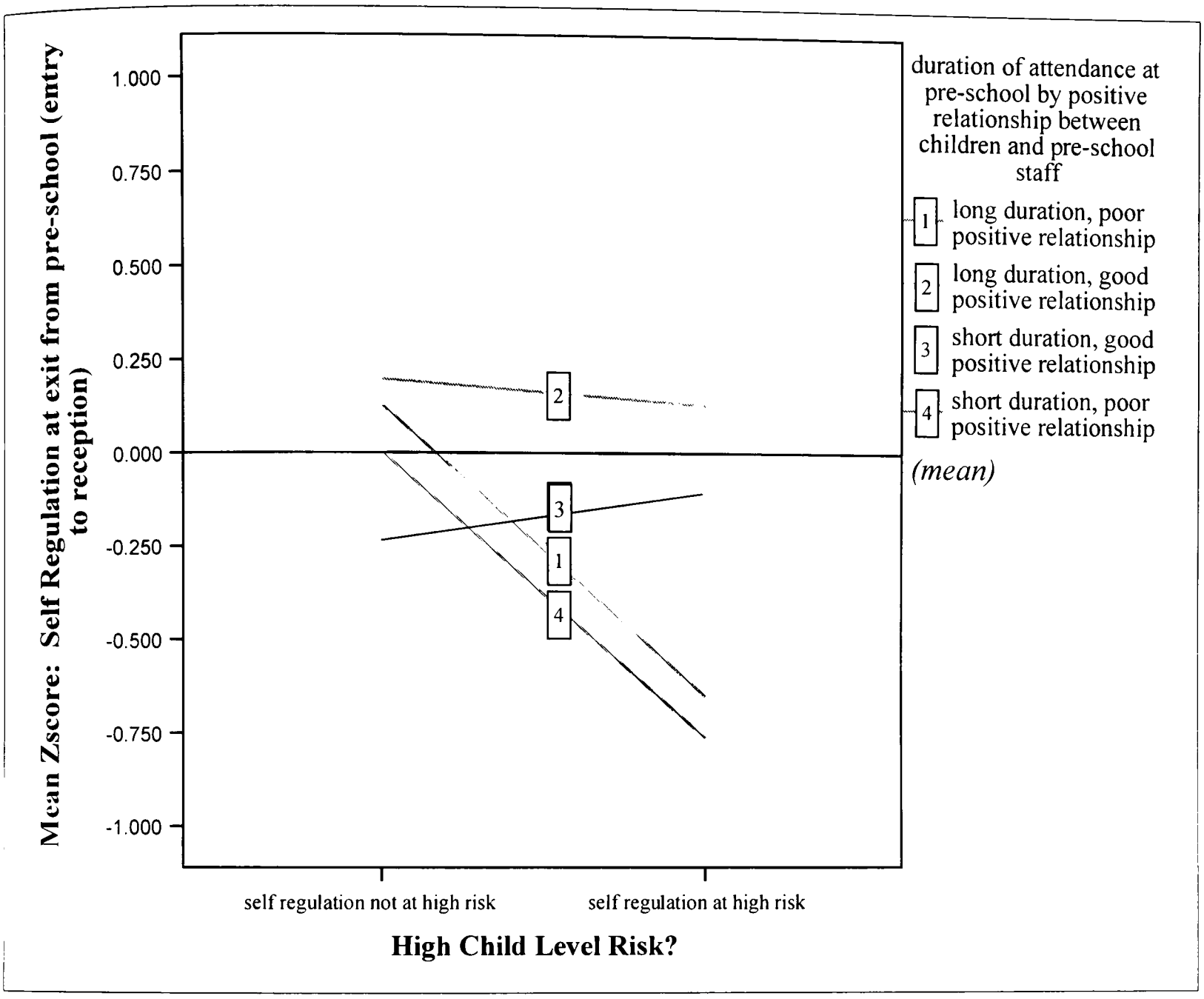
Figure 5.3 illustrates the protective effect that this study found positive relationships between pre-school staff and children ($\beta=0.04$, $p<0.05$) to have upon the impact of the combined child-level risk to children's General Cognitive Ability (GCA) at exit from pre-school ($\beta=-0.10$, $p<0.001$). Although higher levels of child-level risk led to lower GCA, this relationship diminished when children enjoyed more positive relationships with their carers. Furthermore, the number of months (duration) that children attended pre-school did not significantly influence this relationship; going for a shorter or longer period did not significantly alter this protective effect ($\beta=0.00$, $p>0.05$).

Figure 5.3 Impact of child-level risk to General Cognitive Ability at exit from pre-school varying by the positive relationships shared by staff and children



In contrast to Figure 5.3, Figure 5.4 illustrates a protective effect that varied with the duration that children attended their pre-schools. For children who enjoyed positive relationships with pre-school staff, attending these pre-schools for longer periods significantly lessened (Figure 5.4 line 2; $\beta=0.04$, $p<0.01$) the impact of child-level combined risk to self-regulation at pre-school exit ($\beta=-0.09$, $p<0.001$). Furthermore, even attending for a short duration could serve to reduce the effects of child level risk, although it could not (on average) raise self-regulation up to the average level found for the EPPE sample of children (Figure 5.4 line 3). If however, the relationship between pre-school staff and children was poor then an increasing duration of attendance could not lessen the effects of child level risk (Figure 5.4, parallel lines 1 and 4).

Figure 5.4 Impact of child-level risk to self regulation at exit from pre-school varying by the positive relationships shared by staff and children and duration of attendance

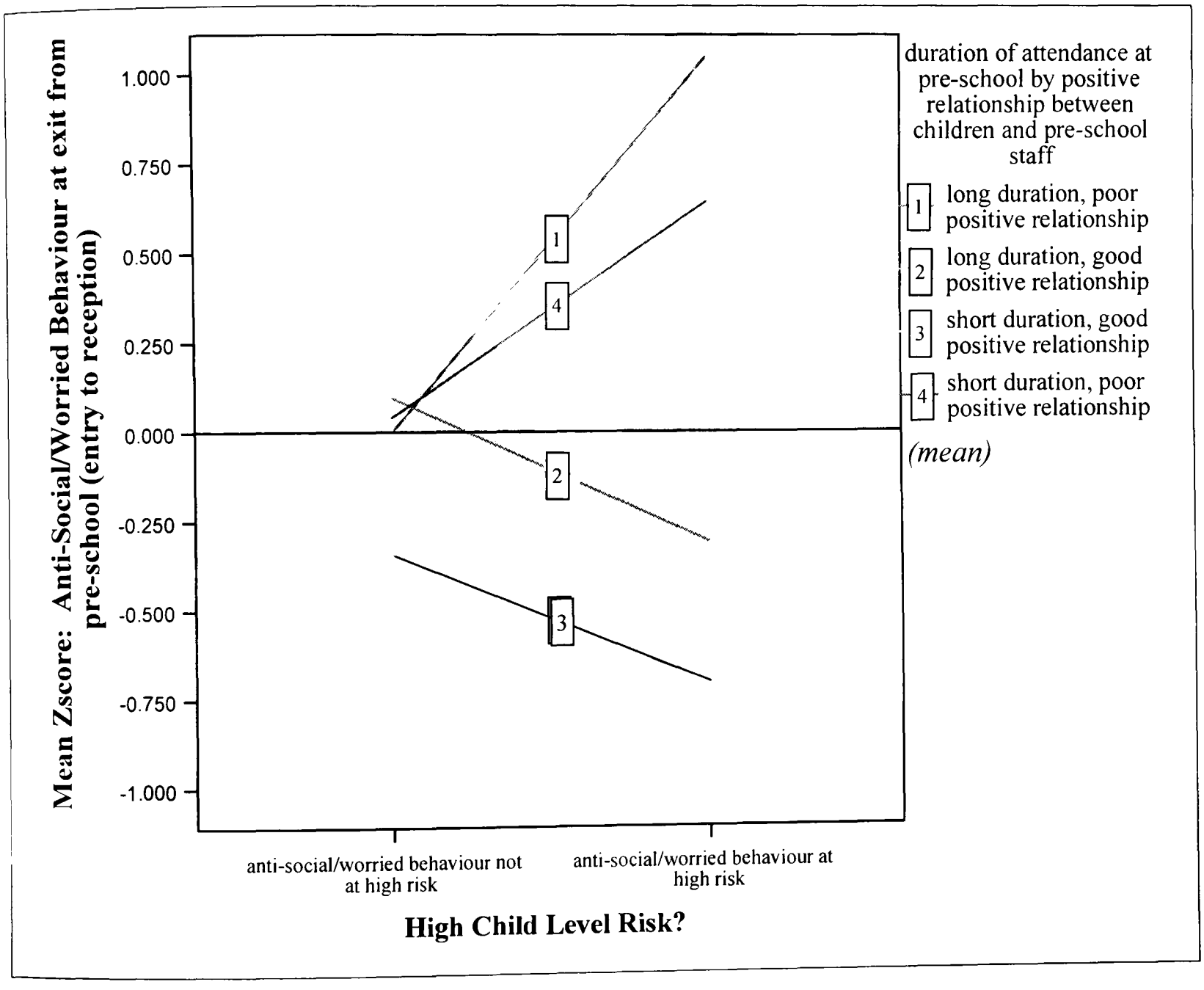


The protective relationship shared between the positive relationship of pre-school staff with children, the duration of children's attendance, child-level combined risk, and children's anti-social/worried behaviour at exit from pre-school is illustrated in Figure 5.5 (β=*-0.06, p<0.01)*. This graph is a partial reversal to those presented in Figures 2.2 to 2.4 in that it is lower values on the y-axis that are desirable[116]. With this in mind, Figure 5.5 reveals that the impact of child-level risk on anti-social/worried behaviour at exit from pre-school (β=*0.12, p<0.001)* was minimised when children had enjoyed highly positive relationship with pre-school staff for a shorter duration of months (Figure 5.5 line 3). However, even if children did attend pre-school for a longer period (with the risk magnifying effect this had as

[116] This is also the case for all subsequent graphs that report on anti-social/worried behaviour at pre-school exit

shown in Figure 5.2), a highly positive relationship between staff and children was still associated with at-risk children displaying lower than average levels of anti-social/worried behaviour (Figure 5.5, line 2).

Figure 5.5 Impact of child-level risk to anti-social/worried behaviour at exit from pre-school varying by the positive relationships shared by staff and children and duration of attendance

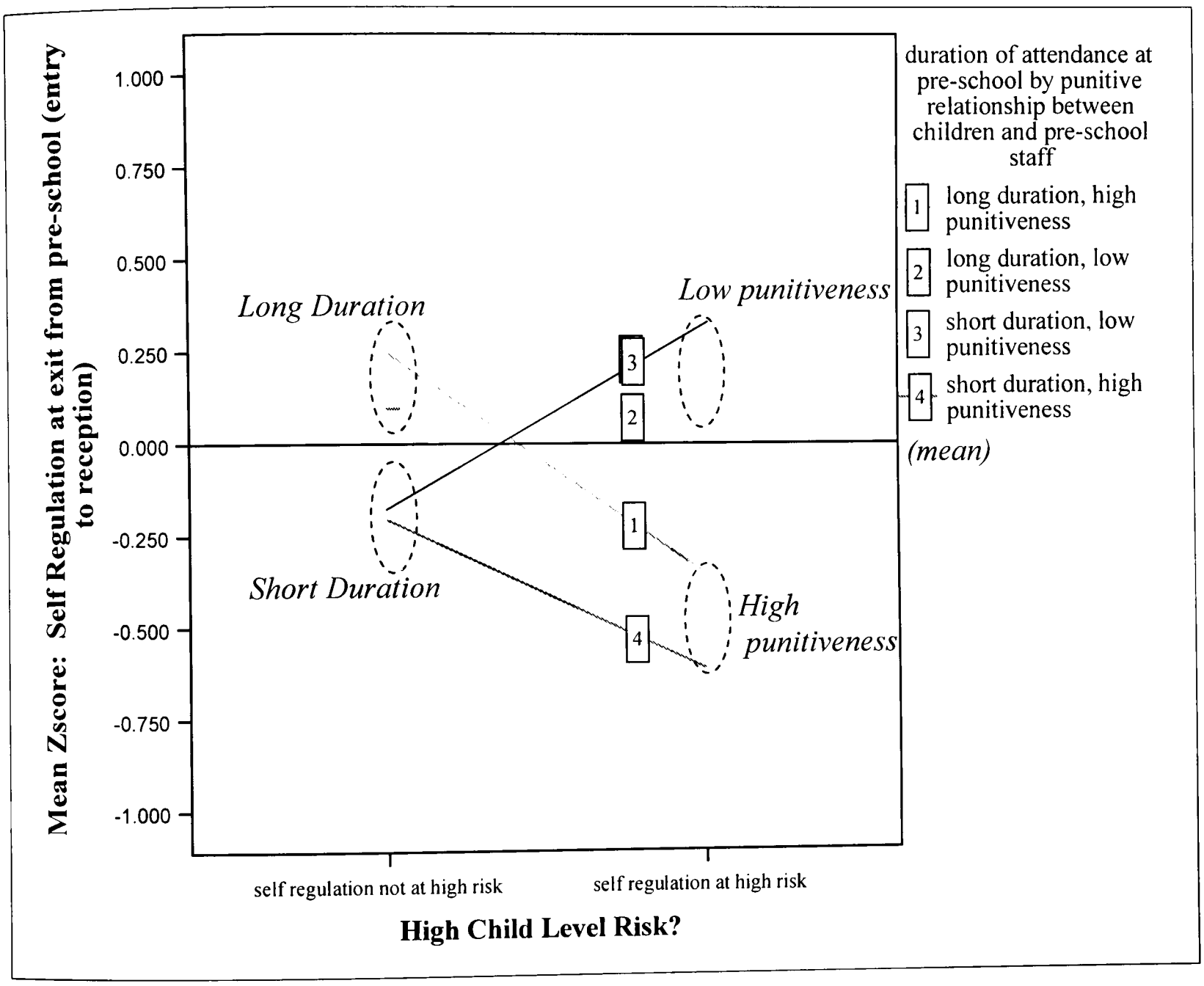


Punitiveness

Figure 5.6 illustrates the significant interaction (β=*-0.04, p<0.001)* and thus protective relationship that this study found to be shared between the punitiveness of the relationship between pre-school centre staff and children, the duration of children's attendance, and the impact of child-level risk to self regulation at exit from pre-school (β=*-0.09, p<0.001)*. When child-level risk was low, longer duration of attendance can be seen to be associated with greater than average levels of self

regulation. However, as risk increased, so the punitiveness of the care the children received played an increasingly important role with lower levels of punitiveness being associated with greater than average levels of self regulation.

Figure 5.6 Impact of child-level risk to self regulation at exit from pre-school varying by the punitive relationships shared by staff and children and duration of attendance



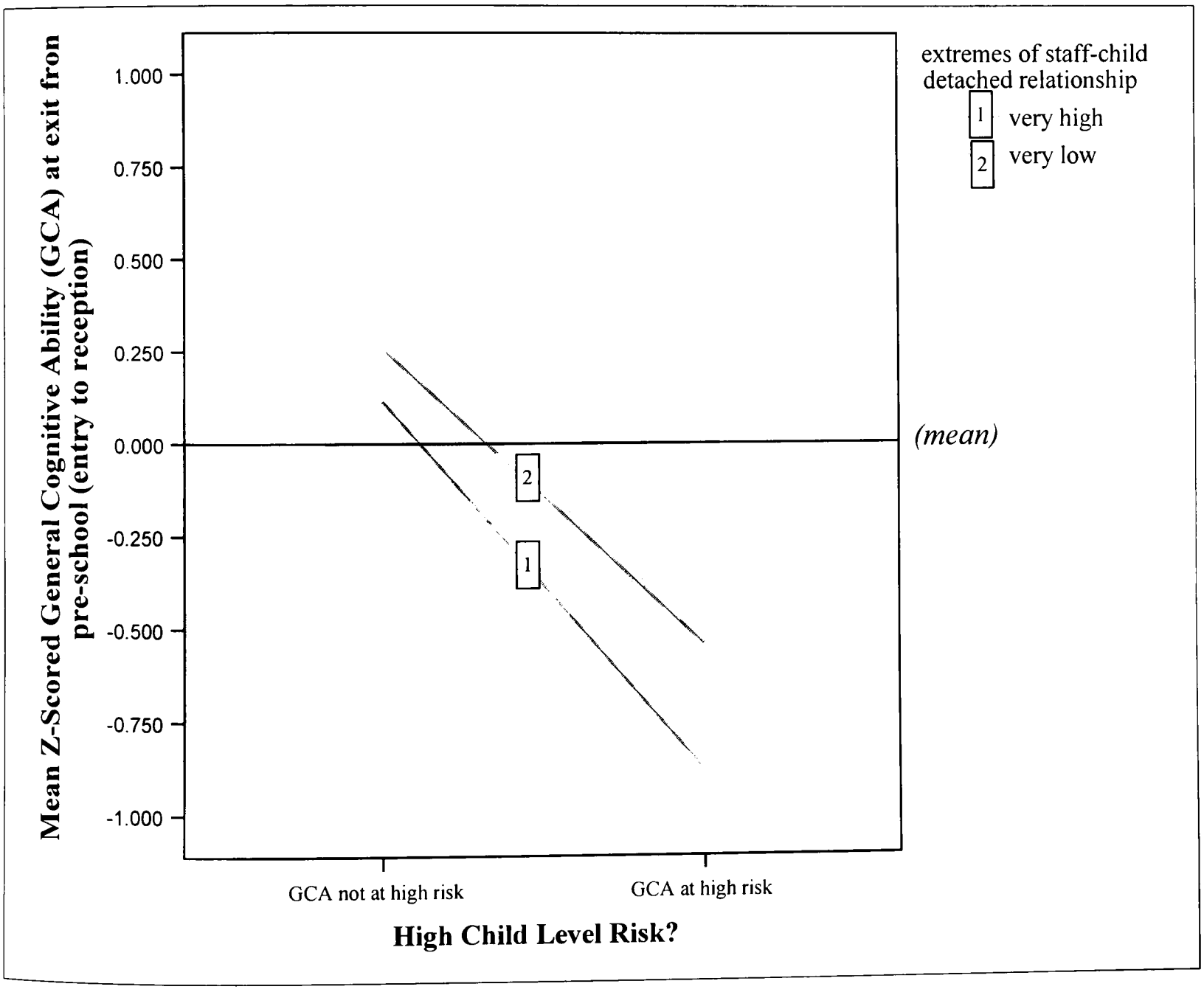
Permissiveness

These analyses found that the (over) permissiveness of pre-school centre staff towards the children in their care had no significant effects upon the impact of either child or family levels of combined risk to young children's GCA, self regulation, or anti-social/worried behaviour at exit from pre-school.

Detachment

Figure 5.7 presents a graphical illustration of the significant statistical interaction that this study found as existing between the extent that staff-child relationships could be considered detached and child-level risk (β=*-0.03, p<0.05)* as both impacted GCA. When children experienced very low levels of detachment, the significant impact (β=*-0.06, p<0.001)* of child level risk to GCA at exit from pre-school decreased. Furthermore, this was a relationship that was found regardless of the duration (in months) that the children had attended pre-school (β=*-0.02, p>0.05)* with the possible reasons for this being discussed in Chapter 6 (see Section 6.3.1).

Figure 5.7 Impact of child-level risk to General Cognitive Ability at exit from pre-school varying by the detached relationships shared by staff and children



Like Figure 5.7, Figure 5.8 illustrates that low detachment in pre-school could offer protection against the significant impact of child-level risk to their developmental

abilities at pre-school exit (β=*-0.06, p<0.001)*. However, unlike the relationships observed in Figure 5.7, those of Figure 5.8 reveal a protective relationship that varied by duration of attendance (β=*-0.04, p<0.01)* and concerned young children's self regulation. When child-level risk was not high, the greatest levels of self regulation were found for those children when had attended pre-school for a longer period, regardless of how detached their relationship was with pre-school staff. However, as child level risk increased to high levels, so the importance of a non-detached relationship increased such that low detachment became increasingly associated with above average levels of self-regulation.

Figure 5.8 Impact of child-level risk to self regulation at exit from pre-school varying by the detached relationships shared by staff and children and duration of attendance

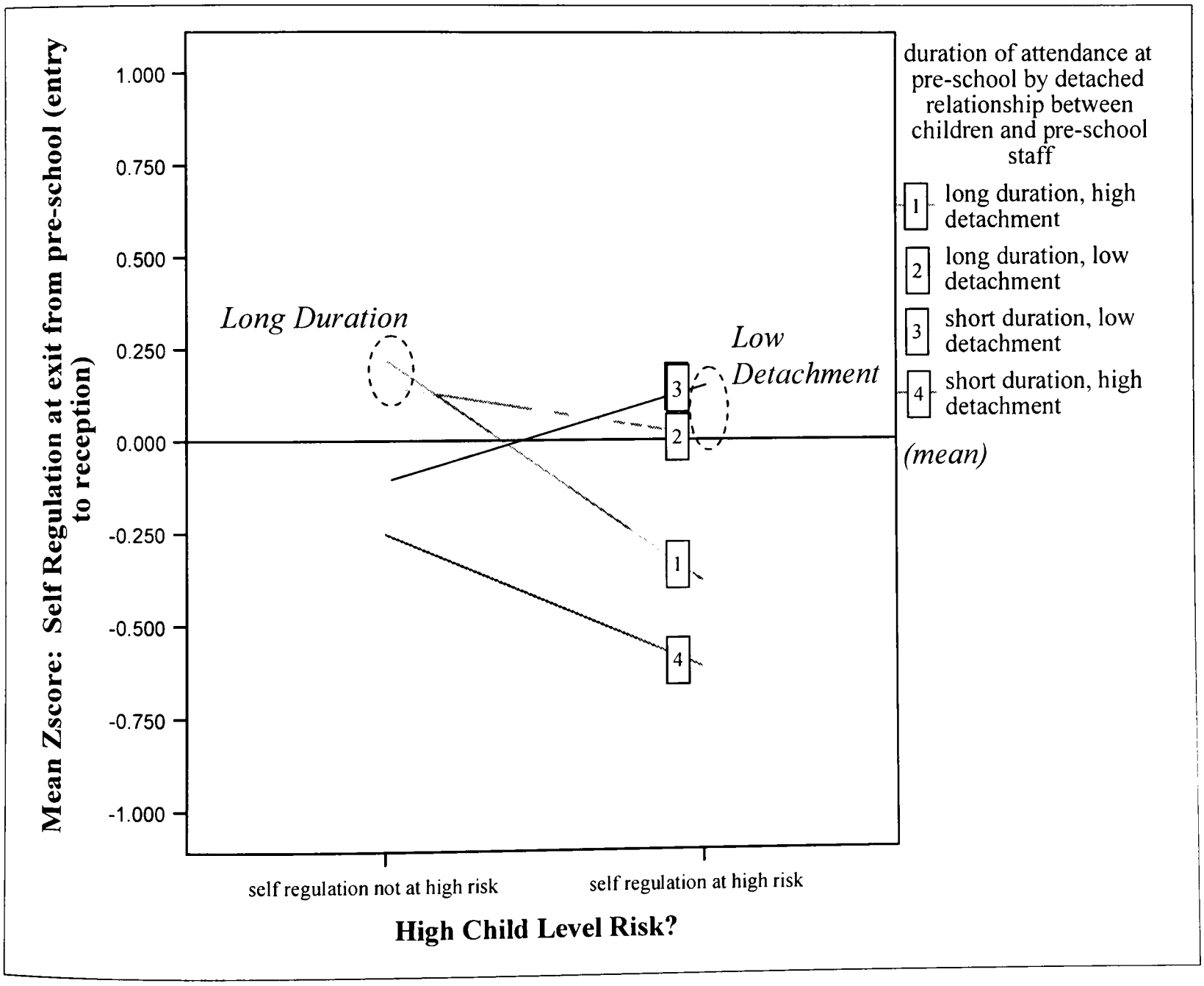
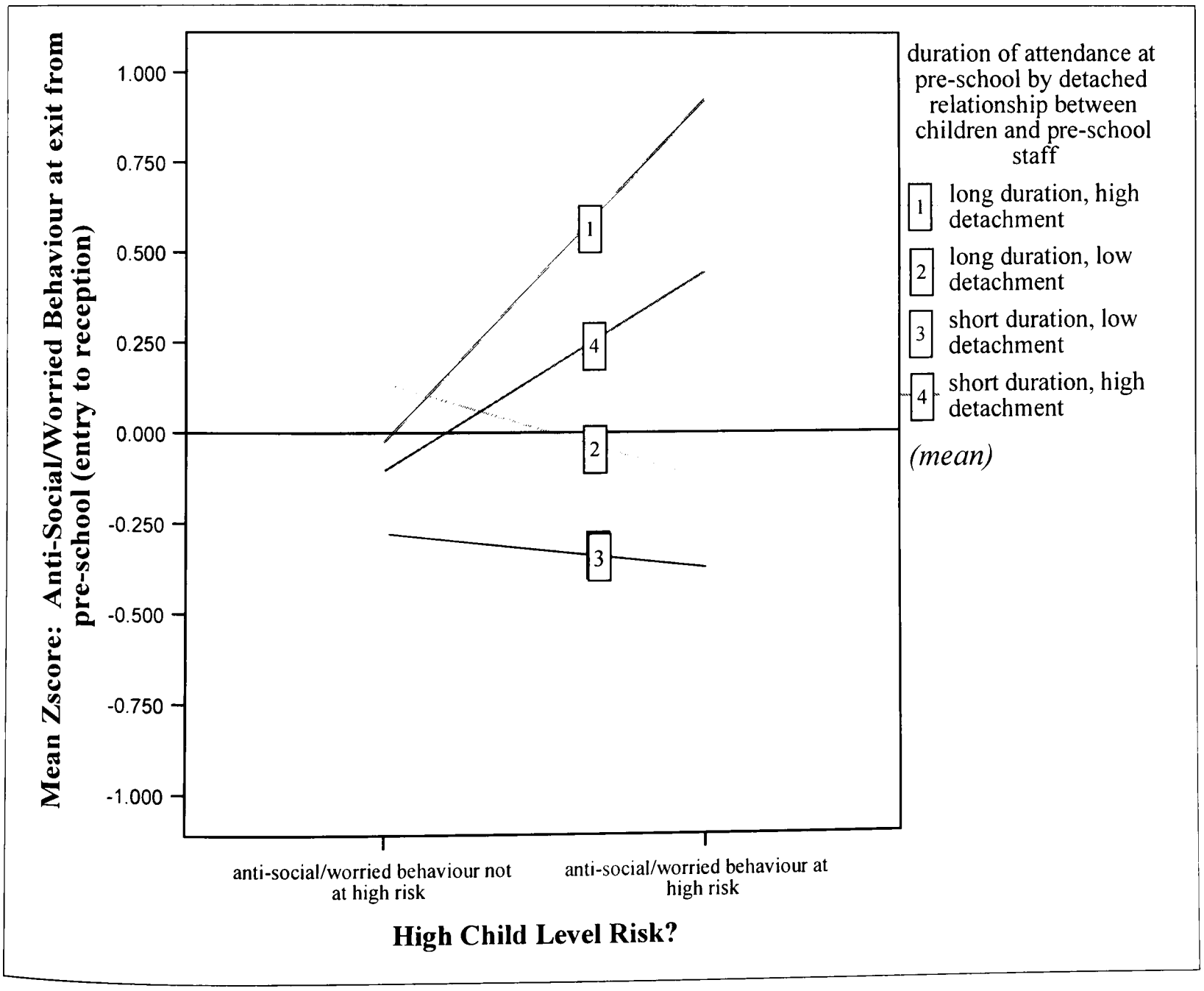


Figure 5.9 presents the significant interaction of detachment, duration of attendance, and child level risk predicting young children's anti-social/worried behaviour at exit

from pre-school (β=*0.06, p<0.01)* with two different relationships between these four measures being observed. First, shorter durations of attendance and lower levels of detached care were associated with a consistently lower level of anti-social/worried behaviour regardless of the level of risk (line 3, β=*-0.01, p>0.05).* Secondly, as child level risk increased, so the differences between the other combinations of detachment and duration increased such that increasing durations of pre-school attendance characterised by detached relationship between staff and children was associated with the greatest levels of anti-social/worried behaviour (Figure 5.9 lines 4 and 1). Conversely, under the same risk, a pre-school experience that was characterised by low detachment was associated with below average levels of this behaviour regardless of the duration of attendance (Figure 5.9 lines 2 and 3)

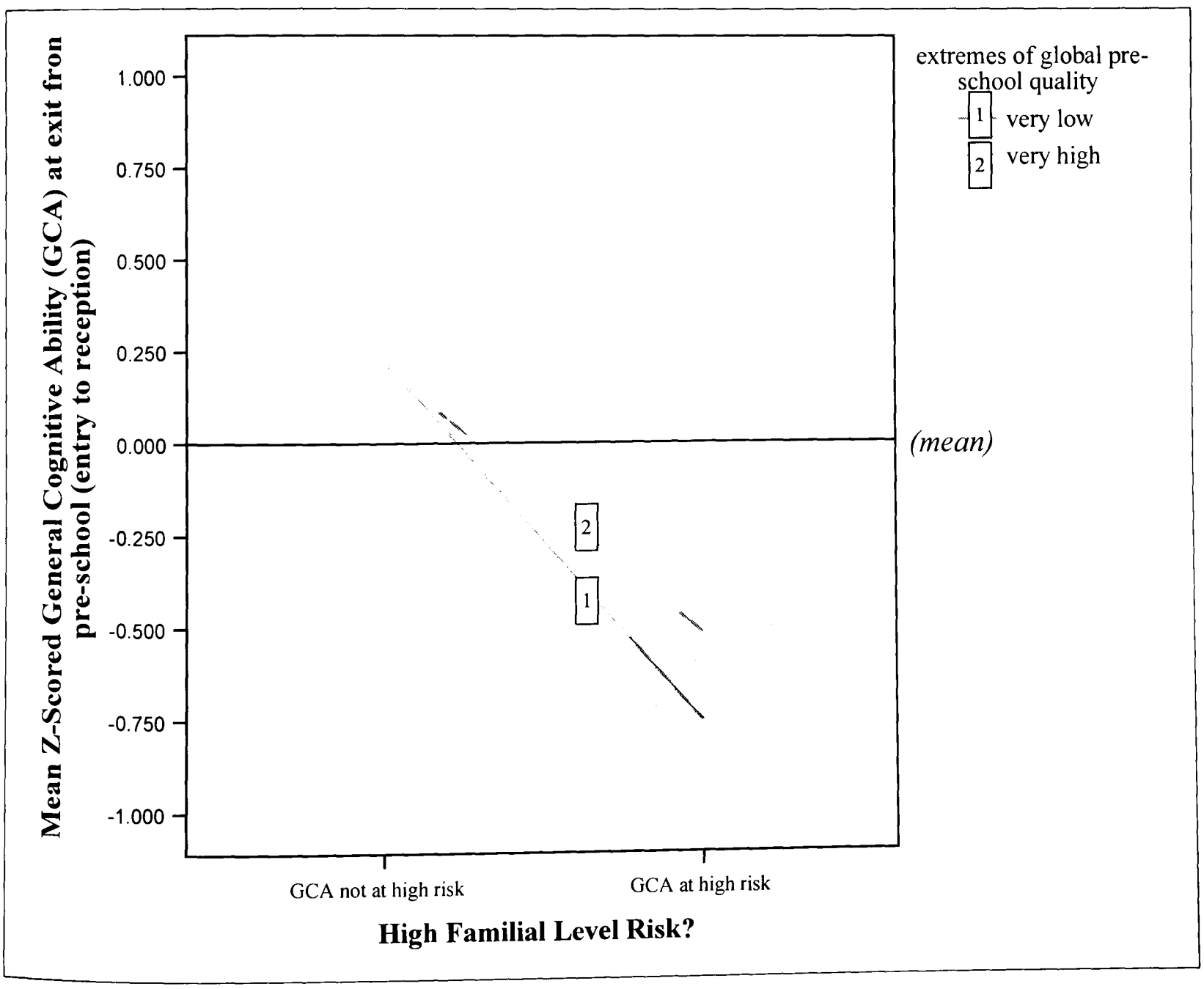
Figure 5.9 Impact of child-level risk to anti-social/worried behaviour at exit from pre-school varying by the detached relationships shared by staff and children and duration of attendance



Global Quality

Figure 5.10 presents one of the most important instances of protection that was identified in this series of analyses. As the global quality (derived from both process and structural observations) of pre-schools increased, so the significant impact of family level risk (broadly analogous to SES) on young children's GCA at exit from pre-school (β=*-0.10, p<0.001)* decreased (β=*0.03, p<0.001).* Although higher levels of family level risk led to consistently below average GCA, this relationship was significantly reduced when the children had attended pre-schools of very high overall quality. Furthermore, this relationship was not found to vary across either short or long durations of attendance (in months) at pre-school (β=*0.00, p>0.05).*

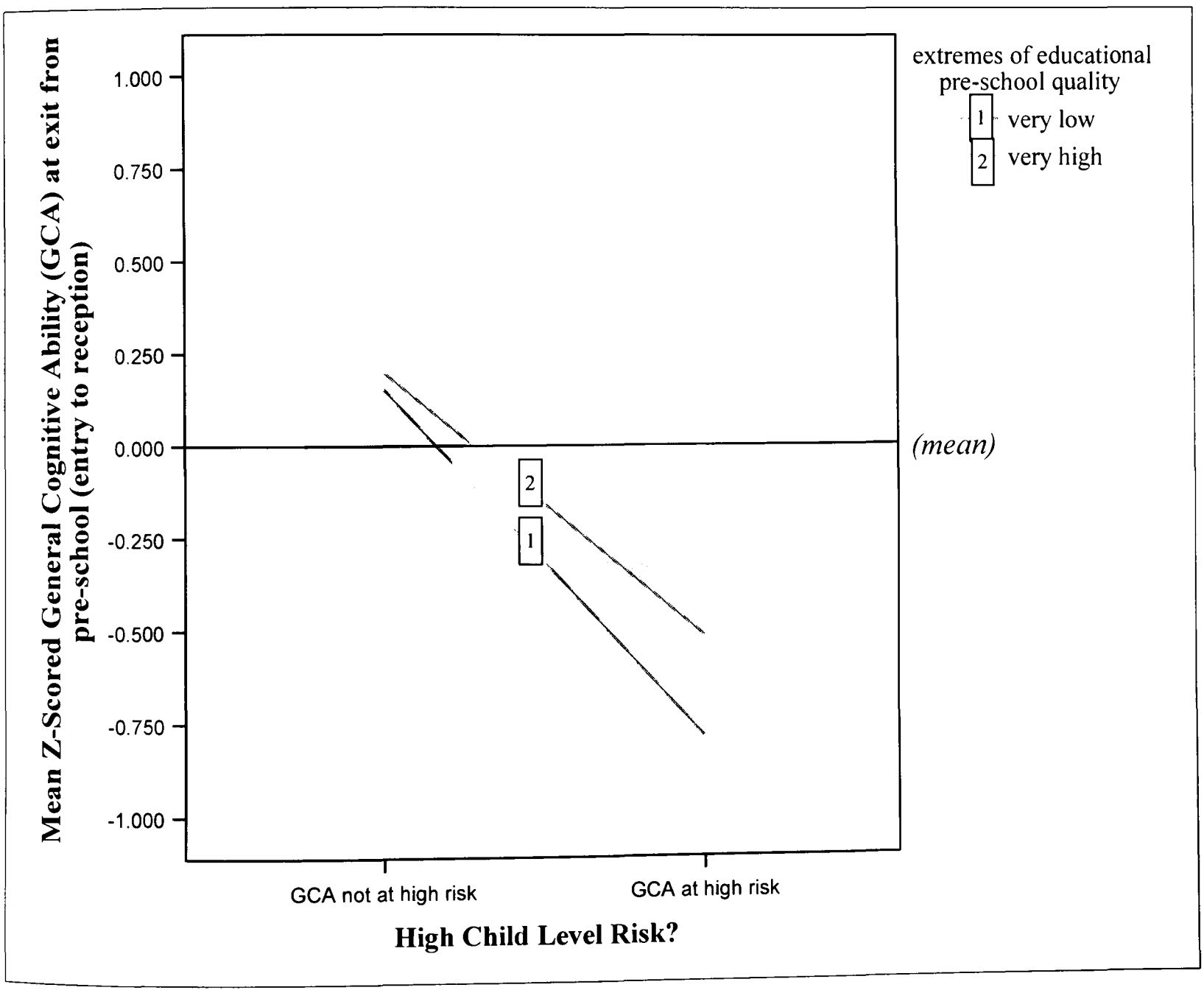
Figure 5.10 Impact of family-level risk to General Cognitive Ability at exit from pre-school varying by the global quality of the pre-school



Educational Quality

Figure 5.11 presents the impact of child-level combined risk to young children's GCA at exit from pre-school (β=*-0.06, p<0.001)* and reveals that this was significantly reduced when pre-school care contained higher levels of appropriate education (β=*0.02, p<0.05;* Figure 5.11, line 2). Furthermore, this protective effect of educational quality was not found to vary with longer or shorter duration of attendance in pre-school as measured in months (β=*-0.01, p>0.05).*

Figure 5.11 Impact of child-level risk to General Cognitive Ability at exit from pre-school varying by the educational quality of the pre-school



Like Figure 5.11, Figure 5.12 illustrates a protective effect of the quality of education within pre-schools upon the GCA of young children at reception exit (β=*0.02, p<0.01).* However, unlike the protection for child-level risks shown in Figure 5.11,

Figure 5.12 reveals that greater educational quality of pre-schools could partially protect GCA against the significant impacts of familial level risk (β=*-0.10, p<0.001)*. The similarity of this relationship to that illustrated in Figure 5.10 that concerned global quality can be partially explained by the similarity of the qualities that they measured: the global quality of pre-schools was very strongly related to the quality of education that was offered by pre-schools (see Chapter 3, *r=0.78 p<0.01*).

Figure 5.12 Impact of family-level risk to General Cognitive Ability at exit from pre-school varying by the educational quality of the pre-school

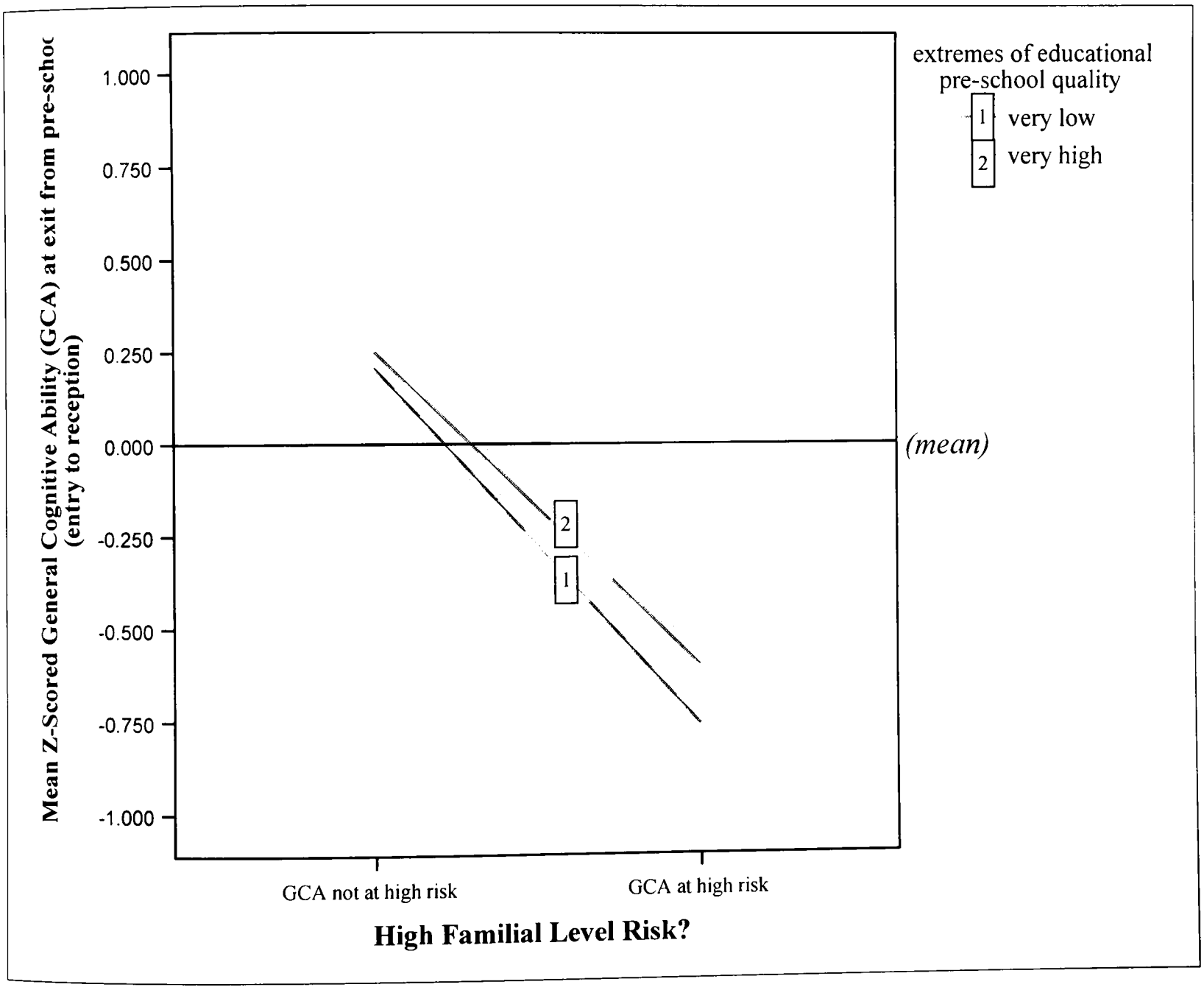
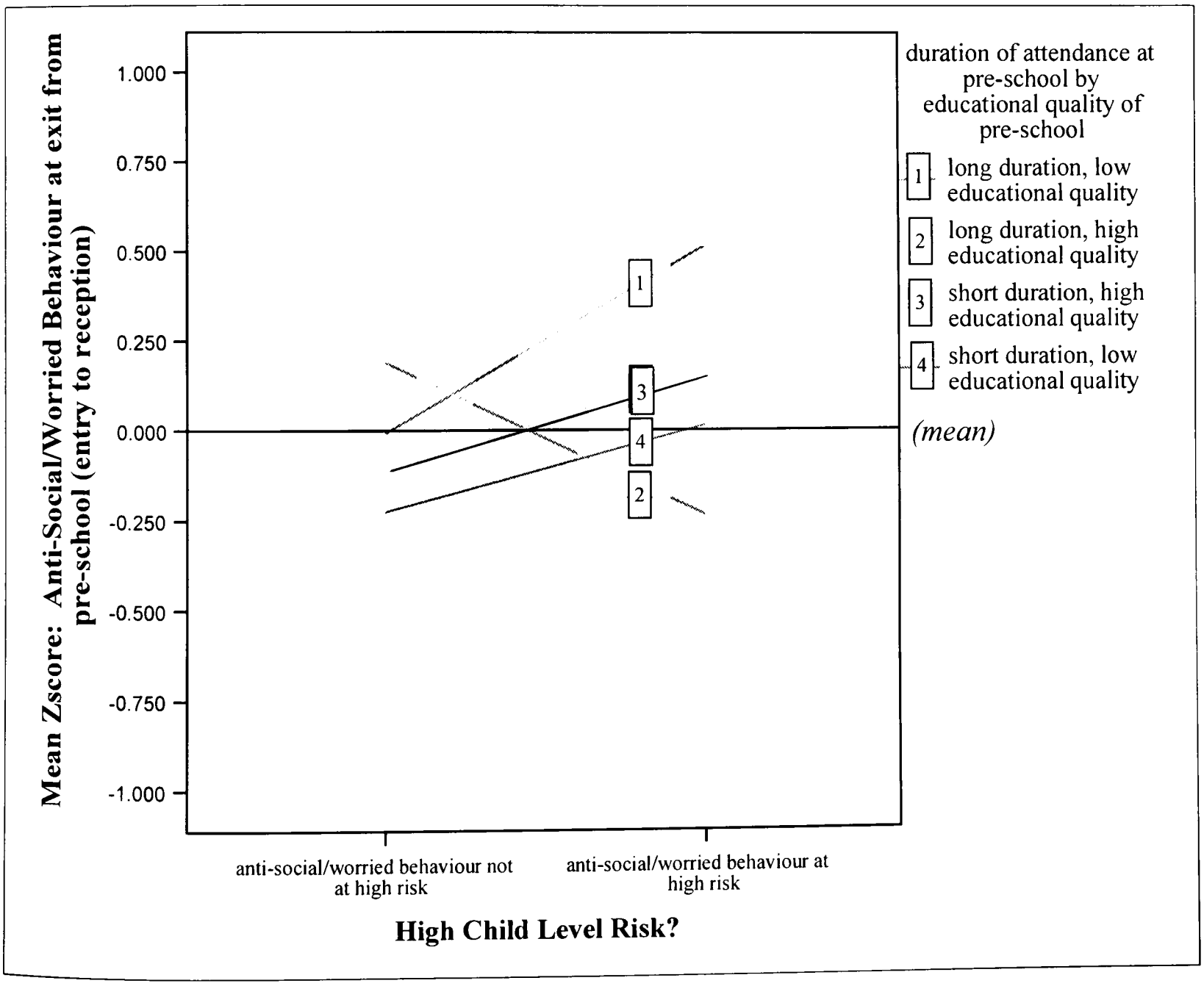


Figure 5.13 reveals a protective effect of high quality education upon child-level risk to anti-social/worried behaviour at exit from pre-school (β=*-0.02, p>0.05)* that varied with the duration attendance (β=*-0.05, p<0.05)*. When child-level risk was low, there was a very slight tendency for longer durations of attendance to result in above average levels of anti-social/worried behaviour. Conversely, when child-level risk

was high, only long durations at pre-schools of high educational quality led to lower than average levels of anti-social/worried behaviour (Figure 5.13, line 2). Simultaneously, under conditions of high child-level risk, the very highest average levels of anti-social/worried behaviour were associated with longer durations at pre-schools of very low educational quality (Figure 5.13, line 1). Taking these findings together, Figure 5.13 demonstrates that as child-level combined risk increased, so the quality of the education offered by pre-schools came to play an ever increasing role in determining the anti-social/worried behaviour of the young children when they left.

Figure 5.13 Impact of child-level risk to anti-social/worried behaviour at exit from pre-school varying by the educational quality of the pre-school and the duration of attendance at it



Pre-school Quality *Varying* Impacts of Risks and Pre-school Structural Qualities upon Young Children's Development at Entry to Reception

Table 5.10 summarises the significant instances of protected development that this investigation found as stemming from the structural qualities of pre-schools[117]. Despite protection being evidenced in each of the measures of development that were taken at exit from pre-school, there was also substantial variation between the frequencies of their occurrence. For example, the structural qualities of pre-school offered more frequent instances of partial protection to General Cognitive Abilities (GCA) than to the social skills of self regulation or anti-social/worried behaviour. Indicating that GCA was more likely to be protected (and thus subsequently resilient) than social skills, these findings also suggest that structural qualities such as staff qualifications do not strongly contribute towards correcting the dysfunctional social skills of young children.

Comparing the instances of protection that were found for the structural (Table 5.10) and process (Table 5.9) qualities of pre-schools, noticeable differences can be observed between the types of protection offered. The primary difference common across both Tables was that there were many more instances of protected cognitive rather than social development (46% vs. 15%). Furthermore, this 46% incident rate of protection itself varied in that the protection associated with structural qualities was consistently coupled with longer durations of pre-school attendance whereas that associated with process qualities was not. Suggesting that it is easier for process qualities of pre-school to protect cognitive development from the impacts of child level rather than familial level risk, this finding can also be extended to the protection of social development. For self regulation and anti-social/worried behaviour at exit from pre-school, although process qualities were found to protect more frequently than structures, all instances of protection were found to depend upon duration of attendance. Overall, these findings suggest that it was easier for the qualities of pre-school to: 1) protect cognitive rather than social development; 2) protect development against the effects of child rather than familial level combined risks; 3) protect development with high quality pre-school processes rather than structures.

[117] See Appendix 7 for the 26 pages and tables that provide full numeric results

Table 5.10 Significant 2 and 3-Way (*with Duration*) Interactions of Developmental Risks with Structural Qualities of Pre-school Impacting Measures of Development taken at Exit from Pre-School at mean age 58 months

Combined Latent Risk	Structural Quality of Pre-school	Developmental Outcome at Exit from Pre-School: General Cognitive Ability	Self Regulation	Anti-Social / Worried Behaviour
Child Level	*Manager:* Highest Academic Qualification	3-Way*		
	Highest Childcare Qualification	3-Way**		
	Staff: Mean Age	2-Way** and 3-Way*		
	Mean Highest Academic Qualification			
	Mean Highest Childcare Qualification	3-Way*		
	Number of Staff			
	Number of Children			3-Way*
	Duration			*2-Way**
Family Level	*Manager:* Highest Academic Qualification			
	Highest Childcare Qualification		2-Way*†	
	Staff: Mean Age		3-Way*	
	Mean Highest Academic Qualification			
	Mean Highest Childcare Qualification	3-Way*		
	Number of Staff	3-Way*		
	Number of Children	2-Way**		
	Duration			

*$p < .05$ **$p < .01$ ***$p < .001$

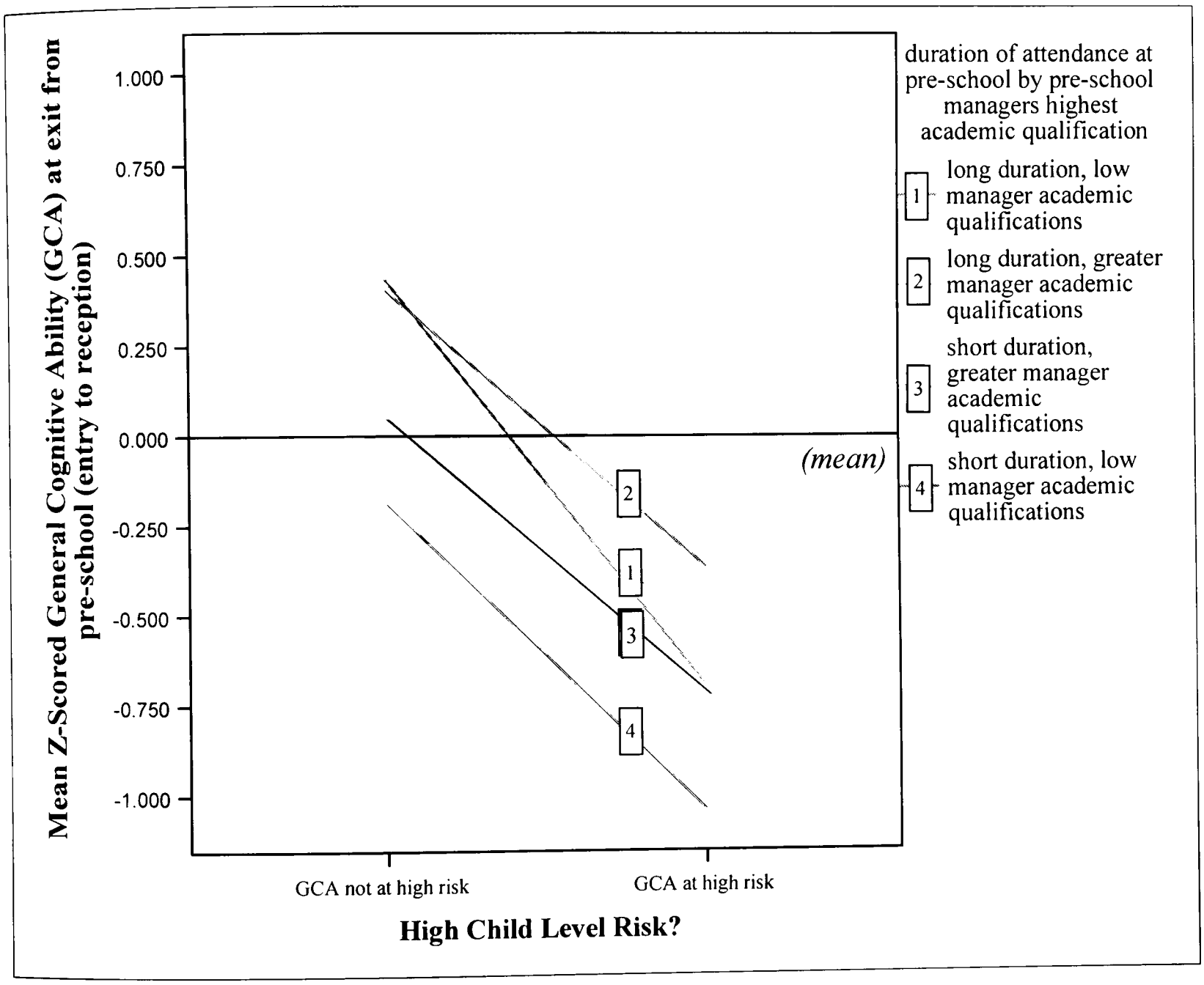
† *Statistically significant interaction between risk and quality upon self regulation, but not indicative of protection, see Section 5.1.3*

Manager's Highest Academic Qualification

Figure 5.14 reveals how the impact of child-level risk to GCA at exit from pre-school (β=-0.05, $p<0.01$) varied by children's duration of attendance and the academic qualifications of managers (β=0.03, $p<0.05$). When GCA was not at high risk, it was longer duration irrespective of qualifications that was associated with the highest levels of cognitive development (Figure 5.14 lines 1 and 2). However, when risk was very high (>+1 s.d.), it took a longer duration at a pre-school run by a manager with

greater academic qualifications in order for GCA to be even partially protected (Figure 5.14 line 2).

Figure 5.14 Impact of child-level risk to General Cognitive Ability at exit from pre-school varying by the academic qualifications of pre-school managers and children's duration of attendance



Manager's Highest Childcare Qualification

The partial protection illustrated in Figure 5.15 mirrors that which was found for the greatest academic qualification of managers (see Figure 5.14 above). As in this previous case, the significant impacts of combined child-level risk to GCA at exit from pre-school (β=*-0.05, p<0.001*) was partially moderated by a longer duration of attendance combined with a more highly qualified manager (β=*0.03, p<0.01*). Again though, this combined effect was only found under conditions of significantly high risk; for those children whose development was not at high risk, it was a longer

duration that proved most beneficial rather than the qualifications of the pre-school manager.

Figure 5.15 Impact of child-level risk to General Cognitive Ability at exit from pre-school varying by the childcare qualifications of pre-school managers and children's duration of attendance

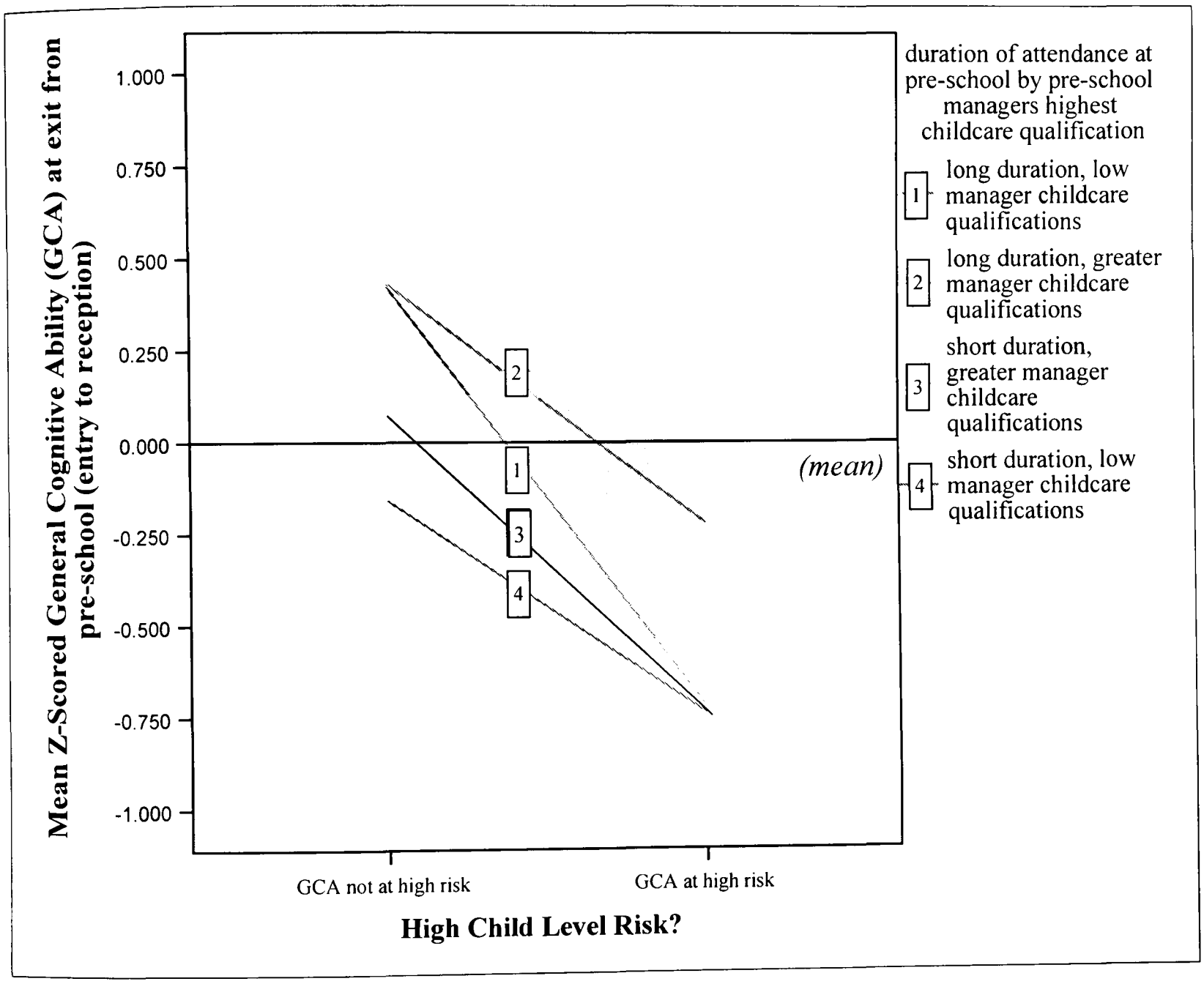
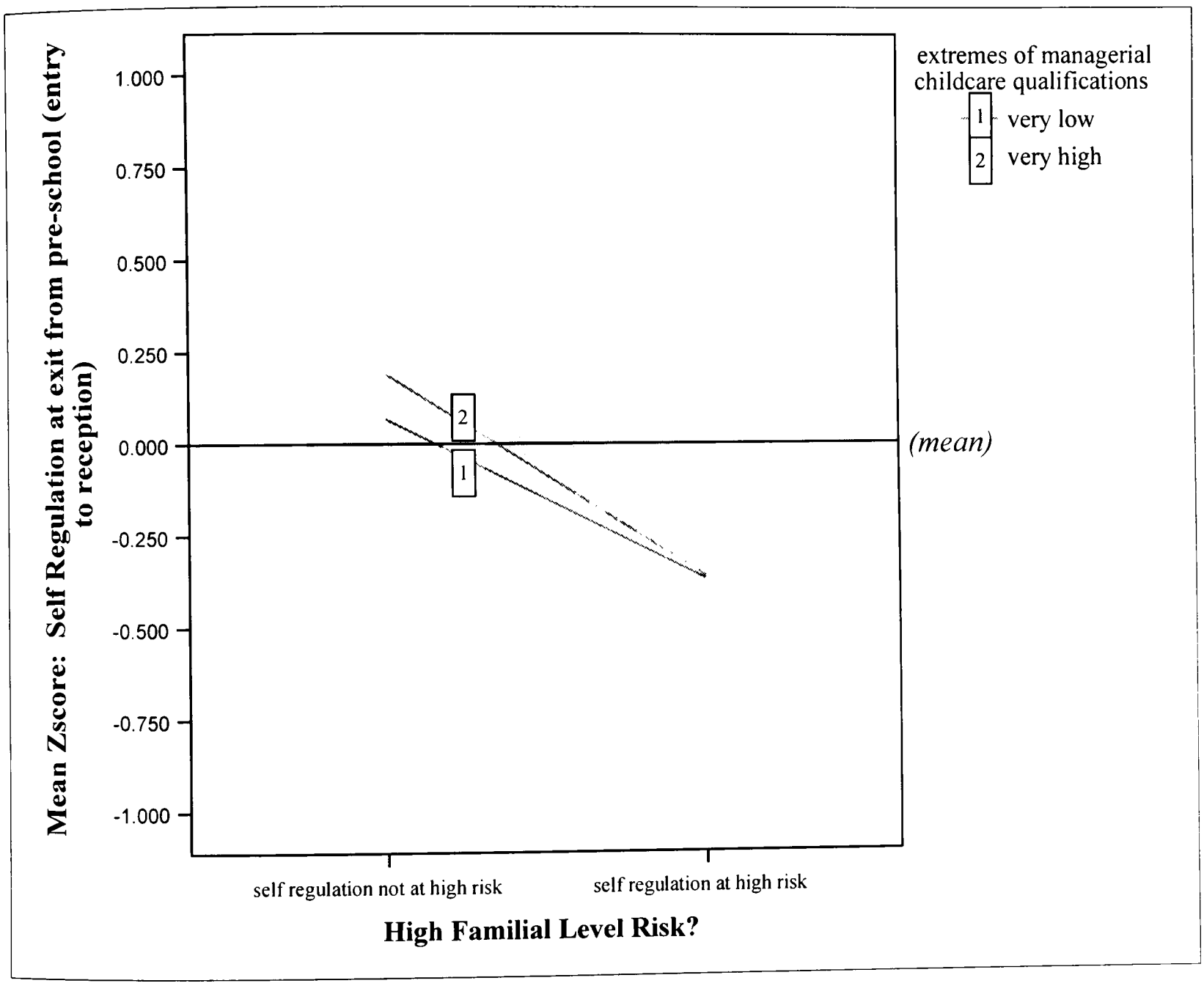


Figure 5.16 displays a statistically significant interaction between risk and quality that is not indicative of protection. Although the impact of family risk on self regulation *(β=-0.14, $p<0.001$)* varied according to the qualifications of managers *(β=-0.04, $p<0.05$)*, under high risk, there was no difference between the self regulation of children who attended pre-schools managed by very highly academically qualified managers and those who did not. In a way, the significant statistical interaction illustrated in Figure 5.16 is almost the opposite of protection: pre-schools with more highly academically qualified managers had a bigger impact on development when

risk was low (rather than high) and thus high risk was not *moderated* by high structural quality to evidence protection. Such a relationship is discussed in Wu and Zumbo (2007) who argue that, "*...a moderation effect is certainly an interaction effect, but an interaction effect is not necessarily a moderation effect.*"

Figure 5.16 Impact of family-level risk to self regulation at exit from pre-school varying by the childcare qualifications of pre-school managers



Mean Staff Age

Figure 5.17 illustrates the protective effect that these analyses found the average age of pre-school centre staff to have ($\beta=0.02$, $p<0.01$) upon the impact of child-level risk to their GCA at exit from pre-school ($\beta=-0.06$, $p<0.001$). Although pre-schools with a younger average age of staff were associated with greater GCA when child-level risk was low, this association was reversed when risk became high. Under these conditions, the GCA of children at exit from pre-school was found to be higher when

the pre-schools that they had attended had been staffed by carers of an older average age.

Figure 5.17 Impact of child-level risk to General Cognitive Ability at exit from pre-school varying by the mean age of the pre-school centre staff

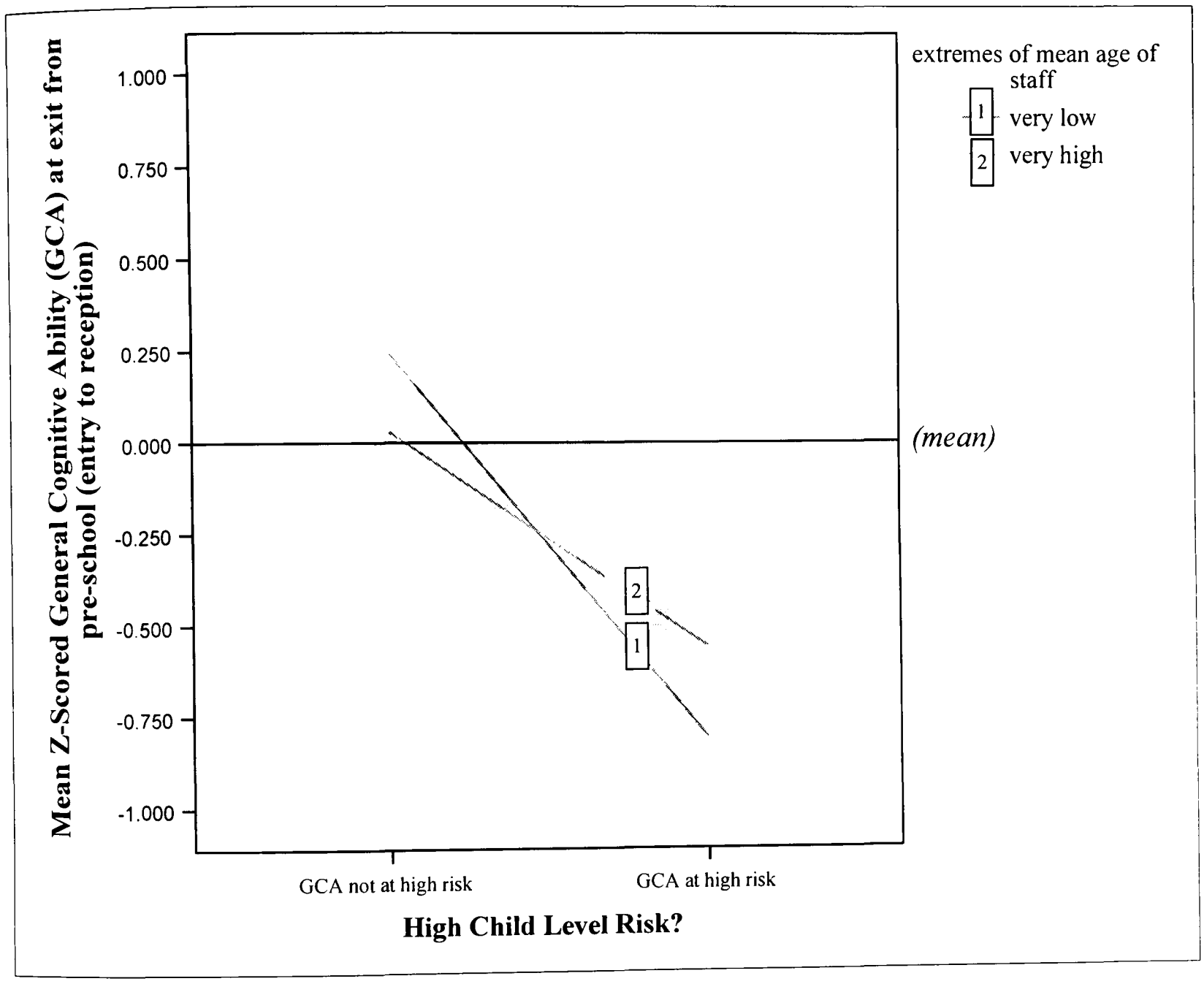
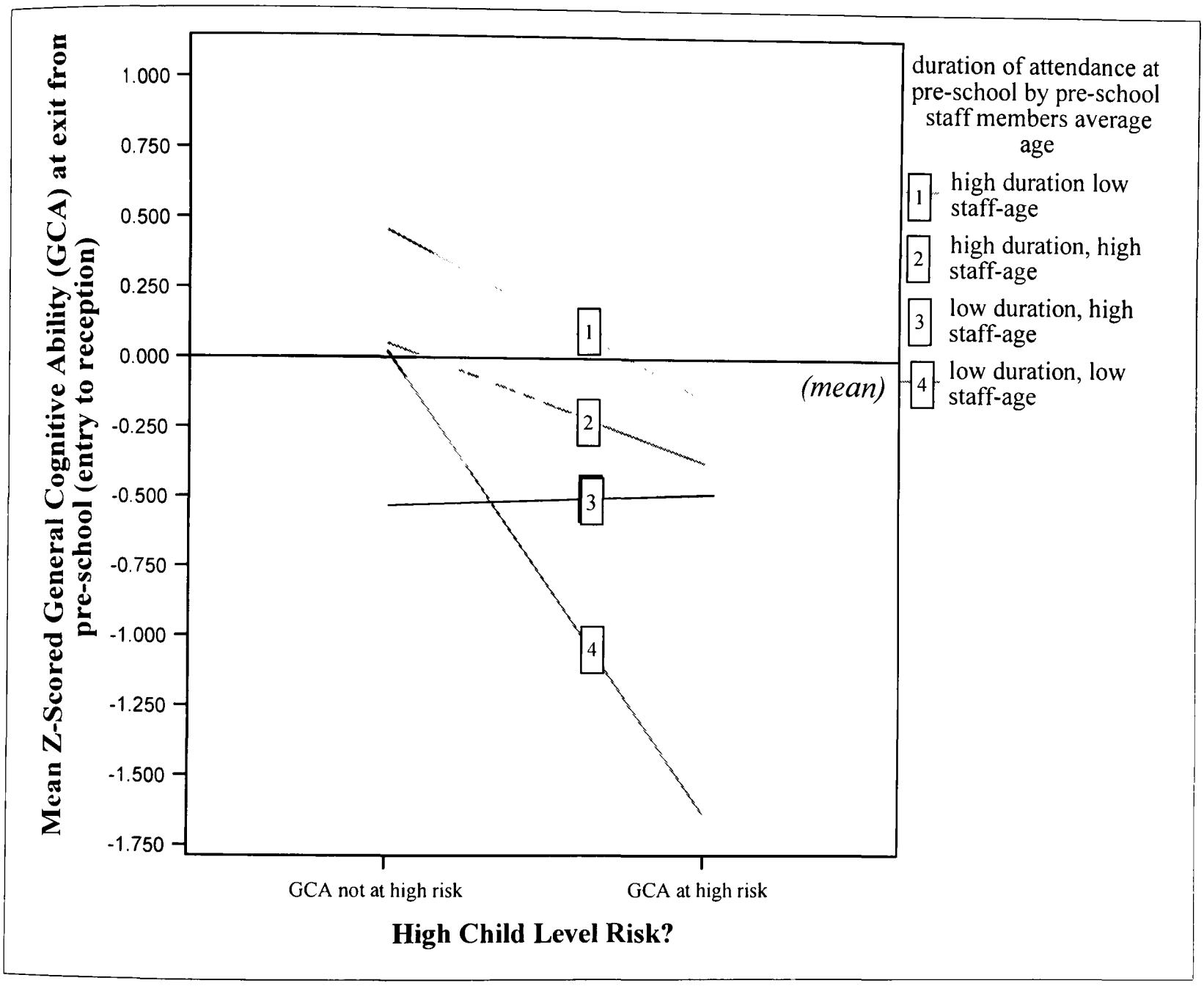


Figure 5.18 builds upon the relationships that were revealed in Figure 5.17. In addition to the finding that having an older average aged staff made a significant contribution to lessening the impact of child level risk to GCA at exit from pre-school (β=-0.06, $p<0.001$), when the simultaneous moderating effect of duration was examined, a further protective effect was also identified (β=-0.03, $p<0.05$). This secondary protective effect was that a longer duration of pre-school can offer partial protection even when the ages of the staff are low (Figure 5.18, line 1). Building upon Figure 5.17, the effect of high levels of risk to GCA was most pronounced in

those children who attended a pre-school for a brief period that was *also* characterised by being staffed by relatively young caregivers (Figure 5.18, line 4).

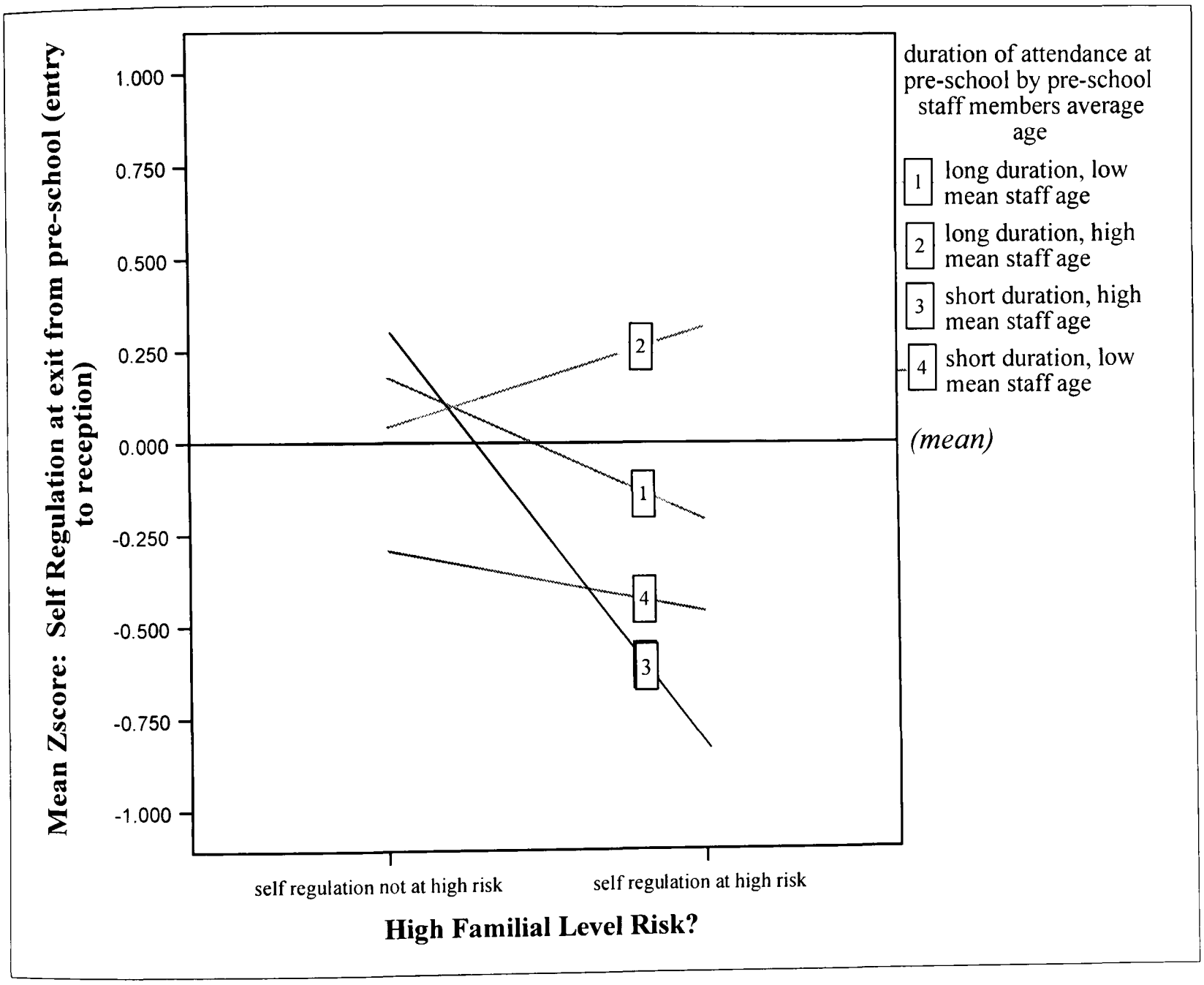
Figure 5.18 Impact of child-level risk to General Cognitive Ability at exit from pre-school varying by the mean age of the pre-school centre staff and duration of attendance



The final protective effect that was found to originate from the mean age of pre-school centre staff is shown in Figure 5.19 and concerned the significant impact of familial-level risk to young children's self regulation at exit from pre-school (β=-*0.15, p<0.001)*. Duration of attendance (in months) combined with the mean age of staff to significantly altered the impact of familial-level risk (β=*-0.05, p<0.05)*. When family level risk was very high (>+1 s.d.), longer durations of care with staff of an older average age led to higher than average levels of self regulation, despite the significant impacts of family-level risk (Figure 5.19, line 2). By contrast, when

family risk was not high, self regulation only ever exhibited a tendency to be below average when the average carer was young and children's duration of attendance was short (Figure 5.19, line 4).

Figure 5.19 Impact of child-level risk to self regulation at exit from pre-school varying by the mean age of the pre-school centre staff and duration of attendance



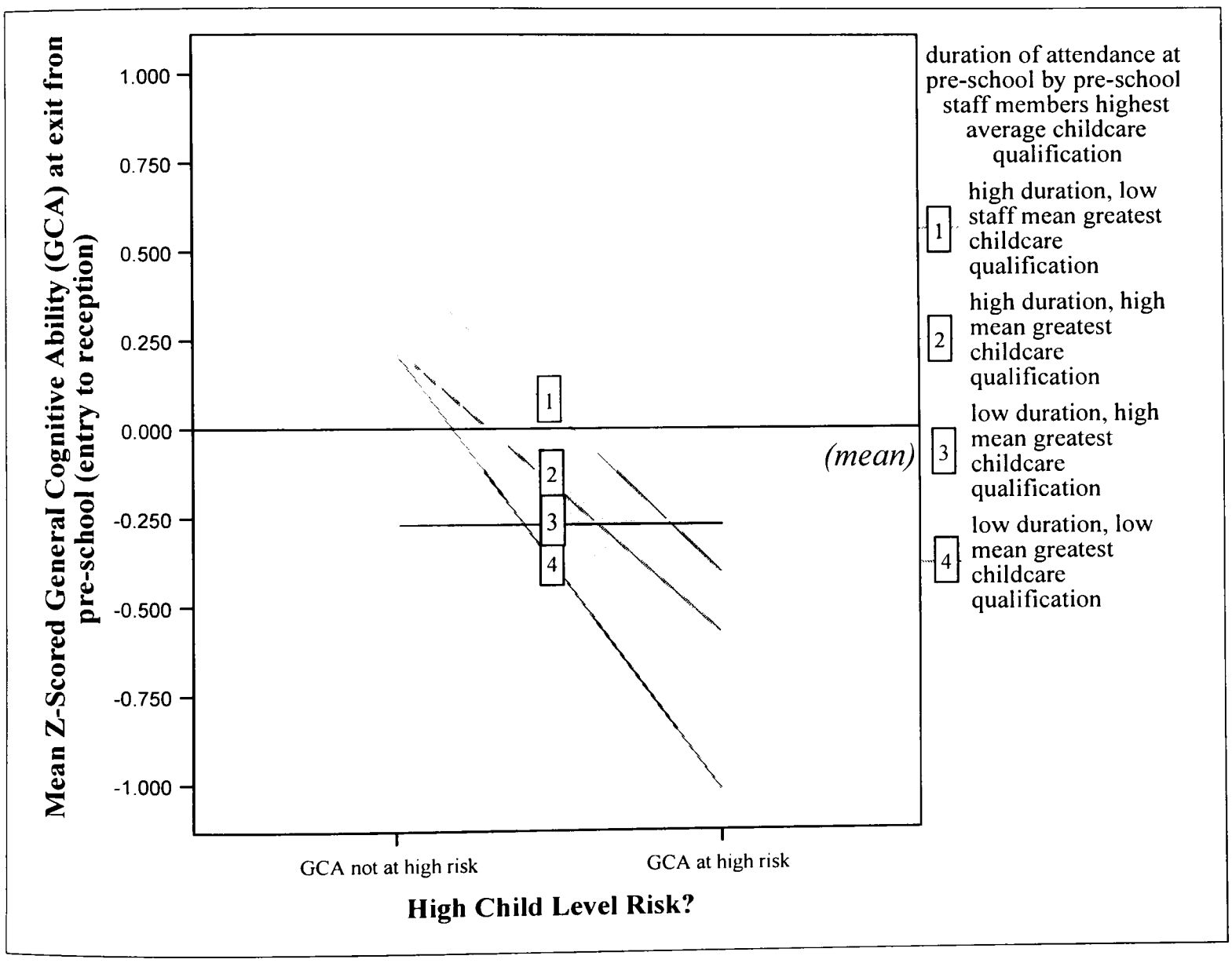
Mean Staff Highest Academic Qualification

These analyses found that the average highest academic qualification of pre-school centre staff had no significant effects upon the impact of either child or family level risk to young children's GCA, self regulation, or anti-social/worried behaviour at exit from pre-school.

Mean Staff Highest Childcare Qualification

Figure 5.20 illustrates the significant impact that combined child-level risk was found to have upon young children's GCA at exit from pre-school (β=-0.06, p<0.001) and shows this to vary by both duration of attendance and by the average childcare qualifications of pre-school staff (β=-0.03, p<0.05). Figure 5.20 reveals a partially protective effect of increasing childcare qualifications and duration of attendance as lessening the impacts of child-level risk (compare lines 2 and 4 for 'at high risk').

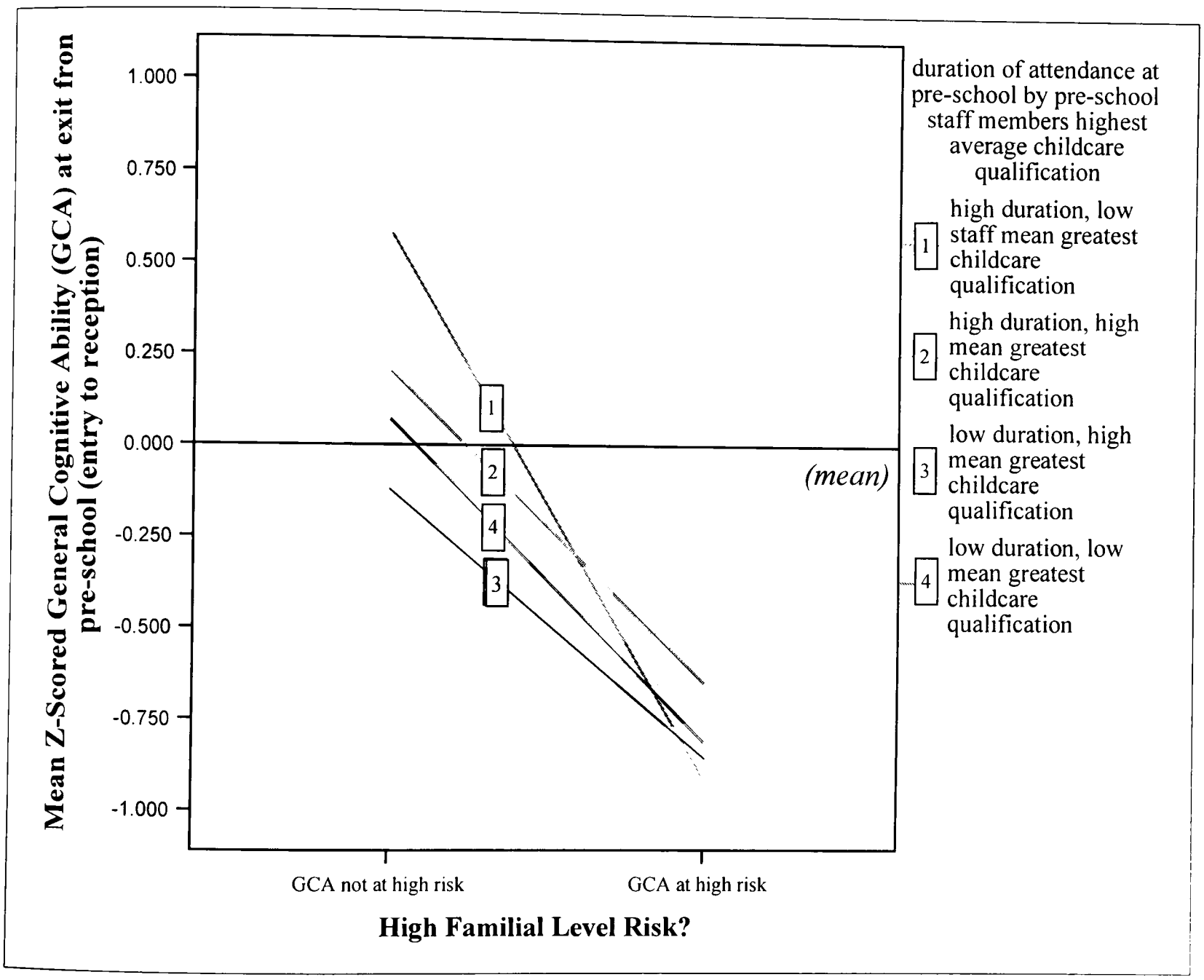
Figure 5.20 Impact of child-level risk to General Cognitive Ability at exit from pre-school varying by the mean highest childcare qualifications of pre-school staff and duration of attendance



As in Figure 5.20, Figure 5.21 illustrates a partially protective effect of greater average childcare qualifications of pre-school staff combined with longer durations of attendance (β=-0.02, p<0.05). However, unlike the above reported protective effect, that shown in Figure 5.21 concerns the partial protection of GCA at exit from pre-school from the significant impacts of *family*-level combined risk (β=-0.10,

p<0.001). Although very high levels of risk were associated with a large decline in average GCA as in Figure 5.20, this impact was again minimised for those children who had attended pre-schools for longer periods and which were staffed by carers with greater average childcare qualifications (Figure 5.21, line 2 for 'at high risk').

Figure 5.21 Impact of family-level risk to General Cognitive Ability at exit from pre-school varying by the mean highest childcare qualifications of pre-school staff and duration of attendance

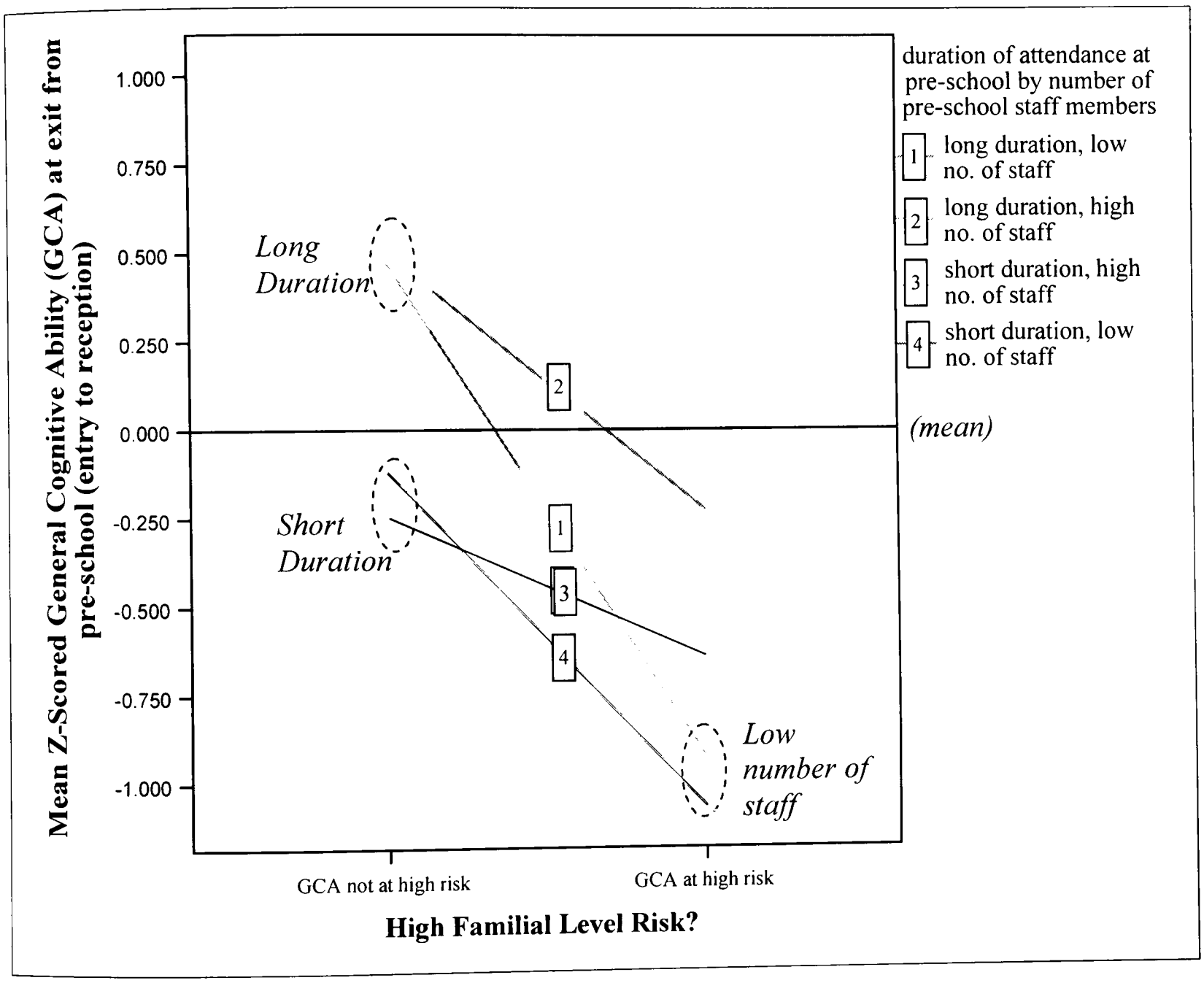


No. of Staff

Figure 5.22 reveals how the significant impacts of family-level combined risk to young children's GCA at exit from pre-school (β=*-0.10, p<0.001)* was protected against by longer durations spent at pre-schools with greater numbers of staff (β=*-0.01, p<0.05)*. When risk was not high (<+1 s.d.), longer durations of time spent in pre-school was associated with greater levels of GCA irrespective of the number of

staff within in. However, when family level risk was high (>+1 s.d.), the greatest average GCA scores were found for those children who had attended pre-schools with more staff for a longer period (Figure 5.22, line 2), whilst the lowest average GCA scores were found for children who had attended pre-schools with relatively few staff.

Figure 5.22 Impact of family-level risk to General Cognitive Ability at exit from pre-school varying by the number of centre staff and children's duration of attendance

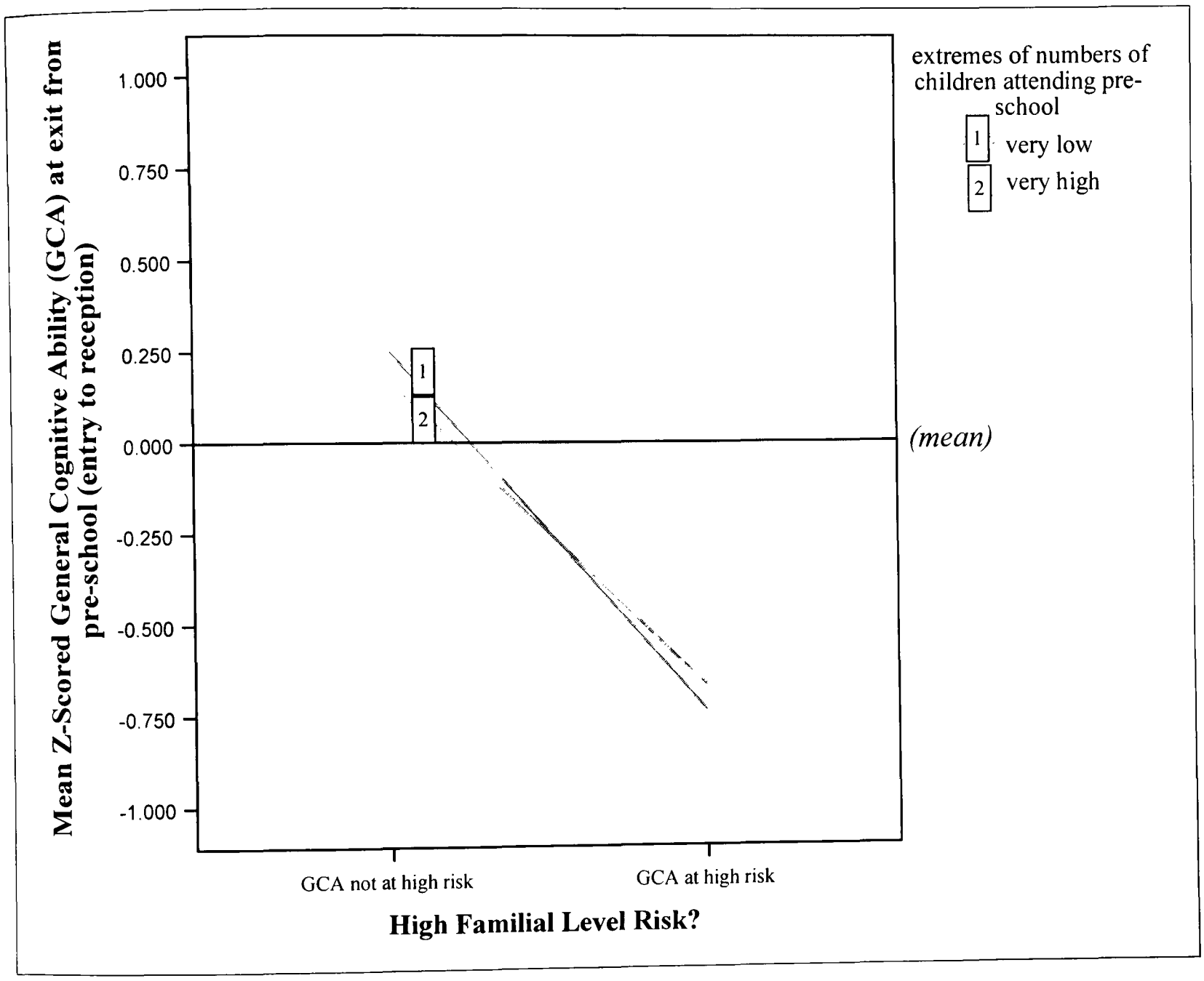


No. of Children

The final two instances of pre-school quality (either structural or process) protecting young children's cognitive and social development at exit from pre-school from the effects of child or family level risks that were found by this investigation are revealed in Figures 5.23 and 5.24. Figure 5.23 illustrates a small but significant lessening of the impact of family-level risk to young children's GCA ($\beta=0.03$ $p>0.05$) to be associated with children going to pre-schools which catered for larger numbers

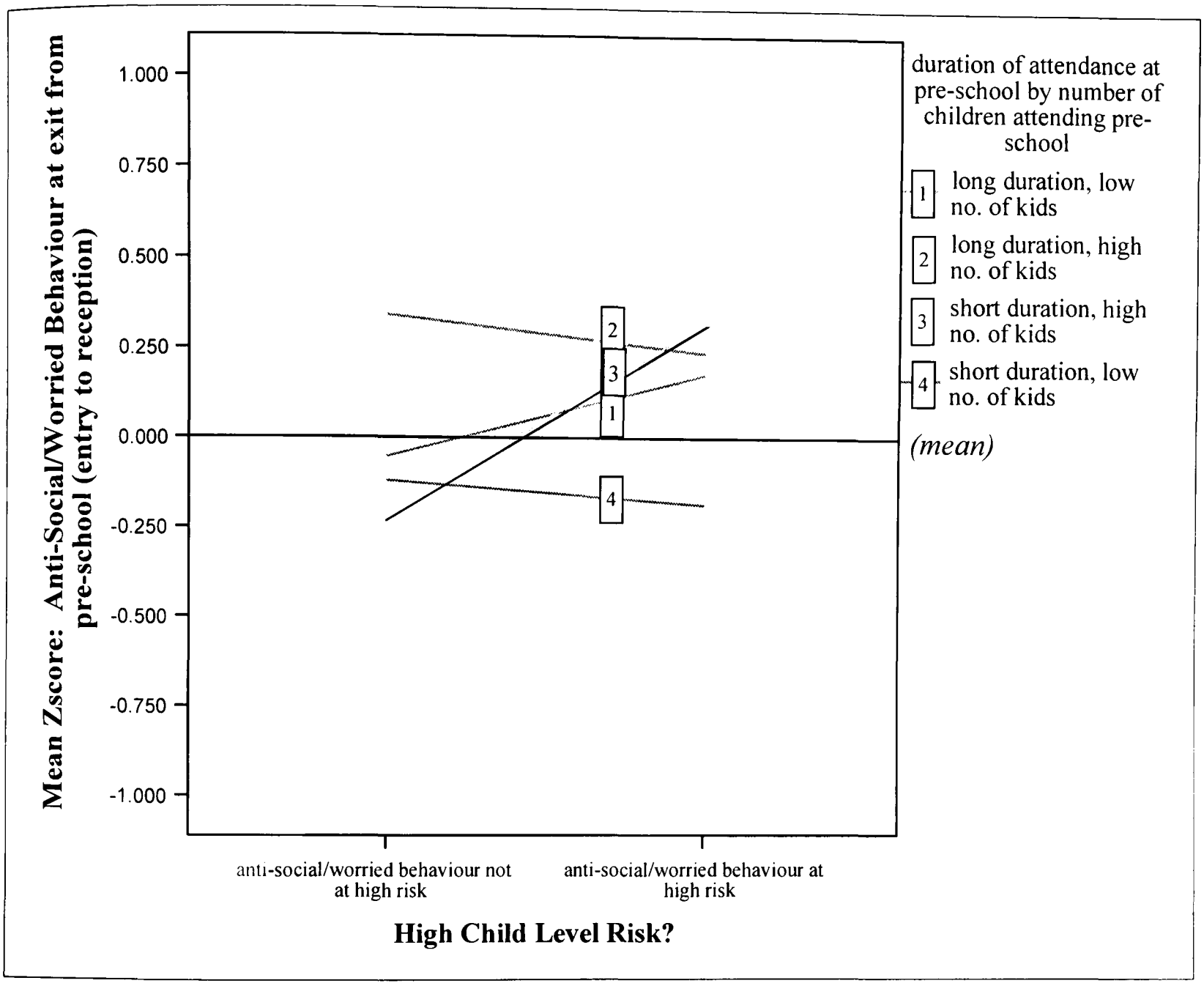
(β=0.38, p<0.01). Furthermore, this was also a protective effect that was found not to vary with increasing duration of attendance (β=0.03, p>0.05).

Figure 5.23 Impact of family-level risk to General Cognitive Ability at exit from pre-school varying by the number of children in a pre-school



In contrast to Figure 5.23, Figure 5.24 illustrates a partial protective effect that *did* vary with duration of attendance and which was associated with child-level risk and young children's anti-social / worried behaviour at exit from pre-school (β=-0.11, p<0.05). Shorter duration of attendance at pre-schools caring for fewer children was associated with the lowest levels of anti-social/worried behaviour (Figure 5.24, line 4). By way of reminder, this was no surprise considering the negative effect on anti-social / worried behaviour that this study found as stemming from simply longer durations of pre-school (see Figure 5.2; β=0.04, p<0.05).

Figure 5.24 Impact of child-level risk to anti-social/worried behaviour at exit from pre-school varying by the number of children in a pre-school and their duration of attendance at it



5.2 Developmental Pathways *in Focus*: Entry to Reception through Key Stage 1

The final section of this chapter expands upon the within developmental domain effects that were presented in Section 5.1.1 (see Tables 5.6, 5.7, and 5.8) by further investigating the longevity of each of the instances of partial protection that have just been evidenced in Section 5.1.2. Whilst the results of this previous section only tested and found strong effects of cognitive and social skills at exit from pre-school upon themselves through Key Stage 1, this section takes these relationships a step further by examining between developmental domain effects as well[118]. As such, this analysis complements the results presented in Section 5.1.1 by providing a more detailed examination of developmental pathways, albeit whilst omitting the previously

[118] I.e. Cognitive development on subsequent social development and vice versa

modelled effects of risks and pre-school (with the rationale for this given at the beginning of this chapter). As a result, this section, its analysis, and its results, extend the findings of Section 5.1. In particular, whilst the previous section found aspects of pre-school to protect developmental skills at exit from pre-school, the importance of this for subsequent developmental pathways was only partially demonstrated. It is this partial indication of the longer-term importance of the protected skills that was evidenced in Section 5.1 that this section (5.2) expands upon.

The first relationships that are reported in this section concern whether the protected cognitive and social skills at exit from pre-school could continue to have an impact upon developmental abilities at the end of the 1st year of primary school (~age 6). Following on, this examination is then taken a stage further by analysing whether there remained effects upon measures of development that were taken at the end of Year 2 (~age 7). The underlying rationale behind this analysis came from the title of this investigation, *"The contribution of early education to vulnerable and resilient developmental pathways"*. Whilst the previous analyses of this chapter examined whether early education could promote resilience in developmental skills that proved *vulnerable* to the impacts of risks, the following results extended this analysis by focusing on the subsequent total developmental *pathways* that these key skills were associated with.

To study the endurance of each of the 20 cases of protected abilities/skills that were evidenced at exit from pre-school / entry to reception, their total effects[119] upon both cognitive and social developmental abilities at the end of the 1st and 2nd years of Primary School were investigated. For longevity to be verified, the abilities and skills at entry to reception were required to have significant impacts upon latter measures of development which were over and above those of the earlier measures of social and cognitive skills at entry to pre-school. By demonstrating the strength of the impacts that General Cognitive Ability (GCA), self-regulation, and anti-social/worried behaviour had upon subsequent development during primary school, the importance of protecting these key skills at entry to reception would be uncovered. In other words, conclusions concerning 'vulnerable' and 'resilient' developmental pathways

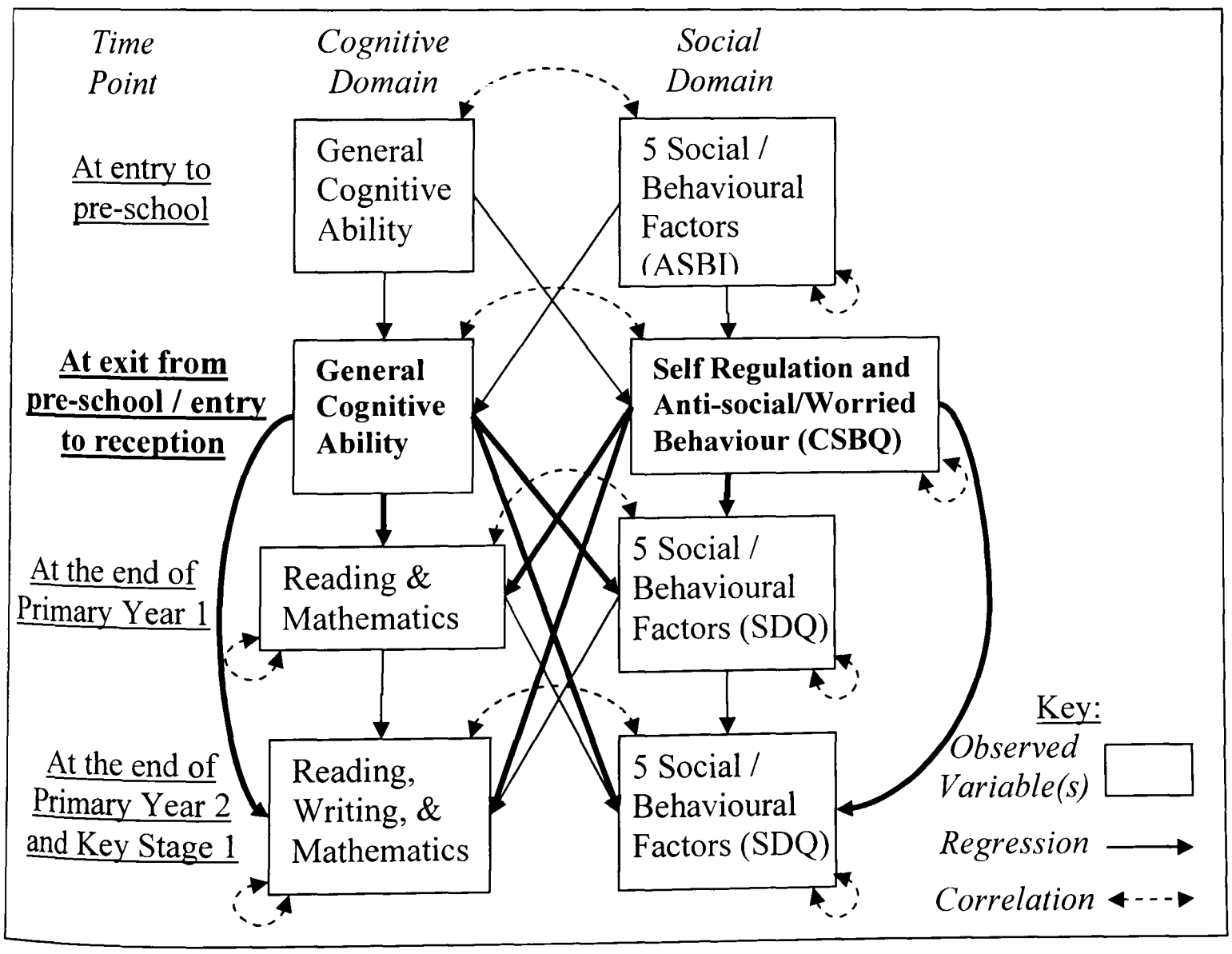
[119] *direct* and *indirect* (see Chapter 2 and Section 2.4.1)

could be only be made by this thesis once the protection that was evidenced in Section 5.1 was combined with a robust demonstration of the *total* subsequent developmental impacts that were associated with these skills (rather than just those that were within developmental domain).

5.2.1 Statistical Model

Figure 5.25 presents a stylised representation of the value-added, aggregated Structural Equation Model (SEM) which provided the results that are reported in this section. Unlike the models which were hypothesised and tested previously (see Figure 5.1) this analysis differed in two important ways. First, the model that is presented in Figure 5.25 contains no latent variables (being instead a *'path analysis'*). Second, the statistical model tested both domains of development *simultaneously* in order to more appropriately (and with greater ecological validity) measure the *total* developmental impacts of each of the skills that were measured at exit from pre-school/entry to reception (compared to Tables 5.6, 5.7, and 5.8).

Figure 5.25 *Stylised* path diagram illustrating the multi-level Structural Equation Model used to establish the total effects of skills/abilities at entry to reception[113]



To complement the separate analyses of children's development that have been conducted in this investigation, the SEM illustrated in Figure 5.25 modelled all of the developmental measures of this investigation *simultaneously*. Furthermore, these developmental measures were included alongside all the possible ways by which the three developmental skills that were measured at exit from pre-school (and which were the focus of Section 5.1) could possibly impact subsequent development. There were fourteen ways in which developmental skills at exit from pre-school were hypothesised to impact subsequent development:

- Within cognitive developmental domain *direct* effects upon[120]:
    1. Development at the end of primary year 1
    2. Developmental at the end of primary year 2 (Key stage 1)
- Within social development domain *direct* effects upon[113]:
    3. Development at the end of primary year I
    4. Developmental at the end of primary year 2 (Key stage 1)
- Between domain *direct* effects of cognitive skills upon[113]:
    5. Social development at the end of primary year I
    6. Social developmental at the end of primary year 2 (Key stage 1)
- Between domain *direct* effects of social skills upon[113]:
    7. Cognitive development at the end of primary year 1
    8. Cognitive developmental at the end of primary year 2 (Key stage 1)
- Within developmental domain *indirect* effects upon development at the end of primary year 2/Key Stage 1 for both:
    9. Cognitive skills
    10. Social skills
- Between domain *indirect* effects upon development at the end of primary year 2/Key Stage 1 that takes one of two forms:
    a. Development at exit from pre-school impacting same domain development at the end of Key Stage 1 via alternative domain skills at the end of primary year 1:
    11. Cognitive development on itself via intermediate social skills
    12. Social development on itself via intermediate cognitive skills

[120] The arrows shown in **bold** in Figure 5.25 are the direct effects of the three developmental abilities at exit from pre-school/entry to reception class.

b. Development at exit from pre-school impacting alternative domain development at the end of Key Stage 1 via same domain skills at the end of primary year 1:

13. Cognitive development on social development via intermediate cognitive skills
14. Social development on cognitive development via intermediate social skills

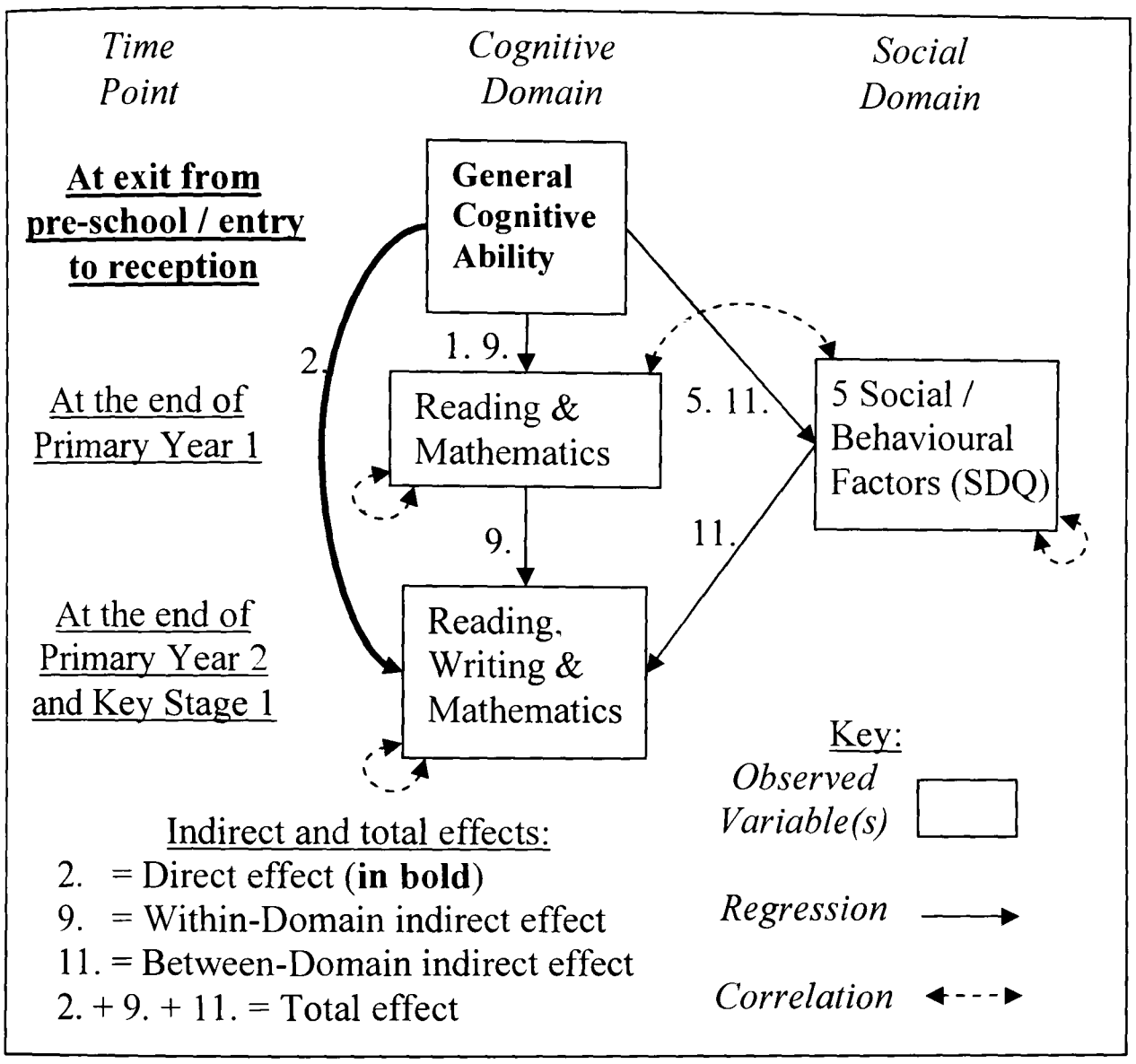
It is via the simultaneous specification of all of these *statistical* pathways that this investigation makes the most valid claims concerning *developmental* pathways. As discussed in Chapter 2 (see Figure 2.5), the alternative specification of either only direct effects[121], or the specification of only some statistical pathways[122] does not constitute an estimation of *total* effects. Instead, the modelling of *total* effects to represent the impact of skills at exit from pre-school upon the 'developmental pathways' which follows carries with it an implicit assumption. This assumption is that the modelling of statistical 'total' effects constitutes some measure of developmental pathways by taking into account all possible intermediary measures of development and their relationships to one another. The validity of total effects for the representation of underlying developmental pathways is supported by previous studies that have used this methodology (e.g. Reynolds & Ou, 2003), and is also greater than the modelling of direct effects.

Figure 5.26 provides an example of the relationships (and from these, the developmental pathways) which were specified in this section in order to guide the reader through the results that follow. In order to support the reader in better associating the statistical relationships illustrated in Figure 5.25 with the list of 14 types of effects that are given above, Figure 5.26 presents a selection of these tested relationships along with their corresponding numeric values (1 through 14). The below figure (5.26) illustrates all of the ways in which General Cognitive Ability at exit from pre-school was estimated to impact the 3 'R's of reading, writing, and maths at the end of Key Stage 2. There is a direct effect (labelled '2.'), a within developmental domain indirect effect (labelled '9.') incorporating an intermediate direct effect (labelled '1'), a between developmental domain indirect effect (labelled

[121] As in a classical multiple regression analysis
[122] In reference to those statistical pathways estimated in the earlier reported results of this investigation

'11.') incorporating an intermediate direct effect (labelled '5'), and a total effect (the sum of '2.', '9,', and '11.').

Figure 5.26 Direct, indirect, and total effects of General Cognitive Ability on reading, writing, and mathematics at the end of primary year 2/Key Stage 1



Before the degree to which the model illustrated in Figure 5.25 is shown to have fitted the EPPE data, a final consideration must be given as to why an alternative SEM featuring latent and summary measures of development was not specified. There are two reasons for this with the first relating to substantive issues concerning the measurement of constructs, and the second relating to the accuracy and consistency of the relationships derived from such a model itself.

The first reason why latent summary measures of development were not included in the above model (Figure 2.25) concerns the rationale behind this model and the impact that this has on the findings that are returned. So far, this investigation has hypothesised (and found) that there are very different effects on development which

are specific to both the cognitive and social domains[123]. The alternative modelling of latent summary variables of development at each time point would have been a radical departure from the rationale of the previous analyses and would have homogenised variables and relationships that earlier results from this investigation had shown to differ. Furthermore, by modelling summary variables, this analysis would cease to be as obvious an extension to that of Section 5.1 as the variables concerning development during primary school would be different.

The second reason why latent summary variables were not modelled in this section of the results is the effect that this would have had on the statistical and then consequently the developmental pathways that these were used to approximate. Just as modelling latent summary variables of development at each time point would have unduly homogenised. so to would this have homogenised the *effects* that these would have had on each another. Instead of multiple possible paths by which developmental abilities at exit from pre-school could influence Key Stage 1 achievement, these would be replaced by fewer (and conceptually broader) relationships which would be less sensitive to variations between the subscales that made them up. As such, the detail with which developmental skills and their relationships were being examined would have been reduced. As a consequence, the very estimation of total effects would therefore also have been limited due to the modelling of latent summary measures of development. The systematic underestimation that this decision would have represented is further unjustified due to the ease with which a more detailed examination (via subscales) could be carried out and the results of just such a procedure which are now discussed.

5.2.2 Model Fit Indices

Table 5.11 presents the fit indices of the statistical model that is illustrated in Figure 5.25 and documents how closely the relationships that were hypothesised in the model were able to reproduce the EPPE data from which they were derived. Examining these fit indices, it can be seen that other than the Chi-Square Test (that is known to

[123] See Table 5.9 and the protection of self regulation compared to anti-social worried behaviour for example

be unreliable[124]; see Kenny, 2008), all other fit indices indicated a high degree of model fit. Both the values of the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI) were identified as being close to their shared upper limit of 1 (0.99 and 0.96). In addition, the Root Mean Square Error of Approximation (RMSEA) was found to lie within a range that has also been taken as an indication of a high degree of model fit (0.03).

Table 5.11 Model fit indices of the multi-level path analysis of developmental measures taken from entry to pre-school until the end of Key Stage 1

Fit Index	Value
1. Chi-Square Test	353.37
degrees of freedom	97
P-value	0.000
2. Comparative Fit Index (CFI)	0.986
3. Tucker-Lewis Index (TLI)	0.963
4. Root Mean Square Error of Approximation (RMSEA)	0.030

Using the statistical results obtained from this well fitting model[125], the following Sub-sections present the relationships that were found between GCA, self-regulation, and anti-social/worried behaviour at entry to reception as they impacted each of the developmental measures that were taken during primary school (up until the end of Key Stage 1). To do this, results are presented using two different approaches to measuring this relationship with the first being the *direct* contextualised relationships which were modelled by the path analysis illustrated in Figure 5.25 (each individual arrow). Although this method took into account the aggregated structure of the EPPE data and reliably imputed missing values, it also fails to account for the *indirect* relationships that also exist over time and in between the domains of development. As a result, the second method that was used to illustrate the relationships between reception entry skills and subsequent developmental measures were the *total* effects which included not only those effects that were *direct*, but also the sum total of all

[124] Kenny (2008) reports that when correlations between measures in an SEM are high, the Chi-square statistic will indicate inappropriately poorer model fit
[125] The full results and technical output of which is presented in Appendix 9

possible intermediary *indirect* pathways (including those that existed between the cognitive and social domains)[126].

5.2.3 Impacts at the End of Year 1 of Primary School

Table 5.12 presents the direct effects of General Cognitive Ability (GCA), self-regulation and anti-social/worried behaviour at entry to reception on seven developmental measures that were taken at the end of the 1st year of primary school: reading, mathematics, and the five subscales of the Strengths and Difficulties Questionnaire (SDQ; R. Goodman, 1997, 2001). These results expand upon those presented in Table 5.6 (Section 5.1.1) by modelling effects that were *both* within *and* between domains of development. Although all of these relationships were found to be statistically significant other than anti-social/worried behaviour impacting Year 1 emotional symptoms ($\beta = 0.00$, $p > 0.05$) and peer problems ($\beta = 0.04$, $p > 0.05$), systematic differences can be observed between the various effects. Perhaps most obvious are the large variations that can be seen in the percentages of variance that were explained in the developmental measures at the end of year 1. Whilst variations in maths ability and hyperactivity had 40 and 32 percent of their variances explained by the joint actions of the three measures of development that were assessed at the end of pre-school, these were also the largest of the percentages that were explained. By contrast, these same three measures of development that were assessed at the end of pre-school could only account for 7% of the variation in peer problems, and only 2% of the variance in 'emotional symptoms'.

Such differences as those above illustrated not only the importance of protecting pre-school period cognitive and social skills for future development, but also, that understanding developmental pathways relies upon more than just understanding the influences of previous levels of development. Comparing these effects to those of Table 5.6, it can be seen that the standardised Betas all fell as the percentage of variance that was explained increased. This was relatively unsurprising as competing effects between domains were likely to lead to reduced Betas whilst a greater *number* of effects would likely lead to a greater percentage of variance being explained.

[126] Achieved using the MPlus "MODEL INDIRECT" command (see L. K. Muthén & Muthén, 2004)

However, it is also important to note that the same general pattern of results can be observed in both of these Tables.

Table 5.12 Development at exit from pre-school impacting development at the end of primary Year 1: Direct effects from the aggregated SEM (2 d.p.)

Measures of development taken at: Entry to Reception	End of Primary Year 1	*Direct* Effects *(from the path analysis)* Standardised Beta Co-efficient	Total % variance explained [a]
General Cognitive Ability			
	Reading	**0.40*** **	(see below)
	Mathematics	**0.51*** **	
	Emotional Symptoms	**-0.07** **	
	Conduct Problems	**-0.10** **	
	Hyperactivity	**-0.18** **	
	Peer Problems	**-0.08** **	
	Prosocial Behaviour	**0.08** **	
Self-Regulation			
	Reading	**0.17*** **	(see below)
	Mathematics	**0.22*** **	
	Emotional Symptoms	**-0.07** **	
	Conduct Problems	**-0.16*** **	
	Hyperactivity	**-0.37*** **	
	Peer Problems	**-0.19*** **	
	Prosocial Behaviour	**0.25*** **	
Anti-social/Worried Behaviour			
	Reading	**-0.06** **	24%
	Mathematics	**-0.05***	40%
	Emotional Symptoms	0.00	2%
	Conduct Problems	**0.30*** **	19%
	Hyperactivity	**0.16*** **	32%
	Peer Problems	0.04	7%
	Prosocial Behaviour	**-0.14** **	15%

$*p < .05$ $**p < .01$ $***p < .001$

[a] *Only the* total *% variance explained (due to both GCA, self-regulation, and anti-social/worried behaviour) is available*

Serving to further differentiate the results that are presented in Table 5.12 are the variations that were found between the direct effects of the measures that were assessed at the exit from pre-school upon those that were measured at the end of year 1 of primary school. Although there were considerable differences between these,

Table 5.12 shows that the largest effects which were found were those that were within each domain of young children's development. That is to say, the four largest directs effects were: GCA upon maths ($\beta=0.51$, $p<0.001$); GCA upon reading ($\beta=0.40$, $p<0.001$); Self regulation upon hyperactivity ($\beta=-0.37$, $p<0.001$); Anti-social/worried behaviour upon conduct problems ($\beta=0.30$, $p<0.001$). Furthermore, these cognitive upon cognitive and social upon social effects were not simply the bivariate relationships that were presented in Chapter 3. Instead these within-domain effects simultaneously took into account the impacts of the other development abilities at exit from pre-school as well as the similarity (or otherwise) of the developmental measures to one another. As such, Table 5.12 suggests that there are multiple readily apparent developmental pathways (e.g. self regulation to hyperactivity) which can each be rendered vulnerable and resilient due to young children's differing combinations of risks and experiences in early education (see Section 5.1.2)

5.2.4 Impacts at the End of Year 2 of Primary School & Key Stage 1

Following on from the learning and behaviour outcomes that were measured at the end of primary year 1, Table 5.13 reveals how developmental skills that were assessed at exit from pre-school impacted subsequent developmental outcomes at the end of primary year 2 / Key Stage 1. As with the previously reported results of Section 5.2.2, Table 5.13 reveals systematic similarities and differences between the three cognitive and social skills that were measured at this earlier time point and how these influenced subsequent development. However, novel to these results are the use of *total* effects which took into account all of the intermediate pathways that were hypothesised as existing between the measures of development that were taken at these two time points (illustrated in Figure 5.25). More specifically, these *'causal chains of hypothesised effects'* gave modified statistical effects that took into account the effects that were associated with the primary year 1 measures (see Table 5.12).

Table 5.13 Development at exit from pre-school impacting development at the end of primary Year 2: Direct and Total effects from the aggregated SEM (2 d.p.)

Measures of development taken at:		Standardised Regression Co-efficients *(standardised βs)*		
Entry to Reception	End of Primary Year 2	*Direct* Effects *(from the path analysis)*	*Total* Effects (Total *Direct* + Total *Indirect*)	*Total* % variance explained[a]
General Cognitive Ability				
	Reading	**0.23*** **	**0.50*** **	(see below)
	Writing	**0.16*** **	**0.42*** **	
	Mathematics	**0.20*** **	**0.48*** **	
	Emotional Symptoms	-0.05	**-0.11*** **	
	Conduct Problems	-0.02	**-0.09** **	
	Hyperactivity	-0.04	**-0.18*** **	
	Peer Problems	**-0.06***	**-0.10*** **	
	Prosocial Behaviour	0.04	**0.09*** **	
Self-Regulation				
	Reading	**0.06** **	**0.22*** **	(see below)
	Writing	**0.04** **	**0.23*** **	
	Mathematics	**0.07** **	**0.21*** **	
	Emotional Symptoms	0.00	-0.03	
	Conduct Problems	0.00	**-0.11*** **	
	Hyperactivity	**-0.12*** **	**-0.31*** **	
	Peer Problems	**-0.07***	**-0.15*** **	
	Prosocial Behaviour	**0.07***	**0.20*** **	
Anti-social/Worried Behaviour				
	Reading	-0.03	-0.03	58%
	Writing	**-0.04***	-0.04	46%
	Mathematics	-0.01	-0.03	52%
	Emotional Symptoms	**0.06***	0.05	9%
	Conduct Problems	**0.16*** **	**0.30*** **	34%
	Hyperactivity	**0.07*** **	**0.17*** **	47%
	Peer Problems	**0.08***	**0.13*** **	19%
	Prosocial Behaviour	**-0.07***	**-0.16*** **	27%

$*p < .05$ $**p < .01$ $***p < .001$

[a] *Only the* total *% variance explained (due to both GCA, self-regulation, and anti-social/worried behaviour) is available*

As in Section 5.2.2, the results of this section extended those that were found in the risk models that were presented in Section 5.1.1 (Table 5.7). The results shown in Table 5.13 broadly mirror those of the earlier results by demonstrating that GCA, self regulation, and anti-social/worried behaviour at exit from pre-school continued to exert sizeable significant effects on children's subsequent development during Key Stage 1 (up until the end of Primary Year 2). Further, these are findings which have

been found both within contexts of developmental risks (Section 5.1.1) and simultaneous modelling of cognitive and social developmental domains. That said, the differing statistical models did produce varying effects. Mirroring Table 5.12 in Section 5.2.2, the results of Table 5.13 displayed altered Betas and percentages of variance that were explained when compared to those that were obtained from the risk analyses. Compared to Table 5.7, the results of Table 5.13 revealed increased percentages of variance were explained by the total effects of GCA, self regulation, and anti-social/worried behaviour and this is to be expected given the increased number of simultaneous predictors. What is more surprising is the fact that the dual modelling of cognitive *and* social development led to increased cognitive upon cognitive relationships, but smaller social upon social relationships. This finding suggests that cognitive results may have greater a explanatory role for social development than social skills have for the development of cognitive skills.

The relationships that were observed between developmental abilities at entry to reception and the end of year 1 remain apparent in the results presented in Table 5.13: There were sizeable disparities in the percentages of variance in year 2 developmental abilities that were explained by the model illustrated in Figure 5.25. Whilst reading and maths at the end of Key Stage 1 had over 50% of their respective variances explained by the developmental measures assessed at exit from pre-school and the end of year 1 of primary, this fell to 9% for emotional symptoms. These findings support those that were made from the results revealed in Table 5.12, namely that although developmental abilities at entry to pre-school can be highly associated with subsequent development, this is not necessarily the case for all abilities/behaviours.

Again, repeating the patterns that were observed in the results at the end of primary year 1 (Table 5.12), the results presented in Table 5.13 were found to be differentiated by the *domain* of development that they were hypothesised to impact. GCA at entry to reception remained the most important predictor of children's subsequent academic skills, whilst self regulation remained most strongly association with hyperactivity, and anti-social/worried behaviour with conduct problems. Furthermore, these results were found in both the *direct* and *total* impacts of pre-school exit abilities although these results might be expected given the repeated measurement that was used throughout years 1 and 2. Nevertheless, the conclusions that were drawn from the

results concerning development at the end of primary year 1 are supported and extended by those that are presented in Table 5.13. GCA, self regulation, and anti-social worried behaviour at exit from pre-school remained key skills for young children's subsequent development. Not only do these developmental abilities continue to exhibit significant direct and total effects, but it has also been shown (see Section 5.1) that their vulnerability to risks can be offset by various facets of high quality early education to facilitate developmental resilience.

5.3 Conclusions

In conclusion, this chapter demonstrated how abilities and behaviours at exit from pre-school could be termed '*vulnerable*' due to the significant impacts of developmental risks (which are detailed in Chapter 4). However, this chapter also demonstrated how various aspects of pre-school could mitigate the risks that resulted in this vulnerability (Section 5.1) to render these same skills and abilities *'resilient'*. Taking this argument a step further these same skills at exit from early education (General Cognitive Ability (GCA), self-regulation, and anti-social/worried behaviour), were then shown to be strongly linked with developmental pathways over the next two years and so the conclusions concerning vulnerabilities and resilience may be extended (Section 5.2). Because developmental pathways during Key Stage 1 could be concluded to be vulnerable due to the earlier impeded developmental abilities during pre-school, then '*protecting*' these abilities could also be seen to offering protection to the subsequent developmental pathways with which they were so strongly associated. As such, it can therefore be concluded that the cognitive and social developmental pathways during Key Stage 1 that were studied in this investigation were rendered partially resilient to the impacts of pre-school period risks thanks to the contribution of high quality programmes of early education.

6. DISCUSSION AND CONCLUSIONS

This study drew upon a number of major themes from previous research that had investigated the development of young children to consider *'The contribution of early education to vulnerable and resilient developmental pathways'*. These themes included the substantive hypotheses of developmental risk, resilience to risks, and protective processes that facilitate resilience. Further, the operationalisation of these themes was in part accomplished through the use of the methodological hypotheses of mediation and moderation. This chapter begins with a discussion of each of these themes which draws upon conceptual threads first outlined in the Introduction Chapter.

Beginning with the major themes of this investigation that related to child development, risks were hypothesised as co-occurring and having probabilistic combined impacts on development that are specific to their timing and their ecological level (here: child or family). This was a novel conceptualisation of the characteristics of children and their families relative to the original EPPE investigation. In contrast to developmental risk, developmental resilience was hypothesised to be a process of overcoming the effects of risks and again, is specific to individuals, the ages of these individuals, and the ecological contexts in which they develop. However, the process of demonstrating resilience to risks is also facilitated by third-party protective processes which lessen the impact of an otherwise significant risk on any particular developmental outcome. These very specific definitions which were used by this investigation for the terms risk, resilience, and protection came from an evaluation of their use in previous research (Chapter 1).

It is from the very specific definitions of developmental risk, resilience, and protection that were employed by this investigation that resilient developmental pathways were defined and operationalised in two stages. First, developmental abilities at exit from pre-school were demonstrated to be impacted by combined risks and these impacts were shown to be partially protected against by the quality of early education. Second, the partially protected developmental abilities at exit from pre-school were then found to be strongly associated with development over the next 2 years. Thus, the resilience of developmental abilities at exit from pre-school implied resilience in the developmental pathways that followed and this argument

supports a conclusion that high quality programmes of early education could be considered to offer a type of early prevention.

The three central developmental themes of this investigation (risk, resilience, and protection) were consistently operationalised in the analyses of Chapter 3, 4, and 5 through the use of two statistical multi-variate hypotheses: *mediation* and *moderation* (see Section 2.4.1). The hypothesis of mediation was used to represent risks having impacts upon development that varied over time as well as development at one time point predisposing subsequent development (developmental pathways). By contrast, moderation was used to operationalise hypotheses that the quality of early education could protect the social and cognitive development of young children from the impacts of otherwise salient developmental risks.

This chapter is now divided up into a number of sections that first summarises the main findings (Section 6.1 below) and then presents the conclusions that can be drawn from these (Sections 6.2 and 6.3). After summarising the main findings and conclusions, this chapter then discusses possible explanations for both (Section 6.4), answers the research questions of this investigation (Section 6.5), and then considers the limitations (Section 6.5) and possible directions for future research (Section 6.6).

6.1 Summary of Main Findings

Chapter 5 examined the impacts of family and child level combined risks to General Cognitive Ability (GCA), self-regulation, and anti-social/worried behaviour during the period that young children attended programmes of early education (pre-school). Noting differences in the composition of the combined risks and the magnitude of their effects, Section 5.1 examined whether any of thirteen measures of pre-school quality (one global, five process, seven structural) could independently, or in combination with duration of attendance, ameliorate the developmental impacts of these risks. Despite analytical compromises that arguably reduced the ecological validity of the statistical models that were developed and tested, these nonetheless proved highly sensitive to variations in both the impacts of developmental risks, and to the qualities of the pre-schools.

The analyses documented in Chapter 5 identified many more instances of significantly protected development than had been the found in pertinent previous research (especially Buchinal, Peisner-Feinberg, Bryant and Clifford, 2000; NICHD, 2000a). Further, the results of Section 5.1 showed how these instances of protection systematically varied by: the nature of pre-school quality, the nature of developmental risk, and the domain of children's development under examination. Pre-school quality proved better able to protect development: 1) in the cognitive rather than social domain; 2) against the effects of child rather than familial level combined risks; 3) when pre-schools offered particularly high quality processes rather than similarly high quality structures.

However, these instances of protection were also found to be partially dependent upon the durations that children attended their programmes of early education. Not only was the protection of self regulation and anti-social/worried behaviour always found to be dependent upon duration of attendance in these programmes, but so too were the majority of instances of protection against family level risk. In fact, the only occasions when pre-school quality was found to offer protection to developmental skills that was not dependent upon duration was when this protection came from: high quality processes, the developmental risk was pertinent only to the child, and the outcome at exit from pre-school was General Cognitive Ability.

Moving on to consider the potential legacies of the most frequently duration-dependent protective effects that were identified in Section 5.1 on subsequent developmental pathways during Key Stage 1, Section 5.2 built upon Section 5.1 with a detailed statistical examination of young children's cognitive and social development up until age seven. By identifying that at exit from pre-school, GCA, self regulation, and anti-social/worried behaviours had significant sizeable (direct and indirect) effects upon subsequent abilities and developmental pathways[127], it was possible to extend the risk and resiliency conclusions from Section 5.1. In other words, *'The contribution of early education to vulnerable and resilient developmental pathways'* was revealed. This thesis demonstrated how early education offered partial protection to developmental pathways that had been

[127] e.g. Explaining up to a total of 58% of the variation in children's reading performance at the end of year 2 (see Table 5.13)

rendered vulnerable through the impacts of risks to result in them displaying resilience. In turn however, the vulnerabilities, protection, and resilience of these developmental pathways were also strongly dependent upon General Cognitive Ability, self regulation, and anti-social/worried behaviour at entry to primary school at around age 5 (see Tables 5.12 and 5.13).

6.2 The measurement of combined developmental risk

Before discussion turns to the contribution of early education to protected development (Section 6.3), it must first be stressed that these findings and corresponding conclusions were strongly dependent upon the measurement of combined developmental risk. Furthermore, the literature review of Chapter 1 (see Section 1.1.1) documented how the traditional method of measuring this risk has faced strong criticism[128], and it was this criticism, in combination with the importance of this measurement, which led to the new approach that was documented in Chapter 4: simultaneous Confirmatory Factor Analyses (CFA) using formative measurement to represent multiple ecological levels of combined developmental risk.

Primarily, the CFA procedure was shown to yield factor scores that were broadly comparable with the measures that were returned from a cumulative index (significant correlations of large magnitude). However, as the CFA strategy diverged from the cumulative index procedure, so a systematic increase was observed in the impacts of these measures upon young children's cognitive and social development (see Section 4.1). Furthermore. this was a finding that was observed whilst statistically controlling for earlier levels of development thanks to 'value added' longitudinal analyses. By using an approach that was driven more by developmental theory and less by statistical data, these findings permitted this thesis to extend the conclusions that were made by Burchinal, Roberts, Hooper and Zeisel (2000). Further, this alternative to the cumulative risk procedure was then itself built upon and improved by dividing risks according to theoretical ecological levels (see Section 4.2). This resulted in further improvements to the measurement of combined risk by revealing systematic variations in both the formation of combined risks and in their impacts upon development.

[128] e.g. Luther (1993, 2006); Burchinal, Roberts, Hooper and Zeisel (2000); Kraemer, Stice, Kazdin, Offord and Kupfer (2001)

Putting into perspective the systematic differences between each of the methods of measurement that were tested in the first part of Chapter 4, the magnitude of the differences was shown to vary according to the age at which young children's development was assessed. For example, the difference between the methods in their explanation of the percentage of variance was 11% at 36 months of age whilst at 58 months, this fell to only 2%. One explanation for this disparity is that the abilities at 58 months took into account those same abilities from 22 months earlier (see Figure 4.1). Due to the strong statistical association between these repeated measures, the percentage of variance that was left for the combined measures of risk to explain by themselves at this latter time point fell. While there was 100% of the variance available to be explained at 36 months, this could only be less 22 months later when the ability at 36 months was a simultaneous predictor alongside the combined measures of developmental risk. The fact that there remained *any* systematic difference at 58 months *at all* indicates that the differences between the methods were robust when it came to estimating their impacts upon the psychological development of young children.

From these findings, Section 4.1 clearly demonstrated that when estimating the combined impact of risks to young children's cognitive and social development, constructing a cumulative risk index does not always produce a measure with the greatest predictive power. This conclusion is made on the back of the undertaken tests that were made of the implicit assumptions in cumulative risk indices: 1) that it is valid to dichotomise individual risks, and 2) that each of these dichotomies should then contribute equally (through summation) to a derived measure of combined risk. It was instead shown that individual risks can contribute very differently when each is hypothesised to be a cause of a latent underlying composite risk (see also Sammons, Kysel, & Mortimore, 1983).

Further support for the use of the procedure documented in Chapter 4 is lent by the factor loadings of the individual risks that were returned from the CFA. These provided a source of information that the traditional accumulation procedure could not match: namely the individual and relative contribution that each risk made to a latent composite that represented the effects of these risks in combination. With this

information, the relative contribution of each risk to the estimate of their effect in combination (the latent composite) can be compared and contrasted. For example, Table 4.5 revealed that the Home Learning Environment made a greater contribution to a combined social risk than mother's employment. As such, this finding indicates that the activities a mother and child engage in are of greater importance to the child's cognitive development than this same mother's occupational status (see Clarke-Stewart & Dunn, 2006).

The additional information that is available from a Confirmatory Factor Analysis rather than a cumulative risk index is also not the only reason that justifies its use as a valid procedure for estimating a combined risk. If it was, then there would be little reason to use this strategy instead of the exploratory alternative as documented by Burchinal, Roberts, Hooper and Zeisel (2000). A more fundamental merit of a CFA that uses formative measurement lies in its ability to simultaneously overcome drawbacks found in: cumulative indices, exploratory factor analysis, and CFA that uses *reflective* measurement. The procedure outlined in Chapter 4 retained and returned more information than a cumulative index; used a conceptual basis for deriving a combined measure of risk (unlike exploratory factor analysis)[129]; and used a more appropriate method for specifying the relationships between individual risks and their effects in combination (due to formative rather than reflective measurement[130]).

The findings of Burchinal, Roberts, Hooper and Zeisel (2000) do however aid in interpreting why the Confirmatory Factor Analysis procedure that was tested in Chapter 4 was found to demonstrate greater predictive power of young children's psychological development. Factor analyses, whether exploratory as in the work Burchinal *et al.*, or confirmatory as used in chapters 4 and 5, appears to be better able to statistically predict a developmental outcome than an equivalent cumulative index. In turn, this appears to be due to the factor analysis solution retaining more information about the original variables and their relationships as it does not dichotomise, summate (both of which discard information), nor inappropriately homogenise risks from different ecological levels.

[129] Allowing for the modelling of hypothetically different ecological levels of risk as in Section 4.2
[130] See Section 2.4.3

From the results of this study and the earlier work of Burchinal, Roberts, Hooper and Zeisel (2000), consistently smaller statistical relationships were found between measures of combined risk and young children's development when a cumulative risk index was used instead of a multiple regression or a factor analysis. This is an important finding because it is exactly these statistical relationships that have been so relied upon in earlier investigations that have examined ways of preventing the maladaptive developmental outcomes that are associated with combined risks (i.e. *vulnerable developmental pathways*). As a result, this investigation suggests that the effects of combined risk that have been identified in previous studies may have been unintentionally but systematically underestimated when this traditional means of measurement was used.

The novel method developed by this investigation to measure the impacts of combined risks also extends existing literature on the *specificity* of these risk effects (as discussed in the Introduction Chapter). This extension has been through the development of an alternative to cumulative risk indices (e.g. Ackermann, Schoff, Levison, Youngstrom, & Izard, 1999) for the specification of the interplay amongst risks as they impact development. The newly developed method of CFA using formative measurement improved upon the ability of cumulative risk indices to specify risk effects in two ways. First, the additive assumption of this original method was demonstrated to underestimate the impact of both child and family ecological levels of combined risk. Second, the validity of differentiating risks according to their ecological levels was demonstrated to unmask otherwise hidden differences between the impacts of risks from different levels. However, it was only possible to draw these conclusions by making use of the existing literature on specific risks effects and through the use of two hypotheses in particular which are now discussed in greater detail.

First, *mediation* (see Section 2.4.1) has traditionally been used to specify ecologically distal risks impacting children's development through intermediate effects on those risks that are more proximal (e.g. Conger et al., 1992; Conger, Ge, Elder, Lorenz, & Simons, 2994; Linver Brookes-Gunn, & Kohen, 2002). In this investigation however, the possibility of ecologically distal *family* level risks impacting development through

the more proximal *child* level risks was not examined as this would have been ancillary to the research questions. Instead, mediation was employed to specify risks having effects that differed over time (chronological specificity). As a result, not only were cumulative risk indices improved upon through use of the newly developed procedure, but improvements were found in both *direct* effects at entry to pre-school and simultaneously, also value-added *total* effects at exit from pre-school.

The second hypothesis that has been widely used in specifying the impacts of different risks is *moderation* (see Section 2.4.1). Whilst mediation has been used to specify how distal risks can impact development via more proximal risks, moderation has been used to represent how the impact of a risk can be lessened by the indirect effect of a third variable. For example, Ackerman, Kogos, Youngstrom, Schoff, and Izard (1999) tested whether child gender could lessen the impact of family instability on problem behaviour. The same principal of risk moderation was adopted here: the impact of combined developmental risks was theorised to be lessened by experiencing high quality early education. This use of moderation led to specificity being demonstrated by different aspects of early education. For example, the combined measure of child level risk was more likely to have impacts on development that were moderated by attending pre-schools offering high quality processes.

In summary, the method of measuring combined risk presented in Chapter 4 has been shown to overcome problems that are primarily associated with the construction of cumulative indices but additionally, also with exploratory factor analysis. Confirmatory Factor Analysis employing formative measurement has been noted as having a number of advantages. It uses a conceptual rather than empirical basis for data reduction, does not inappropriately dichotomise, does not unduly homogenise, and produces a measure of combined risk that does not assume that each component risk has an equal impact. As a result, this method has been shown to return measures of combined risk that demonstrated greater internal and external validity when examining the cognitive and social development of young children between the ages of 36 and 58 months.

6.3 The contribution of early education to protected development

The summarised findings that were stated at the beginning of this chapter clearly indicated that for children whose development could be thought of as *at-risk*, attending pre-schools of higher quality appeared to be able to partially mitigate the impacts of these risks and that this mitigation was frequently dependent upon duration of attendance. In turn, this can be taken as evidence that attending high quality pre-school (early education) can act to *protect* young children's developmental abilities and behaviours and thus facilitate *resilience* to *risks*. Maintaining the ecological perspective that has been adopted by this study, these results and their implications are now discussed in subsections that pertain to: 1) the development of young children, 2) the processes and activities of pre-schools, 3) the long term impacts upon developmental pathways, and 4) the combating of social inequalities.

However, it is also important to bear in mind the limited amount of pre-existing knowledge about the contributions of programmes of early education to vulnerable and resilient pathways. For example, Luthar (2006) called for a *systematic exploration* of whether high quality *processes* in these programmes could protect young children's development against the impact of risks and noted that earlier attempts had focussed too heavily on just the qualities of the *structures* in these programmes (e.g. the physical space and materials). Further, Peisner-Feinberg (2004) reported that the previous research which had attempted to address these similar questions has produced inconsistent findings; Borge, Rutter, Cote and Tremblay (2004) identified the discrepancies as systematically varying according to the qualities of the programmes of early education (a finding consistent with those in this thesis).

6.3.1 Impacts upon young children's development

This study clearly identified a series of systematically varying impacts that were associated with combined risks affecting young children's cognitive and social development. Further, the disparities between the impacts of these risks[131] also served to justify the novel measurement strategy that was employed (see above, Section 6.2). Given that the traditional strategy of examining the developmental impacts of

[131] Two ecological 'levels' of risks (family and chid), that were relative to only one of three developmental skills at exit from early education led to six (2x3) measures of combined risk.

individual risks had been cautioned against in earlier research (notably Burchinal, Roberts, Hooper, & Zeisel, 2000)[132], the CFA procedure that was adopted by this investigation reliably revealed the circumstances that were *on average* associated with significantly lower developmental abilities at entry to primary school (reception class).

In the context of cognitive development and child level risks, this study found that significant individual risks included: being a boy, being born underweight, having many siblings, growing up speaking English as an additional language, and coming from a one of a number of ethnic minorities (although not all)[133]. Furthermore, the EPPE investigation also studied the same children with exactly these profiles and found some to have a GCA at entry to reception that was around 2 standard deviations lower than the average, lower than approximately 97% of the sample of ~3,000 young children. A similar situation was found with the familial level risks that were identified in this study, risks that included: low family salary, low maternal occupational status and formal qualifications, whether her partner was unemployed, fewer non-parental carers (i.e. nannies, *au pairs*), and a poorer Home Learning Environment. Again, the sample recruited by the EPPE project included children with just such profiles of whom some had a GCA at entry to reception that was around 2 standard deviations lower than the sample average, again lower than approximately 97% of the sample.

In the context of social development and risks to self regulation and anti-social/ worried behaviour at exit from pre-school/entry to reception, there were both similarities and differences in the significant risks when compared to those detailed above. Significant child level risks again included: being a boy, being born underweight, and growing up speaking English as an additional language. However, there was no effect of the number of siblings, and only a very small ethnic minority effect upon anti-social/worried behaviour[134]. However, much larger disparities were noted when it came to family level risks with the only consistent individual risk across all three measures at entry to reception being that of the Home Learning Environment.

[132] See also, Section 1.1.1
[133] These included: 'Bangladeshi', 'Black', 'Mixed', 'Pakistani', but not, 'Indian' or 'Other'.
[134] This being associated with 'Other'.

For self regulation at this time point, unique significant family level risks included: a mother's formal qualifications, her being younger, and for those mothers with partners, this partner being older. By contrast for anti-social/worried behaviour, there was a much stronger effect of variables that are traditionally associated with Socio-Economic Status (SES). In addition to the risk of a poor Home Learning Environment, unique significant risks included: total family salary, mother unemployment, and for those mothers with partners, these again being older, and their formal qualifications.

A comparison of the many figures in sections 5.1.2 and 5.1.3 with that of the protection demonstrative Figure 1.2 from Chapter 1 clearly illustrates the protective effects that were indicated by this study. Primarily and as mentioned in Chapter 5, there were many more instances of significantly protected cognitive development (46%) than social/behavioural development (15%). Secondly, perhaps the most important protective finding was that the global/overall quality (measuring both structures and processes) of pre-schools could protect the General Cognitive Abilities (GCA) of young children from the significant impacts of family level combined risk (see Section 5.1.2, Figure 5.10). Given that combined family risk was also broadly analogous to Socio-Economic Status (SES), this suggests that attendance at increasingly high quality programmes of early education might be able to partially combat the effects of social inequalities (see Section 6.3.4) in a manner similar to Early Interventions such as Sure Start (although not necessarily to the same extent).

For cognitive development, the figures from Chapter 5 revealed that in this investigation, the nature of the risk-protection that was associated with process qualities varied with the specific nature of the process that was being examined. Whilst the effects of the more proximal (to the child) *child* level combined risk was frequently protected against by the more proximal staff-child *relationships*, the more distal *familial* level combined risk appeared to have been protected against by the more distal *overall* quality of pre-school (with educational provision[135] bridging the proximal and distal levels and thus protecting against both). However it is also important to note that in all of these protective effects, duration of attendance did not

[135] Perhaps operating through more Vygotskyian social-cultural processess rather than the separate staff-child relationships.

significantly interact such that longer durations of high quality were more protective than shorter durations. This counter-intuitive finding is certainly one that requires further investigation, perhaps initially studying whether alternative measures of the time that children spend in pre-school can boost the partially protective effects of process quality that were noted here[136]. It is possible that the duration that was studied in this investigation was not the measure of time that might significantly interact with the protective effects of high quality processes in 3-way interactions.

The finding that the protective cognitive developmental effects that were associated with the process qualities of early education were not dependent upon longer durations of attendance is backed up by the findings of the NICHD SECC (e.g. NICHD, 2000b). Although the results of the NICHD identified a non-duration dependent *direct* (rather than *risk-moderating*) effect on development, their study also investigated a wider time frame of children's development than that here (from birth rather than from age 3) and included multiple ratings of the quality of the early education that children were exposed to (five measures between the ages 15 to 54 months).

For the structural qualities of programmes of early education protecting the development of young children's General Cognitive Abilities between the average ages of 3 and 5, the findings can be broadly summarised as relating to most commonly: the qualifications (both academic and childcare) of caregiving staff and managers, the size of the pre-school (in terms of the numbers of caregiving staff and children) protecting against family level combined risk, and the average age of the caregiving staff (see Table 5.10). Interestingly, nearly all of these protective effects also increased when children attended for longer durations. This raises the question, what is so different about the cognitive developmentally protective effects of process quality that makes these independent of children's duration of attendance? Again however, this is a question for future research.

[136] With such alternative measures being discussed in Chapter 2, Section 2.3.2. Alternative measures include: a longer age-range (as EPPE recruited children at aged 3); the frequency of sessions per week; and/or the total hours spent in pre-school care and education since each child began (using both duration and weekly frequency).

By contrast and in the context of social development, the most important initial finding to comment upon is that increasing duration of attendance at pre-schools magnified the effect of child level risk on anti-social/worried behaviour at exit from pre-school/entry to reception (duration thereby becoming a, *"vulnerability factor"* in this instance[137]). Although this was not explicitly predicted by this thesis (in Chapter 2), it is also not a surprising finding given the previous research that has investigated the impacts of pre-school attendance upon young children's social development (see Section 1.2.3). For example, Malhuish (2004) drew upon findings from both the EPPE project (see chapters 1 and 2) and the NICHD (2004) in his conclusion that it is an early start (and thereby a longer duration) in low quality care (i.e. no risk mitigation/protection) that can lead pre-school to have a negative effect upon the social development of young children.

Concerning the developmentally protective effects that were associated with the social/behavioural development of young children in more detail, all of these varied according to the duration that children experienced pre-school[138] and the vast majority of these findings were limited to process qualities partially protecting the social development of young children from the effects of child level combined risks. Both self regulation and anti-social/worried behaviour at entry to reception were partially protected against the effects of these risks by the relationships that caregivers shared with children and for anti-social/worried behaviours, also the quality of the educational provision. Additionally, attending a smaller pre-school for a shorter period was associated with a reduced impact of combined child level risk to anti-social/worried behaviour, and a longer duration of attendance at a pre-school with on average older staff was partially protective of the impacts of combined family level risk to self regulation.

Finally, given that longer durations of attendance were both beneficial to the protection of self regulation and yet also detrimental to the protection of anti-social/ worried behaviour, what conclusion can be drawn concerning what is best for the development of young children? Fortunately, the contextualisation of risks by

[137] Or a, *"susceptibility factor"* to avoid the ambiguity associated with the use of the term, *"vulnerable"* that was noted in Chapter 1 (see also Figure 1.1).
[138] Although longer duration of high quality was *beneficial* to protecting self regulation, but also *detrimental* to protecting anti-social/worried behaviour due to duration being similar to, 'age of onset'.

developmental domain provides a means of establishing for whom longer durations of attendance might be more or less partially protective. For children whose personal circumstances more closely match the significant risks to self regulation, longer duration of attendance at high structural quality pre-schools would prove beneficial. By contrast, for children whose circumstances more closely match the significant risks to anti-social behaviour (insofar as it is possible to differentiate these), then longer durations of attendance should be viewed with caution.

In interpreting these results, it is however also important to note that the results of this thesis differ markedly to those that were discussed in the literature review of Chapter 1 (primarily, Burchinal, Peisner-Feinberg, Bryant, & Clifford, 2000; NICHD, 2000a) which had offered only limited support for the notion that pre-school could protect the development of young children. There are a number of possible reasons for this with the first concerning the differing sample sizes. Whilst the investigation conducted by the NICHD sampled 943 children and the Burchinal *et al.,* study slightly more with 1,307, this sample contained 2,857. Indeed, it was noted by the study conducted by Burchinel and colleagues that in quantitative analysis, an insufficient sample size often limits the knowledge that can subsequently be generated and that this is only exacerbated when one attempts to detect statistically significant moderation effects (as here). With its larger sample size, this study therefore had a greater ability to detect whether the quality of pre-school could significantly moderate the impacts of risks.

In addition to the differences in sample size, this study also differed from those of the NICHD (2000a) and Burchinal, Peisner-Feinberg, Bryant and Clifford (2000) in the way in which it measured the process qualities of programmes of early education. Whilst these earlier studies each included only a single measure of process quality, this investigation included six and found noticeable differences between their ability to moderate the impacts of risk (see Table 5.9). With this more detailed measurement of quality, this study managed to identify patterns of protected development that were not seen in these earlier studies and that are best illustrated with a comparison. The study conducted by the NICHD (2000a) included a measure of quality[139] that was broadly analogous to the Caregiver Interaction Scale (CIS; as used here) in that it

[139] Titled, "The Observational Record of the Caregiving Environment" (ORCE; NICHD, 1996)

attempted to measure the extent of a caregiver's detachment, positive regard, and responsiveness. Furthermore, the NICHD study also examined a measure that they termed *"family risk"* (again similar to here) and found that their CIS analogous measure did not prove broadly protective against the developmental impacts of this risk. Importantly, these findings were mirrored here (again, see Table 5.9) but also extended upon such that the caregiving relationships that were examined in this study were instead found to be significant moderators of the developmental impacts associated with combined *child level* risk (not something studied in the NICHD invesetigation).

The use of multiple measures of combined risk that are unique to specific ecological levels, whilst supported and called for by the pre-existing literature (e.g. Schoon, 2006), also has important ramifications. Not only does it permit the possibility of detecting important variations in the impact and mitigation of significant risks (such as those noted above), but it also permits instances of resilience that are specific to certain ecological levels of risk and the protective effects that operate at these levels. Thus, although a central driver of current early education policies in Britain is a combating of poverty-effects (i.e. SES or as here broadly, "combined family level risk", see Section 1.2.1) and support for this notion was found in this investigation, the combating of non-poverty risk effects (e.g. child level risks) were also noted as well. Further, the presence of these additional effects is also of little surprise given that other European nations maintain early education policies which focus more explicitly on the possibility of mitigating the developmental impacts of non-poverty based risks to development (e.g. see Smith, 2008; or for historical examples, Whitbread, 1972).

However, modelling different ecological levels of risk also warrants an investigation into the relative impacts of each of these whilst controlling for the impacts of the other relationships that were not studied in this thesis. However, the work of Rutter and Rutter (1993) provides a means of evaluating the validity of another set of risk impacts that matched those in this work: combined familial level risks to cognitive development. Rutter and Rutter (*ibid*) summarised two studies that investigated adopted children and which noted impacts of family level risk to the cognitive abilities of young children which were similar to those identified here. Both Capron

and Duyme (1989) and Schiff and Lewontin (1986) found that after controlling for the social backgrounds of natural parents (i.e. partially accounting for *biological risk*), adoptive parents who were socially advantaged (i.e. had very low *family risk*) exerted a 12 point increase in children's IQ scores. Thus, although this study did not investigate the relative impacts of combined child and familial risks to development, the magnitude of the developmental impacts of family level risk that *were observed* nonetheless had effects there were similar to those of these earlier studies that did account for such effects.

The impact of risks to young children's cognitive and social development and the systematic variation of these that were noted by this study are also mirrored in the variation that children can exhibit in response to these risks. Children are not merely passive recipients to the effects of risks and nor is it valid to assume that their responses are uniform. Instead and offering a possible explanation for the broadly duration-dependent findings of partial protection that have been noted in this investigation, Section 6.4 explores young children's perception of and response to psychological stressors. However, this chapter first discusses the conclusions that can be drawn from the findings of this study in relation to pre-schools, the possibility of effects over the very long term, and then a particular case of this, the combating of social inequalities.

Finally, the results of this investigation indicated a number of surprising findings which relate to the contextualised model of developmental resilience that was adopted by this study. First, the simple bivariate correlations of Chapter 3 indicated that some measures of the quality of early education (notably the academic qualifications of managers) had a counter-intuitive relationship with subsequent measures of development. In other words, *higher* levels of quality were found to be associated with a subsequently *lesser* rate of development. However, a developmental contextual model of resilience also suggests that the relationship between quality and development may be driven by an underlying relationship that both quality and development share with developmental risks. Here, both development and quality were found to be impacted by risks and this suggests the possibility of a mediational model of effects (see Figure 2.5): Although risks may impact subsequent development directly, it is also possible for risks to have an indirect effect by

lessening the developmentally salient quality of early education. However, the possibility for risks to have such effects on the quality of the earlier education was not investigated in the multivariate analyses of this study and this is a limitation that is returned to in Section 6.6.

The second surprising finding from the results of this investigation was that the combined impact of risks to self-regulation at exit from pre-school appeared to operate in *more direct* fashion than the equivalent combined impacts of risks to either GCA or anti-social/worried behaviour (Chapter 4). This conclusion again relates to a developmental contextual model of resilience in that risks were conceptualised to vary in their impact across time and across different measures of development. In Chapter 4, the *total* impacts of risks to development at exit from pre-school were hypothesised to be made up of both a *direct* impact and an *indirect* impact that operated through earlier impacts at entry to pre-school (see Figure 2.5). As such, it was hypothesised that the *direct* impact of combined risks at exit from pre-school would be smaller than the direct impacts at entry to pre-school because these earlier impacts would then go on to be an *indirect* competing predictor. The conclusion that the combined impacts of risks to self-regulation operated in a more direct rather than indirect manner was based on the observation that risks had similar sized impacts on self regulation at exit from pre-school as they did on social/behavioural at entry to pre-school. Further, it was only possible to draw this conclusion because a developmental contextual model of resilience prompted longitudinal analyses with distinct combinations of risks and measures of development.

The third surprising finding from this investigation comes from the last results chapter (Chapter 5) and again is one that again relates to the developmental contextual model of resilience that was employed. Section 5.2.3 revealed that the simultaneous modelling of cognitive and social development between the ages of 5 to 7 years led to larger relationships between cognitive measures and smaller relationships between social measures. The developmental contextualised model of resilience which prompted this simultaneous dual modelling of cognitive and social development can thus be seen to have once again impacted the findings of this investigation.

6.3.2 Processes and activities in pre-school provision

As mentioned at the beginning of this chapter, this study found that the structures and activities/processes that take place within programmes of early education/pre-schools can offer significant partial duration-dependent protection to the development of young children's cognitive and social abilities which are *at-risk*. However, the results of this study are more complicated than this, especially because these qualities have been found to systematically vary across the different types of pre-school provision that were investigated in the EPPE studies (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004). For example, pre-schools which integrated care with education (combined centres) were found to offer, on average, a higher quality of educational provision and also provide better care.

From the observation that quality varies across types of programmes of early education, it can be seen that the likelihood of a pre-school being of a high enough quality to offer partial protection to young children's development will not be uniformly or even randomly distributed. Rather, it will vary systematically in such a manner that the protective effects identified in this study can be expected to be greatest in those types of provision that offered the highest process and structural qualities. For example and although they have changed in the UK since the EPPE studies began in 1997 (West, 2006), Table 6.1 illustrates the average process qualities that were found for each type of pre-school that were included in this investigation. Combined centres that integrated care with education offered the highest average quality of processes on almost all the measures that were included in this study.

Table 6.1 Mean process (and overall) qualities of pre-school by type of pre-school in the EPPE project (adapted from Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004)

Type of pre-school	Mean ECERS-R	Mean ECERS-E	Mean CIS sub-scales[1] positive	permissive	detached
Nursery class	4.9	3.7	3.5	**1.3**	1.3
Playgroups	3.4	2.1	2.9	1.6	1.7
Private day nurseries	4.0	2.9	3.2	1.5	1.5
Local Authority day care	4.6	3.2	3.3	1.6	1.5
Nursery schools	5.3	4.0	3.5	1.4	1.2
Integrated (combined) centres	**5.5**	**4.6**	**3.7**	**1.3**	**1.1**

[1] *punitiveness excluded as it was invariant across types*

A comparison of programmes of early education against programmes of Early Intervention (EI) provides some explanation as to why it was that certain qualities of pre-school seemed to be able to protect young children's development. Sylva (2000) identifies similarities in both the forms and impacts of high quality EI and pre-school provision. When they offer high quality provision, both have been found to prevent the outcomes of school failure and poor adjustment that have been associated with development in the context of social disadvantage (e.g. Campbell & Ramey, 1994; Sammons et al.. 2002). As a result, Sylva (*ibid*) makes the argument that programmes of early education therefore have the potential to serve as interventions within normal populations by serving as a type of primary prevention. This comparison also elucidates upon why it was that integrated centres that combined care with education were found to offer, on average, the highest quality of provision that might protect against the impacts of risks (in Table 9). The integration of child care and early education, as in Early Interventions, was aimed at supporting families and these programmes subsequently influenced the creation of the *Children's Centres* that are an integral part of the UK Sure Start program (Tunstill, Allnock, Akhurst, & Garbers, 2005). Designed to prevent the social exclusion of children who live in poverty through community targeted intervention, this programme aims to provide an early years service that *integrates* early education with early child care (Brown & Dillenburger, 2004; DfES, 2003)[140].

[140] For a more detailed discussion of this, refer back to Chapter 1, Section 1.2.

At the same time however, this thesis does *not* conclude that programmes of early education and care that are characterised by high quality structures and processes can serve as any form of panacea to the developmental impacts that are associated with significant combined risks. Instead, this investigation merely identified inconsistent patterns of partial protection; although the significant and sizeable impacts of risks could be at-best lessened, they nonetheless remained manifest in their effects. This limitation to the results of this work is also in line with similar previously stated caveats such as those of S. L. Kagan and Zigler (1987) and Brooks-Gunn (2000). Both sets of authors strongly emphasised the deleterious effects of poverty/social disadvantage/low SES on development, and in particular also commented upon the inherent limitations that can be expected of any programme of early education or EI that attempts to mitigate these.

6.3.3 Long term impacts upon developmental pathways

Just because this thesis found that some young children who attended high quality pre-schools were found to have greater than anticipated levels of development given a background of significant risks does not automatically mean that these children will manifest resilient development in the long term. Luthar, Cicchetti and Becker (2000a) offer an explanation: developmental skills and abilities do not facilitate adaptive development by themselves. Rather, the promotion of future developmental trajectories is instead accomplished by earlier skills being at first protected before then being made use of within wider environments (see also Luthar, 2006; Schoon *et al.*, 2002). As a result, the long term benefits of the partial protection that has been indicated by this study should not be assumed.

At the same time however, authors such as Masten (1997) also argue that facilitating 'normal' cognitive development is perhaps the single most important protective factor for future resilient development that a child can exhibit and so the protection of this skill in particular does seem to suggest one way of partially protecting the trajectories of future developmental pathways. Partly based on this and partly based upon the observation that adaptations during early childhood are strongly related to adaptations in future development (e.g. Egeland, Carlson, & Sroufe, 1993), the partial protection that has been identified in this study does therefore seem to have a potential for future,

albeit indirect, protective effects as the children age and this was evidenced in the results of Section 5.2.

Perhaps unsurprisingly, the research evidence supporting this conclusion is however also far from consistent. For example, research on pre-school based programmes of EI has to date revealed that although short term developmental gains can be made, these effects are usually short lived as the exposure to the enriched environment is only relatively brief (Curtis & Nelson, 2003). These authors noted that longer-lasting protective effects can only be expected from such programmes if they run for a extended period, periods that are usually longer than children attend programmes of early education/pre-school. Such findings have relevance for those of this investigation; the duration of the partially protective effects that have been identified here may therefore depend upon the subsequent quality of the *primary school* education that the children found themselves enrolled in. Alternatively, authors such as Yates, Egeland and Sroufe (2003) have also argued that although early resilience may not always end up being manifest or apparent at a later date, it will also never be extinguished. However, determining whether of not this is the case with the relationships that have been observed in this study remains a challenge for future research which has a longer focus, and later measures of risks and school qualities.

Whether or not programmes of early education can have long term partially protective effects upon development to facilitate resilient developmental pathways is also an issue that is discussed by Rutter and Rutter (1993). The authors stress that just as levels of development frequently have strong associations over time, so to do some of the risks that can significantly impede these (e.g. *"poor early upbringing"*). Further, it is these continuing impacts upon development that may explain the long term impacts of risks upon developmental pathways that have been observed rather than any special processes that may take place during any critical early period (e.g. that noted by O'Connor, 2006). This is the underlying rationale behind the comment made by Luthar, Cicchetti and Becker (2000a), in the opening paragraph of this section: if protected skills are not made use of then there will be no interruption to the continuing impacts of risks to future development. This again emphasises that the contribution of early education to vulnerable and resilient developmental pathways relies upon the developmental skills, abilities, and behaviours that are protected at exit from

pre-school being of central importance to future levels of development. Further, this was exactly that which was shown in Section 5.2: General Cognitive Ability, self regulation, and anti-social/ worried behaviour all had sizeable direct and indirect effects upon future cognitive and social skills during Key Stage 1 (up until age 7).

The importance of the developmental skills of young children at entry to primary school for subsequent vulnerable and resilient developmental pathways, both within the cognitive and also the social/behavioural domains, is also further stressed by Schoon (2006) and again elaborated upon by Rutter and Rutter (1993). These latter authors make the argument that environmental factors influence cognitive mindsets which in return perpetuate the environmental effects that produced them in the first place. This mechanism, it is argued, provides one of the means that underlie long term indirect effects such as those that are involved in creating vulnerability or resilience in developmental pathways that have been exposed to significant risks. The premise is that skills and abilities at entry to school set children up to develop mindsets about themselves (e.g. beliefs concerning the stressfulness of school[141]) which then result in a variety of encounters with future risks.

Although the benefits of promoting early cognitive skills for those that follow in the future are relatively self evident given the pyramidal nature of the progress of cognitive abilities over time (these building upon one another), extending this view to social skills is problematic because social skills do not develop as a continuous progression towards a fixed endpoint (i.e. Rutter & Rutter, 1993). However, in regard to the two social/behavioural skills at entry to reception class that were examined in this thesis, both self-regulation and the lack of anti-social/worried behaviour have been found to exhibit strong continuity over time. Early levels of both behaviours (even during the pre-school period) have been identified to be persistent over time (e.g. respectively, Dunn, 1988; Richman, Stevenson, & Graham, 1982). In other words, early levels of these behaviours can be seen as impacting the trajectories of young children's subsequent development. As such, it therefore seems reasonable to conclude that programmes of early education can have benefits to developmental

[141] For more on this see Section 6.4

pathways by aiding both the cognitive *and* the social skills that were investigated here.

6.3.4 The combating of social inequalities

The final part of this chapter's examination into the contribution of early education to protected development focuses on one particular case of protected and therefore hopefully resilient future development pathways, those that protect development from the impact of social inequalities. As was stated in Chapter 1, poverty/social disadvantage/low SES has been defined by some as, "*the greatest risk factor of all*" (Schorr, 1988) due to its impact upon the entire family unit[142] and so the possibility of its partial mitigation warrants especial attention. Perhaps unsurprisingly, this thesis found that although high quality programmes of early education could offer partial protection to development from the impacts of social inequalities, these were also infrequent and almost entirely limited to protecting cognitive rather than social skills (see Tables 5.9 and 5.10). Significant moderators included: the overall/global quality of pre-schools, the quality of their educational processes, the childcare qualifications of managers and staff, and the size of the centres. It seems that programmes of early education find it much more difficult to tackle the negative behavioural effects that result from young children experience social disadvantage/low SES/poverty.

The conclusions concerning the combating of social inequalities that were drawn by this thesis also lend support to those state funded social policies and programmes that have attempted to expand the provision of high quality early education and care (e.g. the *Childcare Act 2006*). Already noted to have impacted government policy in the UK as well as in some American States (Melhuish *et al.*, in press), previous studies have indicated that high quality pre-school provision could be of especially great importance to groups of children who are deemed to be at high risk. This study builds upon these findings by differentiating the developmental impacts that are associated with markers of social disadvantage (e.g. family salary) from those that are not (e.g. child gender).

[142] Hence the conceptualisation of what can broadly be considered SES into, *"family level risk"* in this thesis

This investigation identified that for distal risks (relative to the child), the largest impacts upon development were not associated with indicators of disadvantage, SES, or inequality themselves[143], but instead with the learning activities that parents undertook with their children (their Home Learning Environments). This is an important finding for the combating of social inequalities as it gives hope to those who have this as an aim. Although it proved relatively hard for programmes of early education to mitigate the risk-impacts that were associated with social inequalities, there would also be less risk to mitigate in the first place if only efforts were made to improve these families' Home Learning Environments (see Table 5.2).

Taking this conclusion a step further, for social policies that aim to combat the effects of social inequalities, it appears from the findings of this study that it might simply be insufficient for them to just offer high quality services to disadvantaged communities[144]. Instead, it seems paramount that the services and programmes that are instigated must serve to support the interactions of parents with their children (e.g. Love *et al.*, 2005). Perhaps fortunately, this also seems to be an idea that is currently being put into practice within the UK with programmes and studies being funded by the government that investigate the feasibility of targeted intervention programmes which aim to support parents. For example, the Peers Early Education Partnership (PEEP, Evangelou, Brooks, & Smith, 2007; Sylva, Evangelou, Taylor, Rothwell, & Brooks, 2004) attempts to increase the educational attainment of communities of children by working together with these children's parents. Furthermore, this is an idea that also builds upon the intergenerational transfer of developmental risk that was discussed in Chapter 1 (Section 1.1.3).

6.4 Possible theoretical explanations for these findings

In offering an explanation as to why the risks that were investigated in this study have their effects and also why these are protected against by high quality early education, one of the most salient theories concerns the perceptions and then reactions of children to stressors that they encounter in their lives. However, it should also be noted that the following discussions go far beyond the data that was analysed but are

[143] Commonly: total parental/carer salary, average parental/carer education, and/or average parental/carer occupational status

[144] In an effort to mitigate the developmental impacts associated with combined family level risk.

included as they link this study to an important body of literature. This literature has strongly shaped research that has investigated vulnerability and resilience in developmental pathways, perhaps most notably in the research of Project Competence[145] (see, Garmezy, 1991; Masten & Powell, 2003). However, Ward, Jones and Phillips (2003) comment that the term 'stress' has also been used with a variety of meanings across a plethora of academic disciplines. In turn, it is argued that this variety has led to the emergence of separate independent bodies of literature which discuss the detrimental effects of exposure to 'stressful' life events in isolation from one another. For example, Kenny (2000) reports four separate examples of such instances within research from the field of psychology. The following paragraphs aim to negotiate these disparate discussions whilst presenting children's perceptions of and reactions to psychosocial stressors as a key mechanism behind the risk/quality interactions that have been identified in this thesis[146]. Towards this goal, the stress-*diathesis*[147] model of development is first presented which forms a framework upon which discussion can then take place of issues including: the effects of stress, the perception of events as stressful or not, and the possibility of altering young children's adaptations to stressors and thereby also the salience of developmental risks.

6.4.1 The stress-diathesis model of development

The stress-diathesis model of development has been referred to as, *"...a conceptual and methodological cornerstone of research on psychopathology"* (O'Connor, Caspi, DeFries, & Plomin, 2003). It proposes that individuals demonstrate a variety of predispositions for maladaptive development (i.e. vulnerabilities[148]) which then interact with environmental stressors (i.e. risks) to detrimentally affect health and development (Shanahan & Hofer, 2005). It is a theory that complements both the theories of young children's adaptations to developmental risks (see Section 1.1.2) and the intergenerational transfer of risk (see Section 1.1.3) by clarifying the role of

[145] Founded by Nornam Garmezy in the 1970s and based out of the University of Minnesota, it started off as a cross-sectional study but soon turned longitudinal and lasted over 20 years (see Masten and Powell, 2003 for details).

[146] *"...to account for the persisting effects of early experience and exposure on psychological development... ...there is considerable interest in an HPA-mediated mechanism"* (O'Connor, 2006; see also Figure 6.1)

[147] A genetic predisposition for the development of an abnormality or disease

[148] With *'vulnerability'* being used as an antonym of *'protection''* rather than a synonym of, *"at-risk"*

predispositions in children's development. Moreover, the combination of theories of adaptation (e.g. Sroufe, 1979; Schoon, 2006) with this theory emphasising predisposition leads to a more comprehensive model of development: Children are conceived as being born with probabilistic predispositions for certain developmental outcomes which are then realised or negated by subsequent and continual adaptations to events that can be perceived as stressful. This is a process that in turn, then predisposes the developmental outcomes of these individuals through childhood and adulthood as well as those of future generations.

Developmental research that uses theoretical models which emphasise stress-diathesis have frequently investigated the interaction between genetic vulnerabilities/susceptibilities with environmental stressors in examinations of pathological outcomes such as schizophrenia (e.g. Relier, 2001) and depression (Francis, Caldji, Champagne, Plotsky, & Meaney, 1999). However, such investigations do not generate knowledge about the entire range of gene-environment interactions over the entire course of human development (e.g. for the age range of young children studied here). Rather, the investigation of extreme combinations is another example of the 'extreme groups approach', a method that has faced repeated criticism (see Preacher, Rucker, MacCallum, & Nicewander, 2005; Agaibi & Wilson, 2005). Furthermore, despite research having demonstrated the developmental outcomes of gene-environment interactions, both the nature of genes and the role of the environment depend upon how 'stress' itself is conceptualised. For example, Shanahan and Hofer (2005) identified that behavioural genetics needs to be integrated with life course sociology to understand how stressors affect development. Yet at the same time, studies such as Ward, Jones and Phillips (2003) report that these are also disciplines which use different scientific language when they refer to that which is termed 'stress'. Such a lack of consistency means that this term requires clarification; only afterwards can the associations between children's perceptions of stressors, their reactions to these, and then resultant patterns of vulnerability and/or resilience exhibited in development be discussed in relation to the findings of this investigation.

6.4.2 The perception of stressors

Cicchetti and Walker (2001) commented that it is difficult to define stress as a single concept because there are both psychological *and* physiological responses to

perceived as well as *actual* threats. As a result, these discussions employ a relatively broad definition: *stress* and *stressors* are here defined as that which prompts an adaptive response in individuals to perceived threats which involves the activation of two main biological responses (see Cicchetti & Valentino, 2006). With reference to Figure 6.1, these biological responses concern the sympathetic branch of the autonomic nervous system which responds by activating the Sympathetic Adreno-Medullary system (SAM), and the endocrine system which responds by activating the Hypothalamic-Pituitary-Adrenal (HPA) axis. When the individual either ceases to perceive the stressor or no longer perceives an event as being a source of stress, counter regulatory systems are then triggered in an act of internal homeostasis. Of relevance to this investigation, it is the actions of all these systems which Cicchetti (2003) explicitly reports as being able to inform research that investigates resilience in developmental pathways.

Figure 6.1 Biological responses to perceived environmental stressors in:
a) the endocrine system and, b) the sympathetic nervous system
(adapted from Evans, Hucklebridge and Clow, 2000)

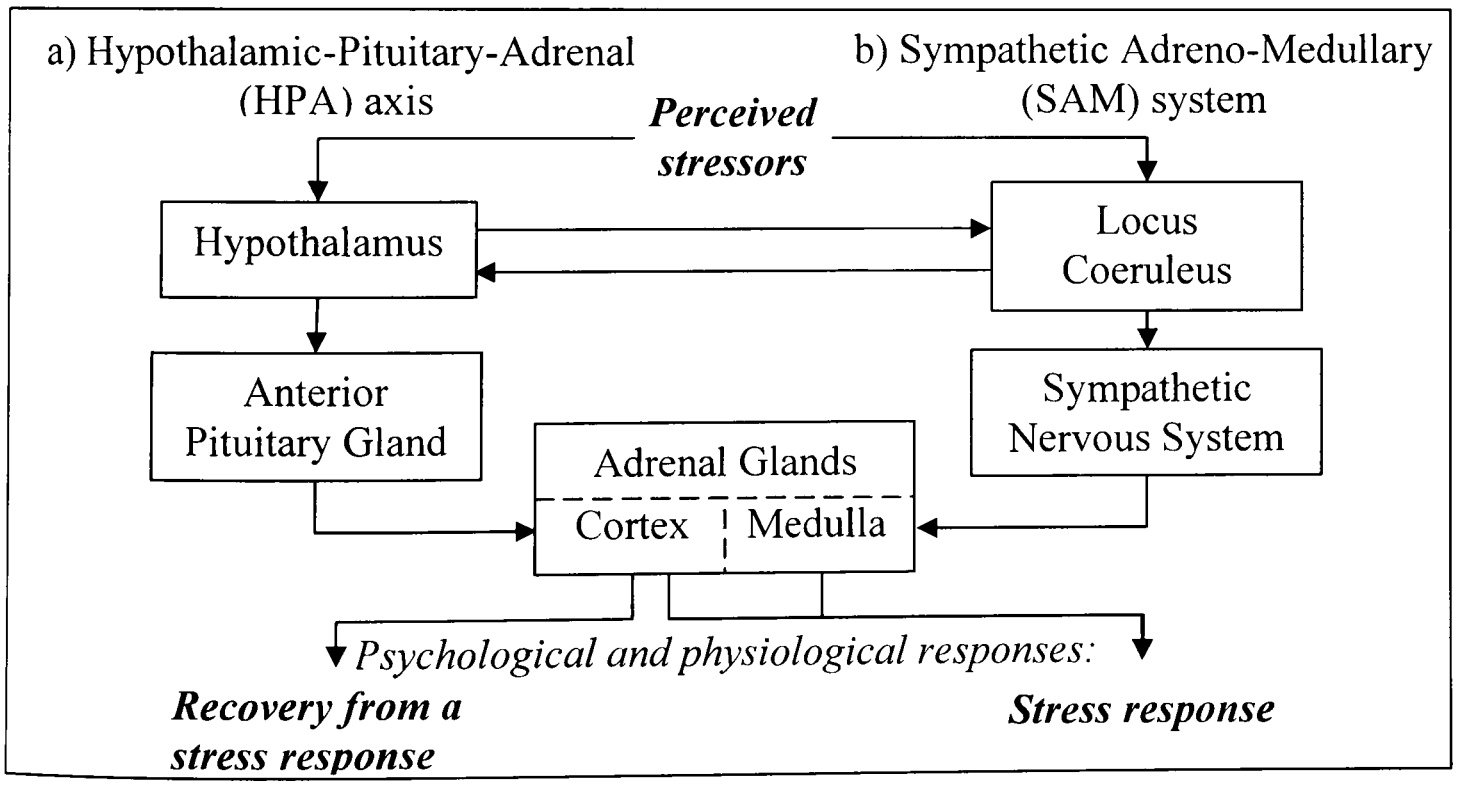


Figure 6.1 illustrates the psychological and physiological responses of individuals to the *perception* of stressors and it is clear that these are adaptations to environmental events. Simultaneously however, the stress-diathesis model (see Section 6.4.1) noted that the predispositions of individuals can be vulnerabilities promoting *mal*adaptation. Considering responses to perceptions of stress together with the stress-diathesis

model, a mechanism for explaining protective effects then emerges. First perceptions of stressors suggest that, *'protection'* can be an effect that promotes individual-adaptation such that less stress is perceived or the ability of an indivudal to cope is increased. Second, the stress-diathesis model supports this conceptualisation by associating the opposite of protection, *'vulnerability'*[149] with the opposite of adaption, *'maladaptation'*.

Taking these arguments a step further, because perceptions of stress occurs in both the psychology as well as the physiology of individuals, it is perhaps unsurprising that altering psychological processes have also been found to alter how individuals *perceive* seemingly stressful events (see below, Section 6.4.3). In turn, this also offers perhaps a simpler explanation for a means by which programmes of early education might have a protective effect that promotes resilience in developmental pathways (see Agaibi and Wilson, 2005).

However, despite the association between the perceptions of events as stressful, the direct[150] and indirect[151] psychological antecedents of these, and then the consequential developmental sequelae, the relationships between all these are often also measured through proxies. For example, both the psychological *causes* (e.g. poor attachment; Rees, 2005) and latter *consequences* (e.g. anti-social behaviour; van Goozen *et al.*, 1998) of stressors are frequently used within many studies of developmental vulnerability and resilience[152]. Further and within the context of early education, the relationships between significant developmental risks, stress perception and adaptations such as those illustrated in Figure 6.1, and developmental outcomes remains a relatively under investigated area of research (see Masten, 2007). First though, discussion in this chapter now turns to what findings there have been and considers the possibility that: 1) altering adaptations to stressors might be a means of mitigating the impacts of risks and 2) whether it is reasonable to hypothesise programmes of early education to have these effects.

[149] With *'vulnerability'* implying *'susceptability'* rather than an *'at-risk'* status in and of itself
[150] E.g. risks and/or promoters (see Figure 1.1)
[151] E.g. vulnerabilities/susceptibilities and/or protective processes (see Figure 1.1)
[152] Although the specificity of the relationships between all of these remains under researched (McMahon, Grant, Compas, Thurm, & Ey, 2003)

6.4.3 Altering adaptations to stressors and thereby also risks

Linking this section with that above, the transactional model of stress (Cohen & Lazarus, 1984; Lazarus, 2000) argues that the adaptations of children to stress are driven by their *perceptions* of these stressors (as above) and thus therefore, also any ensuing changes in behaviour (e.g. Lupien, King, Meaney, & McEwen, 2001) which could affect learning and therby also cognitive outcomes. Further, the perception of events as stressful occurs through a process of psychological appraisal, firstly of the event itself ('primary appraisal'), and secondly of the *beliefs* of individuals about their ability to cope with this event ('secondary appraisal'). As a result of these appraisals, changes in behaviour come about which Ogden (2004) notes as taking the form of: directed actions, information seeking, and/or coping strategies. Additionally, the relationship between these appraisals and subsequent behaviours originates in their mutually shared development, development that is moulded by the attachment style infants and young children enjoy with their parents/primary caregivers (Kenny, 2000; Rees, 2005).

Jackson and Warren (2000) found that despite little being known about *how* children appraise events in their lives, a positive appraisal of events can buffer (i.e. protect) children from the effects of (i.e. the risk associated with) low levels of social support. Moreover, the authors concluded that the mechanism behind this protective effect was an increase in adaptive behaviour. Additionally, Chen and Matthews (2001) identified that children from disadvantaged backgrounds (high family level combined risk) were more likely to appraise events as threatening and thus respond with aggressive behaviour. Subsequently, the appraisal of events as threatening was then found to be associated with greater evidence of stress reaction in these children. However, although both these studies demonstrate systematic differences between children in their primary appraisals, children are also further differentiated by psychological characteristics which relate to themselves. These have been found to include: *self efficacy* - belief that one's desires are achievable (Lazarus & Folkman, 1987); *self esteem* - belief in one's own worth (Rutter, 1987); and *self regulation* (i.e. one of the outcomes studied here) - the control one has over one's own actions and behaviours (Blair, Granger, & Razza, 2005).

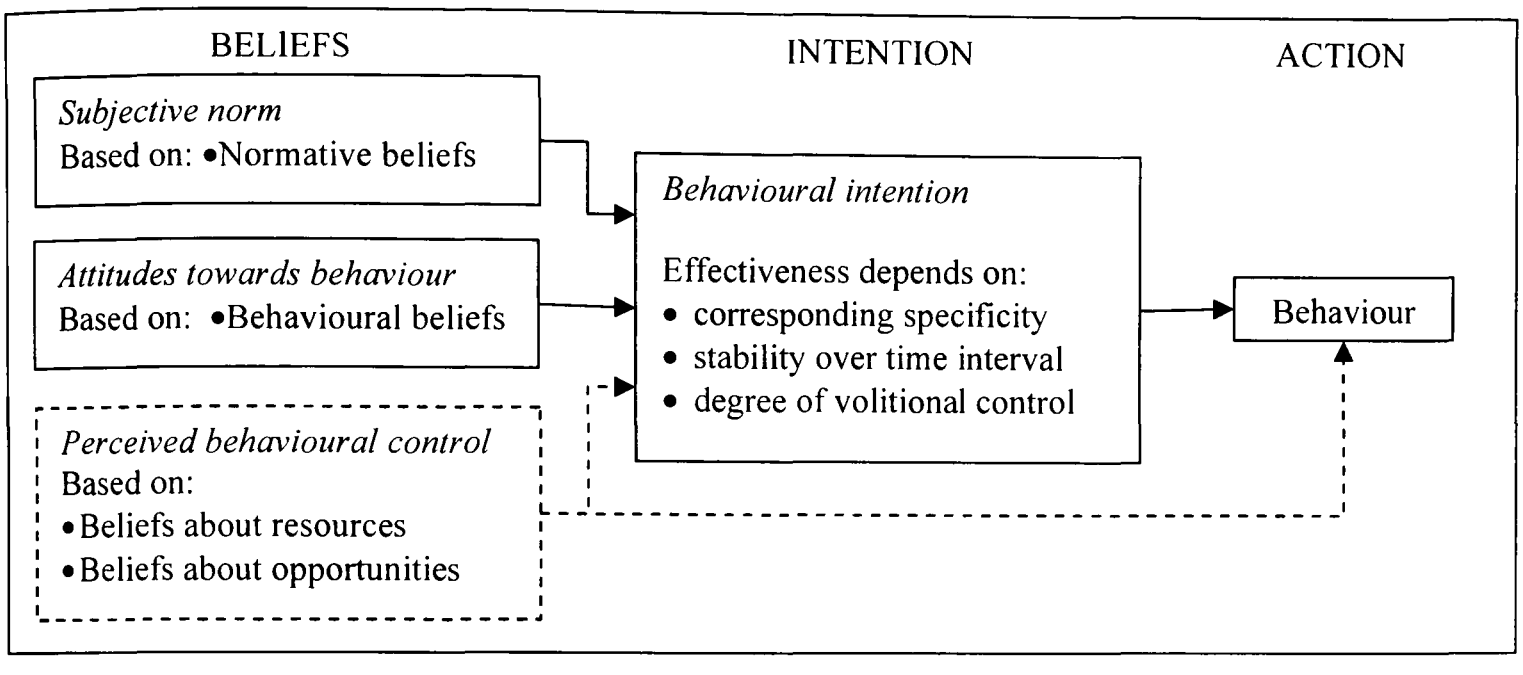
As well as finding that a positive appraisal of events can protect the development of children, Jackson and Warren's (2000) study also identified that social support can be protective in the relationship between risks, stressors, and outcomes and thereby also promotive of resilience. These relationships reflect the importance of secondary appraisal; children with more social support have greater resources to draw upon when they perceive an event is stressful (see Thompson, Flood, & Goodvin, 2006). Crucially, social support has been found to be particularly important for younger children (i.e. those studied here) who have not yet developed protective internal resources such as sufficient self regulation (Kenny, 2000) or a mature physiological stress response (Evans, Hucklebridge, & Clow, 2000). At the same time though, the effects of social support are often found to be stronger in girls; for example Jackson and Warren (*ibid*) found that only a female sub-sample closely matched the larger mixed gender sample when both were used to establish the effects of social support. Additionally and as with primary appraisal, these individual differences can also be differentiated by psychological characteristics. For example, both effective coping strategies and an internal locus of control have been found to promote adaptive changes in behaviour (see Ogden, 2004).

The changes in behaviours[153] that can result from individuals appraising both events and their abilities to cope with these also represent individual adaptations to salient environments. As such and as mentioned in Section 6.4.2, *mal*adaptive behaviours are often investigated in studies of vulnerability and resilience. Amongst others these behaviours have included conduct disorders (Hartman, Stage, & Webster-Stratton, 2003) such as *anti-social behaviour*[154] (van Goozen *et al.*, 1998) and aggression (De Bellis, 2001). Offering an explanation of how individuals' perceptions of both events and their abilities can lead to such maladaptive behaviours, Figure 6.2 depicts the Theory of Planned Behaviour (Ajzen, 1991). This is a model that presents behaviours as the result of intentions which stem from beliefs that one has about one's self (i.e. self esteem), one's abilities (i.e. self efficacy), and which are both altered by beliefs concerning perceived control (i.e. self regulation, coping). These interacting (although not necessarily in a moderating sense) components allow the theory to offer a strong explanation of the associations between children's perceptions of stress (their

[153] Including behaviours that are associated with learning and thereby also subsequent cognition as well
[154] Again and like self regulation, a social developmental ability that was studied in this investigation

beliefs) and the vulnerability and/or resilience they later exhibit in their developmental pathways (through the behaviours that they then exhibit).

Figure 6.2 The Theory of Planned Behaviour (Ajzen, 1991; from Hogg and Vaughan, 1998)



In addition, the Theory of Planned Behaviour also takes into account the perceived beliefs of significant others (subjective norms), whom in the case of young children such as those studied in this investigation are most obviously family members and/or primary caregivers. As such, the theory unintentionally demonstrates that the relationship between a primary caregiver and child, the *attachment style* that is shared between them (Bowlby, 1969), can play a significant role in promoting adaptive behaviour and thereby also resilient development (see Rutter, 1987). However, the style of this attachment is itself shaped by the attachments that parents experienced during childhood with their own parents (Daniel & Wassell, 2005)[155]. Further, a mechanism driving this intergenerational transfer is yet again an alteration of perceptions and reactions to stressors (see Gunnar & Vasquez, 2001). This work of Gunnar and Vasquez offers another example of how developmental risk can be transmitted across the generations and is an example whose effect is accentuated when accompanied by a broader history of familial poverty or social disadvantage (Cicchetti & Rogosch, 2001)[156].

[155] See also Figure 1.4, *"The intergenerational transfer of risk: mediation through the interplay of characteristics with environments"* in Chapter 1

[156] With reference back to Section 6.3.3 and the combating of social inequalities

By way of partial summary of the discussion up until to this point, so far it has been argued that the psychological mechanisms that underpin children's perceptions of and reactions to salient stressors are also central to the interactions between individuals and their environments that have been theorised to underlie vulnerable and resilient developmental pathways. These psychological mechanisms have been presented and examined because it is hypothesised that through their alteration, programmes of early education might be able to have an effect on vulnerable and resilient developmental pathways. Research demonstrating the impact of early education on just these psychological processes in young children, and consequently also their development, is now considered in order to contextualise the findings of this study within the wider pre-existing literature.

As has already been discussed in this chapter, two of the principal mechanisms that underlie vulnerable and resilient developmental pathways are children's perceptions of and adaptations to stressors and thereby risks (Rutter & Rutter, 1993). Of particular relevance to this investigation, programmes of early education have been shown to facilitate stress-coping in young children who perceive pre-school as stressful when it is of high rather than low quality (Gunnar & Donzella, 2002; Dettling, Parker, Lane, Sebanc, & Gunnar, 2000). In turn, this has been argued to be possible because caregivers who are warm and sensitive in their interactions with children can act as buffers (i.e. a source of protection) against the stresses that 'at-risk' children perceive and then adapt/respond to (Gunnar, 1998). Further, it is exactly these kinds of caregiver-child interactions[157] (amongst other qualities) which were shown by this investigation to offer consistent partial protection (against combined child level risk) to the development of young children's: General Cognitive Abilities, self regulation, and anti-social/worried behaviour (see Table 5.9).

Nevertheless, and as with the promotion of children's development, programmes of early education and care have also been found to have detrimental effects upon children: it can be a significant stressor (Dettling, Gunnar, & Donzella, 1999). However, these authors also identified that children's gender and age of intial attendance differentiated their perceptions of early education as being stressful or not,

[157] These being *'positive relationship'* and the lack of a *'detachment'* in the relationships

and these are exactly the same characteristics that have been found to differentiate whether early education can have a beneficial or detrimental effect on young children's development (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004). Additionally and again in reference to the results of this study, these are findings which are also mirrored here and which thereby lends credence to the idea that stress reactions might be a key mechanism underling the significant results that are reported in Chapter 5. for example, here it was found that the longer children had spent in their primary programme of early education (thus implying an earlier age of entry), the greater the impact of child level risk upon anti-social/worried behaviour at exit (without accounting for the protective of effects of high quality in this relationship).

Yet another similarity between the results of this study and those of the pre-existing literature examining the effects of early education on young children's development concerns child temperament. First, when early education of low quality has been associated with aggressive behaviour, children have also been found to display increased levels of stress reactivity (Gunnar, Sebanc, Tout, Donzella, & van Dulman, 2003). Second, programmes of early education that are characterised by *low* process quality have been associated with increased levels of behavioural problems, again such as aggression (e.g. Burchinal, Peisner-Feinberg, Bryant, & Clifford, 2000). Taken together then, the similarities between the findings of this investigation with those of the studies that have been documented in the last three paragraphs strongly suggest that programmes of early education might effect developmental resilience by impacting children's perceptions of and adaptations to stress, including the potential stressor of early education and care itself. Indeed, even if it is the case that children perceive early education as stressful, successfully coping with this may also serve to further improve the readiness of these children for school (Turner-Cobb, 2005; Rutter and Rutter, 1993). Moreover, the promotion of school readiness has been stated as something that should be a central aim of early education (C.J. Hill, 2005) because to do so would effect positive change in children's *developmental pathways* (see NICHD, 2003b, 2003c). At the same time however, whether an alteratation of children's stress-responses (be it via primary and/or secondary appraisal) really does offer a partial explanation of the quality-mitigated developmental impacts of risks is

an under-researchered question. Refferring to just this issue in their call for further research, Watamura, Donzella, Alwin and Gunnar (2003) commented that,

> *"What we do not know is whether early experiences of mild repeated neuroendocrine stress such as that observed in the present study for toddlers have any influence on the developing brain."* (Watamura, Donzella, Alwin, & Gunnar, 2003)

6.5 Summary answers to research questions

1) Can high quality programmes of early education mitigate the impact of risks to promote resilience in the social and cognitive development of young children at school entry at age 5?

Although it was only evidenced as partial, inconsistent, and frequently relying on longer durations of attendance, this thesis found that high quality programmes of early education could protect (and thereby promote resilience in) the development of young children from the impacts of significant developmental risks. That said, these instances of protection also varied systematically such that protection was most common when examining the combination of: cognitive development, child level risk, and process qualities. By contrast, protection was least common when examining: social/behavioural development, family level risk, and structural qualities.

a) *How do these effects impact subsequent vulnerable and resilient developmental pathways between ages 5 and 7?*

Because the social and cognitive skills that children possess at entry to school have proven to be so important for latter developmental pathways (both in this investigation and those that preceded), so the protection of these skills thereby impacts subsequent vulnerable and resilient developmental pathways. Referring back to the very beginning of this thesis (see Section 1.1.1), if 'vulnerability' is used to imply developmental pathways being 'at risk' of being sub-optimal, then raising the level of initial abilities has been shown to strongly improve these future developmental pathways. Conversely, if 'vulnerability' is used to imply a 'susceptibility' of developmental pathways to the effects of risks, then due to the strong association of developmental abilities with themselves over time (see Section 5.2), the raising of these cognitive and behavioural skills at an early age means that developmental pathways are set on a positive cycle. In turn, such positive cycles

means it is harder for latter encountered risks to have a significant detrimental effect upon developmental skills and this implies that resilience has therefore been promoted.

2) *Through what means might early education achieve such effects?*

   a) *Can early education that is of high quality supplement the care and education provided by families?*

Of the measures of combined family level risks that were examined in this work, by far the strongest contributor to all of these was the Home Learning Environment that was present in children's homes and which was created by families. Discussed in Chapter 2 (Section 2.3.4), this measure assessed the extent to which parents/carers engaged in learning activities with their children such as reading or educational visits (e.g. to the library). Because it was the major driver of the family level of risk whose developmental impact was examined in this thesis, so it becomes possible to address this question. High quality programmes of early education were found to partially supplement the care provided by families such that they could mitigate the risks associated with low levels of this. However, this partial mitigation was found to be much more apparent when it came to the impacts of family care on child cognition rather than on behaviour (see Tables 5.9 and 5.10).

   b) *Can early education that is of high quality increase children's school readiness?*

Programmes of early education that were characterised by high quality processes and structures were found to strongly increase the school readiness of young children. Not only were they found to help ensure higher levels of General Cognitive Ability, self regulation, and lower levels of anti-social/worried behaviour at the entry of young children to reception class, but these same skills were also shown to be strongly associated with subsequent success in school up until the end of Key Stage 1 at age 7.

6.6 Limitations of this study

Despite the conclusions drawn earlier in this chapter, there remain unique limitations to the findings and methods used by this study. Further, the limitations of the current investigation can then be drawn upon by potential future studies as they attempt to make their own unique contributions to knowledge. Although Section 6.3 argued that

an extension of knowledge had been generated compared to investigations such as those of Burchinal, Peisner-Feinberg, Bryant and Clifford (2000) and the NICHD (2000a), the original contribution to knowledge that this extension represents is also not without its own limitations. Prior to discussing limitations however, there is also the need for the originality and contribution to knowledge that have been generated by this study to be presented as these contextualised each other. For example, a greater number of limitations may be accepted for the findings to still hold ecological validity if a study and its contributions are especially original. For this investigation in particular, issues of originality and contributions to knowledge relate to broadly similar previous research, and the findings of the original EPPE study whose data was here re-examined in a secondary analysis.

Beginning with the originality of this study compared to previous research which had similar aims and research questions, the originality of the study design and findings is demonstrated through comparison to two especially prominent[158] recent investigations (Burchinal, Peisner-Feinberg, Bryant and Clifford, 2000; NICHD, 2000a). This study extends upon these previous investigations with the following characteristics, methods, and findings:

- A much larger sample size of young children
- Many more measures of the quality of early education
- Both previous studies were carried out with samples from the USA
- The novelty (and demonstrable validity) of the developed method of measuring the interplay amongst developmental risks
- The volume of significant instances of protected development that were found

In terms of the originality of this study compared to the original EPPE investigation, the most prominent original feature was again the novel method that was developed to measure the interplay amongst risks as they combine to impact child development. Furthermore however, this study also offered an original contribution to the findings of the original EPPE investigation from its conceptualisation of the characteristics of

[158] 'Prominent' due to claims of being the first with a sufficient sample size to adequately test a moderating hypothesis (Burchinal, Peisner-Feinberg, Bryant and Clifford, 2000), and the first to address the limited represetation of developmental risks that had been previously studied (NICHD, 2000a).

children and families as constituting risks to child development. This original contribution to knowledge is then extended due to the novel focus of this study on whether pre-school quality could mitigate the impacts of these risks rather than both simply having competing impacts upon development.

Aside from the original contributions to the knowledge generated by this investigation these are also not without limitations. Furthermore, it is these limitations that can be drawn upon to provide directionality for potential future studies. Beginning with limitations first however, these are now discussed and can be broadly split into limitations concerning the methods that were employed, and limitations concerning the findings that were drawn.

Beginning with limitations that are pertinent to the methods used by this study and considering first the use and measurement of self regulation, the very inclusion of *any* measure of this concept carries with it caveats concerning the external validity of conclusions that can be drawn. This is because self regulation has been presented as synonymous with the terms self-control, inhibitory control, effortful control, and has even on occasion been represented as closely matching emotional regulation (Kochanska, Philibert, & Barry, 2009). The external validity of the findings of this study are thus impacted by the use of such a wide variety of interchangeable terms and the fact that even conceptually separate terms have been argued to closely match (i.e. self and emotional regulation).

For this investigation in particular, the conclusions that have been made concerning self regulation are limited in their relevance to those other studies which share matching definitions of this term. By way of reminder, here self regulation was assessed through observer rated behaviours that included assessments of hyperactivity and impulsivity (see Appendix 5). The consequence for the generalisability of the findings of this study due the varying definitions of *self* regulation is also particularly acute thanks to the definitions employed of *emotional* regulation[159]. In particular, the findings of this study will have greater relevance to the literature concerned with

[159] With self regulation being either very similar to emotional regulation (as in Kochanska, Philibert, & Barry, 2009), or emotional regulation being perhaps just one aspect of a broader self regulation (as implied in Cole & Deater-Deckard, 2009)

developmental risks and resilience if self regulation is defined as a concept that overlaps with emotional regulation. This is because emotional regulation has been very strongly linked both to the impacts of developmental risks and also the possibility of their mitigation (e.g. Cole & Deater-Deckard, 2009; Cicchetti, Ackerman, & Izard, 1995). Aside from issues of varying definitions however, the conclusions made by this investigation concerning self regulation are further limited by the procedure was used for measurement. Here, self regulation was measured through *child-specific* observational ratings of children's behaviour and this means that there is no guarantee of inter-rater reliability. The conclusions made by this investigation are therefore much more reliable when in reference to cognitive skills rather than self regulation because of limitations specific to both definition and the method of measurement.

Moving on to consider the limitation of the factor analysis procedure that was used to derive a measure of combined risk, whether this is exploratory or confirmatory in nature, both require a considerable sample size and this is not always possible within studies of high-risk individuals (Sameroff, Gutman, & Peck, 2003). However and as an alternative, a cumulative index of risks is not necessarily validated by a small sample size either, especially if this is a procedure that is based on assumptions of questionable validity. Further, a cumulative index also returns an ordinal measure that at first glance appears simpler to interpret: an increase of one unit represents the child being exposed to one additional risk. By comparison, a factor analysis will return an interval level measure where the individual numeric values are more abstract[160]. However, because a combined risk that is indicated through cumulative indices lacks validity due to the implicit assumptions that are maintained, this apparent simplicity in interpretation might be inappropriate. Thus, although the use of a cumulative risk index might more easily permit an odds ratio analysis that reveals the effect of exposure to each additional risk to the likelihood of a negative outcome (e.g. Johnson and Waldfogel, 2002), in reality, any analyses is no easier as the cumulative index is a less precise measure of developmental risk.

[160] Although it still stands that: higher value=increased risk to development

Another limitation concerns how the methods presented here, as well as those investigated by Burchinal, Roberts, Hooper and Zeisel (2000), of exploratory factor analysis and multiple regression, represent the conceptual 'interactions' amongst the risks. Specifically, none of these methods treat this 'working together' as necessitating moderation or statistical interaction. Instead, researchers must look to alternatives such as the MacArthur moderator-mediator approach (see Essex *et al.*, 2006) for such an explicit representation of risks interacting/moderating one another as they impact a developmental outcome such as children's abilities. Further, this conceptual interaction may also take the form of causal chains of effects amongst the individual risks, especially given that they varied in onset and consistency over time. For example and of relevance to this investigation, Brooks-Gunn (2000) identified that about 50% of the developmental impacts associated with familial income upon cognitive abilities operates through the home environment (of which, all were studied here). By not investigating such non-statistical interaction effects in this study, these thereby become both a limitation and also an area for future research.

A limitation of this study's analysis and one that was particular to formative measurement was the necessity to include a minimum of two outcomes as dependent upon the latent composite risk (see Bagozzi, 2007). Kleine (2006) addresses this drawback by proposing MIMIC factor analyses (multiple indicators multiple causes) as an alternative method to formative measurement which utilises both formative and reflective measurement simultaneously. Furthermore, the measurement of some risks was inherently more exact than others, for example, the number of siblings rather than the Home Learning Environment scale. This difference in measurement poses a problem for Confirmatory Factor Analysis that uses formative measurement as it does not return separate measurement errors for each risk. Consequently, by using this procedure it is harder to establish the internal validity of the composite risk measure score. However, the internal validity of formative measurement is instead primarily established though the added valid directionality of the causal arrows between individual risks and the combined risk (see Figure 2.8).

Turning to limitations that are pertinent to the findings of this investigation and despite the evidence of partial protection that was found, this study made no attempt to investigate how the partially protective impacts that it identified varied across

different types of pre-school provision. Widely understood to vary systematically according to these, the quality of the environments that young children regularly encounter in programmes of early education has had its variation examined in studies that have investigated provision both in the UK (e.g. the EPPE project that was cited in Chapter 1) as well as internationally (e.g. Villalón, Suzuki, Herrera, & Mathiesen, 2002). Although this study made the argument that the partially protective effects that it found would be greatest in those types of pre-school which provided on average, the highest level of care (i.e. integrated child care centres)[161], the association of risk with type remained a question that was left unasked. This was in part due to these questions being dependent upon there being protective effects in the first place, relationships that needed to be firmly established with this investigation contributing towards this.

At the same time however, previous research that has investigated the association between type and risk has identified statistically significant associations between the type of pre-school that a young child was enrolled in and the characteristics of their family such as family income and maternal education (Vandell & Wolfe, 2000). Further, these are also characteristics that this studied identified as having the potential to pose significant risks to young children's psychological development (see Table 5.2). Together, these observations indicate the possibility that the partially protective effect that was offered by high quality programmes of early education could be missed out upon by those who could benefit most, thanks in part due to the type of pre-school that they are enrolled in. Whether or not this is the case this remains to be seen but nevertheless and as discussed earlier, there is a drive by the current UK Government towards providing especially high quality programmes of care and education to disadvantaged communities and the families therein (e.g. Sure Start, DfES, 2003).

A broader criticism of this study and thereby also its findings was the design that it adopted from EPPE, that of a longitudinal observational study, to investigate whether universally available programmes of early education could prove protective against developmental risks. The criticism in this lies from what it attempted to do: this study

[161] See Section 6.3.2

investigated whether there are effects similar to that of an intervention, and the traditional means of establishing this, through an experimental design. Because of this mismatch, the validity of the results of this study might be called into question as there was no randomisation of children across programmes of varying quality and duration so as to minimise the impacts of extraneous variables. Quite aside from the sheer impracticality (let alone dubious ethics) of such a primary study and analysis and ignoring the fact that this was a secondary analyses of a pre-existing investigation, researching developmental risk and resilience through longitudinal designs is itself also an approach that has been called for by Rutter and Rutter (1993). By way of explanation, these authors argue that it proves increasingly impractical to conduct truly controlled experiments when their focus extends over a period of years. Furthermore,

> *"...longitudinal studies are necessary to ensure that the individuals in the contrasting situations were truly comparable before hand and to determine that the key experiences, internal and external, are followed by systematic changes within individuals in the relevant psychological function."* (Rutter & Rutter, 1993)

Yet another limitation of this investigation concerns the characteristics and backgrounds of the young children who were sampled in the original EPPE project. Luthar (2006) notes that although investigations into developmental risk and resilience can benefit from studies that examine samples that are representative of larger populations (as here), there are also benefits in examining sub-samples of individuals whose development is deemed to be at especially high risk. As a result, the findings that were identified here may differ in such smaller higher risk sub-populations of young children, especially if their development is deemed to be at risk due to the actions of variables that were not measured in this study. For example, can high quality pre-school aid the development of young children that is at risk due to physical disabilities?

It might also be argued that a weakness of this study was that it was based on only one experience of a centre/programme of early education per child and, as such, did not account for alterations to this (i.e. moving to a new pre-school). Due to this, the results of this study might be criticised for lacking ecological validity as children

commonly attend more than one form of provision as was the case with the sample gathered by the EPPE team. However, the measure of duration of attendance that was included in these analyses took into account any changing form of provision via the method of its measurement. Rather than a measure of say, the frequency or hours per week that a child attended their dominant form of care, the measure used in this study was one of total months. Not only did this take into account children changing their programme of early education, but simultaneously also variations in their age of onset[162]. Nonetheless, it is also acknowledged that a measure of weekly/monthly frequency of attendance or total hours would provide a different measure of duration that could have differing relationships not only with risks, development, and quality but also the relationships that are shared between these (i.e. whether this measure of 'duration' could protect or modify the instances of quality protection that were identified here).

Another important limitation of this study is that the findings and the conclusions that it made relate explicitly to only British programmes of early education that young children experienced during the mid to late 1990s (1997 onwards). At the same time however, an argument can also be made for the generalisation of these findings to other instances of pre-school/programmes of early education if these are of similarly quality to those that were studied here. Nonetheless, the most comprehensive way to establish whether this is the case or not is to conduct further research to test whether the findings that were identified here can be generalised to current and future programmes of early education both within the UK (especially given the key trio of new millennium policies[163]) and/or to programmes of high quality programmes of early education/pre-school more generally and within different cultures.

A final limitation not just of this study, but also one that is present in all investigations into the impacts of risks to development and the possibility of protection and resilience is that these will always be, at least partially, subjective judgements that are made by researchers. Because developmental resilience relies upon the large degree of variation that individuals exhibit in their response and adaptations to the situations

[162] Which had important consequences as discussed in Section 6.3.1.
[163] These being: the Early Years Foundation Stage (EYFS) statutory framework and its associated curriculum (QCA & DfEE, 2000); *"Birth to Three Matters"* (DfES & Sure Start, 2002); and the Sure Start Programme, *"Every Child Matters"* (DfES, 2004).

that they encounter, so this variation also impacts the generalisation of the conclusions that have been made in this thesis. At best, research investigating risk and resilience can only hope to account for sizeable proportions of the variance in children's developmental adaptations to risks; there will always individuals for whom the results of this study do not hold true. Although this caveat justifiably limits the prescriptiveness of the findings and conclusions that have here been made, it also supports future research. Research that might investigate individuals that although seemingly accurately characterised by the generalised mean-based findings of this study, had development that was either not at risk, or for whom high quality of programme of early education did not seem to offer partial protection to their psychological development.

6.7 Suggestions for further future research

In addition to the future research that leads on naturally from the limitations of this investigation's scope and methods, further future research could be perhaps most strongly benefited from adopting a, *"Multilevel approach to resilience"* (see Cicchetti & Curtis, 2007) that was the topic of a special issue of the Journal, *"Development and Psychopathology"* in 1997 (Volume 19, Number 3). Hinted at with the allusion to biological process that featured strongly in the discussions of this Chapter, Cicchetti and Curtis (*ibid*) argue for a more integrated and holistic approach to resilience in the development of young children and in particular,

> *"Future research on resilience should continue to integrate biological and psychological perspectives with the goals of translating this research into the design and implementation of preventative interventions that aim to facilitate the development of resilient functioning"* (Cicchetti & Curtis, 2007)

To this end and if cost were not an issue, then perhaps the most obvious suggestion for a future follow-up study would be one that had a wider conceptual focus (e.g.. also examining biological development), examined development for a longer period, and did so with a greater sample of children, families and pre-schools (or even a population). However, although the conceptual rationale for such a study has been

well explicated by authors such as Rutter and Rutter (1993)[164] and O'Connor (2006)[165], the cost and practicalities of such a study are also prohibitive. For example, in 2008 a new long term birth cohort was confirmed within the UK that has been allocated a budget of £28 million (see Bynner *et al.*, 2008). Therefore, given the expense of such studies, consideration now turns to a direction for future research which would perhaps be more easily realised.

One limitation of the methods that were used in this study which strongly suggests a direction for future research is that only psychological development was examined over a relatively short period of time when considering very long term developmental pathways (e.g. from birth to adulthood). Further work is needed to establish whether the statistical associations that were documented here are replicable across other areas of children's development, other time frames, and also different types of combined risk (e.g. biological development and biological risks). Also, because it was not investigated in this study, there is also a need for work to investigate whether the tested combined levels of risk impact development in a linear or a threshold fashion (Appleyard, Egeland, Dulmen, & Sroufe, 2005) and whether these impacts vary according to different time frames of development.

Further to the issue of biological development and called for by Masten (2007), Luthar, Cicchetti and Becker (2000a) were some of the first to call for a more multilevel approach to studies investigating developmental risk and resilience. Importantly, these investigations are argued to have the potential to explain not only the mechanisms and processes that underlie the impacts of risks to development (see Section 6.4), but also children's resilience to these risks as they age. As a final thought to this thesis, although work has begun to integrate more biological areas of developmental research (e.g. Gunnar & Vasquez, 2001) with that of psychological development including with a focus on early years education (e.g. Chryssanthopoulou, Turner-Cobb, Lucas, & Jessop, 2005; Gunnar, Sebanc, Tout, Donzella, & van

[164] *"...if social interventions are to be beneficial overall, it is necessary to understand the social system as a whole and not just the bit that you want to alter."* (Rutter & Rutter, 1993)

[165] *"Questions about whether and by what mechanisms early exposures and experiences may have lasting effects on the organism are fundamental to the field of developmental psychopathology..."* (O'Connor, 2006)

Dulman, 2003), there yet remain many questions that have still to be asked, let alone answered.

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7. APPENDICES

1: Matching indicators of parental Socio-Economic Status (SES)

Table 7.1 Matching the categories of the parents' occupational status and education variables of the EPPE study, 1997 UK National figures, and the 2001 British Census

1997 EPPE	1997 UK	2001 British Census
Occupational Status		
Never worked		Never worked
Unemployed		Long Term Unemployed
Unskilled	Unskilled and Semi-skilled	Routine occupations
Semi skilled		Semi-routine occupations
Skilled manual	Skilled manual	Lower supervisory and technical occupations
Skilled non manual		Small employers and own account workers
	Skilled non manual	Intermediate occupations
Other professional non manual		Lower managerial and professional occupations
Professional non manual		Higher professional occupations
	Professional/ Intermediate *(mean of mothers and fathers)*	Large employers and high managerial occupations
Education		
None	Less than O level; other miscellaneous	None
16 vocational		level 1
16 academic	O level	level 1
18 vocational	A level	level 2
18 academic	HND, 18+ vocational	level 3
degree or equivalent	Degree or higher	level 4/5
higher degree		level 4/5
other professional		level 4/5
other miscellaneous		level 4/5

2: Negotiating access to the EPPE Dataset

Department of Education
15 Norham Gardens
University of Oxford
Oxford
OX2 6PY
8/2/2006

Dear EPPE Team and Rebecca Goldman,

I write to you here to address EPPE dataset confidentiality, access and safe-guarding concerns that Brenda Taggart legitimately voiced in our meeting on 26 January. Brenda's concerns mainly centred on keeping to the original DfES-EPPE contract in a responsible way and this letter aims to address these concerns in a considerate and conscientious manner.

Maintaining confidentiality of the dataset is straightforward to address. I realise that access is not a trivial manner and that both EPPE and the DfES have extremely rigorous confidentiality policies. The easiest way to ensure the confidentiality of the EPPE participants is to remove their names, as well as their schools' names from the dataset itself. In this manner, the participants become completely anonymous individuals; only being differentiated by their identification numbers. Furthermore, in order to comply with the EPPE team's own confidentiality policy I suggest that I should sign the Institute of Education's confidentiality sheet. This will ensure that all the contractual obligations of the EPPE team are met in full.

Ensuring that access to the anonymised dataset is secure and safeguarded is also a straightforward matter to address. The dataset will be held on a university password-protected desktop. Only I have the password to this which is changed every month. This computer itself is kept in a lockable office which is locked every night in a building to which access can only be gained via Departmental magnetic swipe cards.

I realise that the access to the EPPE and DfES dataset is an important matter and that the usage and storage of it is something that has to be acted upon carefully. Therefore, in addition to the points outlined already, I will permanently delete the copy of the dataset once my studies are complete. In this manner I hope to keep to all the data safe-guards in the BERA and BPS ethics.

I understand that if the situation should change at any point, a more thorough guarantee may be required. For example, if I were to carry out qualitative interviews, a review of the ethical considerations would have to be undertaken. This is coupled with an internal ethical approval process at Oxford University in addition to a further future renegotiation of access to this EPPE and DfES data.

Yours sincerely,

James Hall

3: Coding scheme of the educational qualifications of pre-school staff

Table 7.2 EPPE Coding scheme of pre-school staff qualifications

Qualification	Old	Revised	5 point	Count	Notes
No qualifications	1	1	0	87	
School Certificates					
CSE	2	2			
O' Levels	3	3			
GCSE	4	4			
Other school certificate	5	5			
Vocational Courses					
GNVQ Foundation	6	6	2		
GNVQ Intermediate	7	7	3		
GNVQ Advanced	8	8	3		
NVQ Level 1	9	9.1	2	1	
NVQ Level 2	9	9.2	2	49	
NVQ Level 3	9	9.3	3	41	
NVQ Level 4	10	10	4		
NVQ Level 5	11	11	5		
BTEC Certificate	12	12.2	2	66	
BTEC Diploma	12	12.3	3	16	
National Certificate	13	13.2	2		
National Diploma	13	13.3	3		
HN Certificate	14	14.2	2	2	
HN Diploma	14	14.3	3	4	
City and Guilds I	15	15.1	2		No one ever mentioned level, so all 2's
City and Guilds II	15	15.2	2	9	
City and Guilds III	15	15.3	3		
Pitmans/RSA	16	16			
NNEB	17	17	3	380	
Other vocational	18	18			
Post-School Certificates (Academic)					
A and A/S Level	19	19			
Other academic	20	20			
Education / Teaching					
Dip. Ed	21	21	3	3	
Cert. Ed	22	22	5	46	
B. Ed	23	23	5	40	
PGCE	24	24	5	36	
Overseas	25	25	99	4	
other education/teaching	26	26			
Degrees					

Qualification	Old	Revised	5 point	Count	Notes
BA	27	27	4	4	
BA Hons + NNEB	27.5	5			
BSc	28	28	4		
BSocSc	29	29	4		
Other degree	30	30	4	1	
Higher degrees					
MA	31	31	4	2	
M Ed	32	32	4		
D Phil	33	33	4		
PhD	34	34	4		
Other higher degree	35	35	4		
Child Care Qualifications					
CECS	36	36	2	2	
PPA Foundation Level	37	37	2	30	
PA Level II	38	38.2	2	19	
PA Advanced	38	38.3	3		
DPP Level III	39	39	3	43	
NNEB with Portage	40	40	3	4	
ADCE	41	41	4	10	
DCC	42	42	3	1	
Montessori	43	43.3	3	16	
Montessori (degree length)	43	43.4	4		
SSCC or CSS	44	44			
Overseas CC qualification	45	45	99	1	
Other CC qualification	46	46	99	1	
Miscellaneous					
Health and safety certificate	47	47	0		
Food handling certificate	48	48	0		
First aid	49	49	0	7	
British Sign Language	50	50	0	1	
Diploma in Welfare Studies	51	51			
NESW (Social Work)	52	52.3	3		
Social Work degree	52	52.4	4		
State Registered Nurse	53	53.3	3	1	
State Registered Nurse (BSc)	53	53.4	4		
State Registered Children's Nurse	53	53.4	4		
Dip Social Care	54	54	3		
Classroom assistant	55	55	3	1	
Registered Child Minder	56	56.2	2	2	If no extra info given
Registered Child Minder	56	56.3	3		If info given that justifies level 3
Other miscellaneous	57	57	99	1	

Qualification	Old	Revised	5 point	Count	Notes
Courses uncertified					
Modular Course in CC	58	58.2	2	2	If no extra info given
Modular Course in CC	58	58.3	3		If info given that justifies level 3
PLA Learning Through Play	59	59	2	11	
LA Course	60	60			
SS course	61	61			
Other Course Uncertified	62	62	99		
Non teaching staff	98	98	98	136	
Missing data	99	99	99	141	
				1221	

4: Instruments used to measure the quality of early education
The Caregiver Interaction Scale (CIS)
(Example of the scoring sheet used in the EPPE investigations)

Observer: To what extent are each of the following statements characteristics of this caregiver? For each item, circle one of the numbers indicated: 1 = not at all, 2 = somewhat, 3 = quite a bit, 4 = very much.

1. Speaks warmly to the children	1	2	3	4
2. Seems critical of the children	1	2	3	4
3. Listens attentively when children speak to her	1	2	3	4
4. Places high value on obedience	1	2	3	4
5. Seems distant or detached from the children	1	2	3	4
6. Seems to enjoy the children	1	2	3	4
7. When children misbehave, explains the reason for the rule they are breaking	1	2	3	4
8. Encourages the children to try new experience	1	2	3	4
9. Doesn't try to exercise much control over the children	1	2	3	4
10. Speaks with irritation or hostility to the children	1	2	3	4
11. Seems enthusiastic about the children's activities and efforts	1	2	3	4
12. Threatens children in trying to control them	1	2	3	4
13. Spends considerable time in activity not involving interaction with the children	1	2	3	4
14. Pays positive attention to the children as individuals	1	2	3	4
15. Doesn't reprimand children when they misbehave	1	2	3	4
16. Talks to children on a level they can understand	1	2	3	4
17. Punishes the children without explanation	1	2	3	4
18. Exercises firmness when necessary	1	2	3	4
19. Encourages children to exhibit prosocial behaviour e.g. sharing cooperating	1	2	3	4
20. Finds faults easily with the children	1	2	3	4
21. Doesn't seem interested in the children's activities	1	2	3	4
22. Seems to prohibit many of the things the children want to do	1	2	3	4
23. Doesn't supervise the children very closely	1	2	3	4
24. Expects the children to exercise self-control. E.g. to be undisruptive for group teacher-led activities, to be able to stand in line calmly	1	2	3	4
25. When talking to the children, kneels, bends, or sits at their level to establish better eye contact	1	2	3	4
26. Seems unnecessarily harsh when scolding or prohibiting children	1	2	3	4

The Early Childhood Environmental Rating Scale Revised (ECERS-R)
Questions and their subscales from the handbook (Harms, Clifford, and Cryer 1998).

Each question is assessed on a 7 point Likert scale of 1 (inadequate), 3 (minimal), 5 (good), 7 (excellent).

Space and Furnishings	1. Indoor Space 2. Furniture 3. Furnishings for relaxation and comfort 4. Room engagement 5. Space for privacy 6. Child related display 7. Space for gross motor 8. Gross motor equipment
Personal Care Routines	9. Greeting/departing 10. Meals/Snacks 11. Nap/rest 12. Toileting/diapering 13. Heath practices 14. Safety practices
Language Reasoning	15. Books and pictures 16. Encourage children to communicate 17. Using language to develop reasoning skills 18. Informal use of language
Activities	19. Fine motor 20. Art 21. Music/movement 22. Blocks 23. Sand/Water 24. Dramatic play 25. Nature/science 26. Math/numbers 27. Use of TV, video, and/or computers 28. Promoting acceptance of diversity
Interaction	29. Supervision of gross motor activities 30. General supervision of children (not gross motor) 31. Discipline 32. Staff-child interactions 33. Interactions among children
Programme Structure	34. Schedule 35. Free play 36. Group time 37. Provisions for children with disabilities
Parents and Staff	38. Provisions for parents 39. Provisions for personal needs of staff 40. Provisions for professional needs of staff 41. Staff interaction and cooperation 42. Supervision and evaluation of staff 43. Opportunities for professional growth

The Early Childhood Environmental Rating Scale Extension (ECERS-E)
Questions and their subscales from the handbook (Sylva, Siraj-Blatchford, and Taggart 2006).

Each question is assessed on a 7 point Likert scale of 1 (inadequate), 3 (minimal), 5 (good), 7 (excellent).

Language	1. Environmental Print 2. Book and Literacy Areas 3. Adult Reading with Child 4. Sounds in Words 5. Emergent Writing 6. Talking and Listening
Mathematics	1. Counting 2. Reading and Writing Numbers 3. Shape and Space 4. Matching, Sorting and Comparing
Science and Environment	1. Natural Methods 2. Science Resources 3. Non-Living 4. Living 5. Food Preparation
Diversity	1. Planning for Individual Needs 2. Gender Equality and Awareness 3. Race Equality and Awareness

N=18

5: Instruments used to measure children's development

The Adaptive Social Behaviour Inventory (ASBI; Hogan, Scott, & Bauer, 1992). *Each question is assessed on a 3 point Likert scale where 1= rarely/never, 2= sometimes, 3= almost always.*

Exploratory factor analyses conducted by the EPPE project (Sammons et al, 2003) revealed the following factors:

Factor 1: Co-operation & Conformity (Cronbach alpha = 0.88)

2. Is helpful to other children
3. Is obedient and compliant
5. Follows rules in games
8. Waits his/her turn in games or other activities
10. Co-operates with your requests
15. Follows household or pre-school centre rules
16. Says "please" and "thank you" when reminded
18. Is calm and easy-going
20. Shares toys or possessions

Factor 2: Peer Sociability (Cronbach alpha = 0.85)

1. Understands others' feelings, like when they are happy sad or mad
7. Is sympathetic toward other children's distress, tries to comfort others when they are upset
11. Can easily get other children to pay attention to him/her
12. Says nice or friendly things to others, or is friendly towards others
13. Will join a group of children playing
14. In social activities, tends to just watch others
17. Asks or wants to go play with other children
19. Plays games and talks with other children

Factor 3: Confidence (Cronbach alpha = 0.70)

9. Is open and direct about what he/she wants
22. Is confident with other people
24. Tends to be proud of things she/he does
27. Is interested in many and different things
30. Enjoys talking with you

Factor 4: Anti-social (Cronbach alpha = 0.70)

21. Teases other children, calls them names
23. Prevents other children from carrying out routines
26. Bullies other children
29. Is bossy, needs to have his/her way

Factor 5: Worried/Upset (Cronbach alpha = 0.61)

4. When you give him/her an idea for playing, he/she frowns, shrugs shoulders, pouts or stamps foot
6. Gets upset when you don't pay enough attention
25. Accepts changes without fighting against them or becoming upset
28. Is worried about not getting enough (where enough might include attention, access to toys, food/drink etc)

Extended ASBI: The Child Social Behaviour Questionnaire (CSBQ; see Sammons et al., 2003)
The 30 ASBI questions were complimented to by 10 from the Strengths and Difficulties Questionnaire (SDQ; R. Goodman, 1997) and 5 from an unpublished scale (See Sammons et al., 2003). Each of the 45 questions was assessed on a 5 point scale: *1=rarely/never; 2=not often; 3=sometimes; 4=usually; 5=almost always*

Exploratory factor analyses conducted by the EPPE project revealed the following factors:

Factor 1: Self-Regulation (Cronbach alpha = 0.88)
2. Thinks things out before acting
14. Easily distracted, concentration wanders (REVERSED)
17. Can move to a new activity on completion of a task
19. Can independently select and return equipment as appropriate
23. Constantly fidgeting or squirming (REVERSED)
33. Perseveres in the face of difficult or challenging tasks
36. Likes to work things out for self; seeks help from teacher/other children only as a last resort; can work independently
42. Restless, overactive, cannot stay still for long (REVERSED)
45. Sees task through to the end, good attention span

Factor 2: Co-operation and Conformity (Cronbach alpha = 0.94)
4. Tries to be fair in games
5. Is obedient and compliant
7. Follows rules in games
10. Can behave appropriately during less structured sessions with no more than one reminder
11. Waits his/her turn in games or other activities
13. Co-operates with your requests
21. Follows school rules
22. Says "please" and "thank you" when reminded
25. Is calm and easy-going
26. Can work easily in a small peer group
28. Shares toys or possessions
35. Accepts changes without fighting against them or becoming upset

Factor 3: Peer Sociability (Cronbach alpha = 0.87)
15. Can easily get other children to pay attention to him/her
18. Will join a group of children playing
20. In social activities, tends to just watch others (REVERSED)
24. Asks or wants to go play with other children
27. Plays games and talks with other children
30. Is confident with other people
31. Will invite others to join in a game

Factor 4: Anti-social / Worried (Cronbach alpha = 0.84)
6. When you give him/her an idea for playing, he/she frowns, shrugs shoulders, pouts or stamps foot
8. Gets upset when you don't pay enough attention

29. Teases other children, calls them names
32. Prevents other children from carrying out routines
37. Bullies other children
40. Is worried about not getting enough (where enough might include attention, access to toys, food/drink etc).
41. Is bossy, needs to have his/her way

Factor 5: Empathy & Pro-social (Cronbach alpha = 0.89)

1. Understands others' feelings, like when they are happy, sad or mad
3. Is helpful to other children
9. Is sympathetic toward other children's distress, tries to comfort others when they are upset
16. Says nice or friendly things to others, or is friendly towards others
39. Apologises spontaneously after a misdemeanour
44. Offers to help other children who are having difficulty with a task in the classroom

Factor 6: Openness (Cronbach alpha = 0.78)

12. Is open and direct about what he/she wants
34. Tends to be proud of things she/he does
38. Is interested in many and different things
43. Enjoys talking with you

The Strengths and Difficulties Questionnaire (SDQ)
The original 25 items from the Strengths and Difficulties Questionnaire (SDQ; R. Goodman, 1997) as used by this investigation. Each item is assessed on a 3 point scale: "Not True"= 0, "Somewhat True"=1, "Certainly True"=2.

Summed Scale 1: Hyperactivity 0-10
2 Restless, overactive, cannot stay still for long
10 Constantly fidgeting or squirming
15 Easily distracted, concentration wanders
21 Thinks things out before acting (REVERSED)
25 Sees task through to the end, good attention span (REVERSED)

Summed Scale 2: Emotional Symptoms 0-10
3 Often complains of headaches, stomach-aches or sickness
8 Many worries, often seems worried
13 Often unhappy, down-hearted or tearful
16 Nervous or clingy in new situations, easily looses confidence
24 Many fears, easily scared

Summed Scale 3: Conduct Problems 0-10
5 Often has temper tantrums or hot tempers
7 Generally obedient, usually does what adults request (REVERSED)
12 Often fights with other children or bullies them
18 Often lies or cheats
22 Steals from home, school or elsewhere

Summed Scale 4: Peer Problems 0-10
6 Rather solitary, tends to play alone
11 Has at least one good friend (REVERSED)
14 Generally liked by other children (REVERSED)
19 Picked on or bullied by other children
23 Gets on better with adults than with other children

Summed Scale 5: Prosocial 0-10
1 Considerate of other peoples feelings
4 Shares readily with other children (treats, toys, pencils etc.)
9 Helpful if someone is hurt, upset or feeling ill
17 Kind to younger children
20 Often volunteers to help other (teachers, other children)

Summed Scale 6: Total Difficulties 0-40
Summed Scales 1-4 (omitting 5, "Prosocial")

6: Z-scoring dichotomous measures: rationale and effects

To approximately equalise scales of measurement, apriori z-scoring was conducted on all of the observed variables used in the statistical analyses conducted in this investigation. This procedure was carried out for the purpose of easing the likelihood of model convergence (see L.K. Muthén & B.O. Muthén, 2004; Nikolov, Coull, Catalano, & Godleski, 2007) which is especially necessary when analysing multi-level data (UCLA Academic Technology Services, 2008). However, this apriori procedure also included the z-scoring of dichotomous variables (e.g. speaking English as an Additional Language [EAL] and premature birth) for the sole purpose of easing model convergence and had no impact upon the subsequent standardised statistical relationships. For example, Table 7.3 shows that the correlations between having EAL and being born premature are the same regardless of whether one or both of these variables are z-scored.

Table 7.3 Pearson's correlations between non z-scored and z-scored dicohomtous measures of speaking English as an Additional Language (EAL) and prematurity

		Premature?	EAL?	Zscore: Premature?
	Pearson			
Zscore: EAL?	Correlation	**-0.036**	1	**-0.036**
	Sig. (2-tailed)	0.045	0	0.045
	N	3061	3169	3061
Zscore:	Pearson			
Premature?	Correlation	1	**-0.036**	
	Sig. (2-tailed)	0	0.045	
	N	3061	3061	
	Pearson			
EAL?	Correlation	**-0.036**		
	Sig. (2-tailed)	0.045		
	N	3061		

Following on from the lack of impact that z-scoring dichotomies has upon standardised correlation coefficients, Table 7.4 reveals similar results from statistical

regression analyses. When both z-scored and non z-scored versions of EAL and prematurity are specified as predictors of General Cognitive Ability at 36 months, the same explained variance, standardised regression coefficients, and the associated probability of these coefficients are returned. In summary, because the z-scored dichotomies of this investigation were only examined in the context of standardised correlation and regression co-efficients, so the effect of this procedure was limited to aiding the convergence of the multi-level SEM in which they were used.

Table 7.4 Multiple regression equations of z-scored and non z-scored English as an Additional Language and prematurity on General Cognitive Ability at 36 months

Predictor	% Variance explained (r^2)	Unstandardised B	Standardised β	Significance
non z-scored predictor regression:				
EAL?	6%	-0.21	-0.08	0.00
Prematurity?		-1.01	-0.24	0.00
z-scored predictor regression:				
Z-scored EAL?	6%	-0.08	-0.08	0.00
Z-scored Prematurity?		-0.32	-0.24	0.00

7: Complete Bivariate Patterns of Missing Data in this Investigation

Table 7.5 Bivariate Pattern of Missing Data shared between Child Level Risks and all other Variables used in this investigation

		Child Level Risks (% Missing Data)										
		No. siblings	Premature	Birthweight	Birth Order	Any event affected development	Black	Other	Indian	Pakistani	Bangladeshi	Mixed
Child Level Risks	Premature?	2.70	2.42	3.68	2.80	2.77	2.49	2.49	2.49	2.49	2.49	2.49
	Birthweight	3.96	3.68	3.68	4.03	3.89	3.75	3.75	3.75	3.75	3.75	3.75
	Birth Order	2.77	2.80	4.03	2.59	2.94	2.66	2.66	2.66	2.66	2.66	2.66
	"Any event affected development?"	2.87	2.77	3.89	2.94	2.59	2.66	2.66	2.66	2.66	2.66	2.66
	Dummy coded Ethnic Minority: Black?	2.56	2.49	3.75	2.66	2.66	0.11	0.11	0.11	0.11	0.11	0.11
	Other?	2.56	2.49	3.75	2.66	2.66	0.11	0.11	0.11	0.11	0.11	0.11
	Indian?	2.56	2.49	3.75	2.66	2.66	0.11	0.11	0.11	0.11	0.11	0.11
	Pakistani?	2.56	2.49	3.75	2.66	2.66	0.11	0.11	0.11	0.11	0.11	0.11
	Bangladeshi?	2.56	2.49	3.75	2.66	2.66	0.11	0.11	0.11	0.11	0.11	0.11
	Mixed?	2.56	2.49	3.75	2.66	2.66	0.11	0.11	0.11	0.11	0.11	0.11
Family Level Risks	2 Parent Family?	2.63	2.56	3.75	2.73	2.63	2.42	2.42	2.42	2.42	2.42	2.42
	Either Parent Working?	24.68	24.54	25.27	24.75	24.61	23.80	23.80	23.80	23.80	23.80	23.80
	Family Salary	24.68	24.54	25.27	24.75	24.61	23.80	23.80	23.80	23.80	23.80	23.80
	Home Learning Environment	4.10	3.99	5.15	4.20	4.17	3.89	3.89	3.89	3.89	3.89	3.89
	Highest Parental Social Class	2.94	2.87	4.06	3.01	2.91	2.73	2.73	2.73	2.73	2.73	2.73
	Greatest Mother Academic Qualification	4.94	4.83	5.95	5.04	4.94	4.76	4.76	4.76	4.76	4.76	4.76
	Greatest Father Academic Qualification	27.62	27.55	28.39	27.72	27.62	27.48	27.48	27.48	27.48	27.48	27.48
	Mother's Employment	2.98	2.91	4.10	3.05	2.94	2.77	2.77	2.77	2.77	2.77	2.77
	Father's Employment	23.80	23.80	24.68	23.91	23.80	23.63	23.63	23.63	23.63	23.63	23.63
	No. Non Parental Carers	2.49	2.42	3.68	2.59	2.59	2.28	2.28	2.28	2.28	2.28	2.28
	Mother's Social Class	4.24	4.17	5.29	4.31	4.20	4.03	4.03	4.03	4.03	4.03	4.03

Pre-school Measures	Father's Social Class	24.12	24.12	25.06	24.19	24.08	23.94	23.94	23.94	23.94	23.94	23.94
	Mother's Age at Child's Birth	3.01	2.91	4.10	3.08	2.98	2.80	2.80	2.80	2.80	2.80	2.80
	Father's Age at Child's Birth	22.58	22.51	23.42	22.68	22.58	22.40	22.40	22.40	22.40	22.40	22.40
	Duration of Attendance	6.51	6.37	7.63	6.58	6.55	5.01	5.01	5.01	5.01	5.01	5.01
	Positive relationship	3.36	3.29	4.52	3.47	3.47	1.05	1.05	1.05	1.05	1.05	1.05
	Punitiveness	3.36	3.29	4.52	3.47	3.47	1.05	1.05	1.05	1.05	1.05	1.05
	Permissiveness	3.36	3.29	4.52	3.47	3.47	1.05	1.05	1.05	1.05	1.05	1.05
	Detachment	3.36	3.29	4.52	3.47	3.47	1.05	1.05	1.05	1.05	1.05	1.05
	ECERS-R	2.49	2.42	3.68	2.59	2.59	0.11	0.11	0.11	0.11	0.11	0.11
	ECERS-E	2.49	2.42	3.68	2.59	2.59	0.11	0.11	0.11	0.11	0.11	0.11
	No. of Children	2.49	2.42	3.68	2.59	2.59	0.11	0.11	0.11	0.11	0.11	0.11
	Manager's Greatest Childcare Qualifications	7.74	7.67	8.89	7.88	7.84	5.53	5.53	5.53	5.53	5.53	5.53
	Manager's Greatest Academic Qualifications	7.74	7.67	8.89	7.88	7.84	5.53	5.53	5.53	5.53	5.53	5.53
	Mean Staff Age	14.39	14.39	15.47	14.56	14.53	12.46	12.46	12.46	12.46	12.46	12.46
	Mean Staff Greatest Academic Qualifications	13.13	13.06	14.21	13.23	13.20	11.06	11.06	11.06	11.06	11.06	11.06
	Mean Staff Greatest Childcare Qualifications	12.85	12.78	13.93	12.95	12.92	10.78	10.78	10.78	10.78	10.78	10.78
	No. of Staff	3.36	3.29	4.52	3.47	3.47	1.02	1.02	1.02	1.02	1.02	1.02
Measures of Cognitive Development	Baseline: General Cognitive Ability	5.60	5.46	6.58	5.71	5.67	3.33	3.33	3.33	3.33	3.33	3.33
	Reception: General cognitive ability composite	11.45	11.31	12.53	11.48	11.48	9.98	9.98	9.98	9.98	9.98	9.98
	Primary Year 1: reading	15.05	14.98	16.07	15.12	15.12	13.83	13.83	13.83	13.83	13.83	13.83
	Maths	15.33	15.26	16.35	15.40	15.40	14.14	14.14	14.14	14.14	14.14	14.14
	Primary Year 2: Reading	16.14	16.00	16.98	16.24	16.17	14.77	14.77	14.77	14.77	14.77	14.77
	Writing	18.24	18.10	19.04	18.34	18.27	16.98	16.98	16.98	16.98	16.98	16.98
	Maths	17.71	17.57	18.55	17.82	17.75	16.35	16.35	16.35	16.35	16.35	16.35
Measures of Social/Behavioural Development	Baseline: Co-Operation and Conformity	2.91	2.80	4.03	3.01	3.01	0.60	0.60	0.60	0.60	0.60	0.60
	Confidence	2.87	2.77	3.99	2.98	2.98	0.56	0.56	0.56	0.56	0.56	0.56
	Anti-social (reversed)	3.01	2.91	4.13	3.12	3.12	0.70	0.70	0.70	0.70	0.70	0.70
	Worried/Upset (reversed)	2.91	2.80	4.03	3.01	3.01	0.60	0.60	0.60	0.60	0.60	0.60
	Peer sociability	2.87	2.77	3.99	2.98	2.98	0.56	0.56	0.56	0.56	0.56	0.56
	Reception: Self Regulation	11.80	11.62	12.71	11.87	11.80	10.40	10.40	10.40	10.40	10.40	10.40
	Anti-social / Worried	11.59	11.41	12.50	11.66	11.59	10.19	10.19	10.19	10.19	10.19	10.19

Year 1: Prosocial Behaviour	17.50	17.43	18.38	17.57	17.57	16.31	16.31	16.31	16.31	16.31	16.31
Hyperactivity	17.50	17.43	18.38	17.57	17.57	16.31	16.31	16.31	16.31	16.31	16.31
Emotional Symptoms	17.61	17.54	18.48	17.68	17.68	16.42	16.42	16.42	16.42	16.42	16.42
Conduct Problems	18.03	17.96	18.90	18.10	18.10	16.84	16.84	16.84	16.84	16.84	16.84
Peer Problems	17.43	17.36	18.31	17.50	17.50	16.24	16.24	16.24	16.24	16.24	16.24
Year 2: Prosocial behaviour	18.38	18.27	19.32	18.48	18.41	17.05	17.05	17.05	17.05	17.05	17.05
Hyperactivity	18.34	18.24	19.29	18.45	18.38	16.98	16.98	16.98	16.98	16.98	16.98
Emotional Symptoms	18.34	18.24	19.29	18.45	18.38	17.01	17.01	17.01	17.01	17.01	17.01
Conduct Problems	18.34	18.24	19.29	18.45	18.38	16.98	16.98	16.98	16.98	16.98	16.98
Peer Problems	18.34	18.24	19.29	18.45	18.38	16.98	16.98	16.98	16.98	16.98	16.98

Table 7.6 Bivariate Pattern of Missing Data shared between Family Level Risks and all other Variables used in this investigation

		Family Level Risks (% Missing Data)													
		2 Parent Family?	Either Parent Working?	Family Salary	Home Learning Environment	Highest Parental Social Class	Greatest Mother Qualification	Greatest Father Qualification	Mother's Employment	Father's Employment	No. Non Parental Carers	Mother's Social Class	Father's Social Class	Mother's Age	Father's Age
Child Level Risks	Premature?	2.56	24.54	24.54	3.99	2.87	4.83	27.55	2.91	23.80	2.42	4.17	24.12	2.91	22.51
	Birthweight	3.75	25.27	25.27	5.15	4.06	5.95	28.39	4.10	24.68	3.68	5.29	25.06	4.10	23.42
	Birth Order	2.73	24.75	24.75	4.20	3.01	5.04	27.72	3.05	23.91	2.59	4.31	24.19	3.08	22.68
	"Any event affected development?"	2.63	24.61	24.61	4.17	2.91	4.94	27.62	2.94	23.80	2.59	4.20	24.08	2.98	22.58
	Dummy coded Ethnic Minority: Black?	2.42	23.80	23.80	3.89	2.73	4.76	27.48	2.77	23.63	2.28	4.03	23.94	2.80	22.40
	Other?	2.42	23.80	23.80	3.89	2.73	4.76	27 48	2.77	23.63	2.28	4.03	23.94	2.80	22.40
	Indian?	2.42	23.80	23.80	3.89	2.73	4.76	27.48	2.77	23.63	2.28	4.03	23.94	2.80	22.40
	Pakistani?	2.42	23.80	23.80	3.89	2.73	4.76	27.48	2.77	23.63	2.28	4.03	23.94	2.80	22.40
	Bangladeshi?	2.42	23.80	23.80	3.89	2.73	4.76	27 48	2.77	23.63	2.28	4.03	23.94	2.80	22.40
	Mixed?	2.42	23.80	23.80	3.89	2.73	4.76	27 48	2.77	23.63	2.28	4.03	23.94	2.80	22.40
Family Level Risks	2 Parent Family?	2.35	24.47	24.47	3.92	2.70	4.73	27.44	2.73	23.59	2.35	3.99	23.91	2.77	22.37
	Either Parent Working?	24.47	23.77	23.77	25.66	24.64	26.43	41.79	24.71	38.85	24.43	25.55	38.71	24.82	37.73
	Family Salary	24.47	23.77	23.77	25.66	24.64	26.43	41.79	24.71	38.85	24.43	25.55	38.71	24.82	37.73
	Home Learning Environment	3.92	25.66	25.66	3.82	4.24	6.23	28.46	4.27	24.75	3.82	5.50	24.99	4.31	23.49
	Highest Parental Social Class	2.70	24.64	24.64	4.24	2.66	5.01	27.65	3.01	23.87	2.66	3.96	23.91	3.05	22.65
	Greatest Mother Academic Qualification	4.73	26.43	26.43	6.23	5.01	4.69	29.05	4 73	25.73	4.69	5.99	25.97	4.69	24.40
	Greatest Father Academic Qualification	27.44	41.79	41.79	28.46	27.65	29.05	27.44	27.83	28.63	27.44	28.84	29.09	27.83	28.04

Pre-school Measures	Mother's Employment	2.73	24.71	24.71	4.27	3.01	4.73	27.83	2.70	23.98	2.70	3.99	24.26	2.80	22.75
	Father's Employment	23.59	38.85	38.85	24.75	23.87	25.73	28.63	23.98	23.59	23.59	25.13	24.96	24.01	24.26
	No. Non Parental Carers	2.35	24.43	24.43	3.82	2.66	4.69	27.44	2.70	23.59	2.21	3.96	23.91	2.73	22.37
	Mother's Social Class	3.99	25.55	25.55	5.50	3.96	5.99	28.84	3.99	25.13	3.96	3.96	25.20	4.06	23.87
	Father's Social Class	23.91	38.71	38.71	24.99	23.91	25.97	29.09	24.26	24.96	23.91	25.20	23.91	24.29	24.57
	Mother's Age at Child's Birth	2.77	24.82	24.82	4.31	3.05	4.69	27.83	2.80	24.01	2.73	4.06	24.29	2.73	22.75
	Father's Age at Child's Birth	22.37	37.73	37.73	23.49	22.65	24.40	28.04	22.75	24.26	22.37	23.87	24.57	22.75	22.37
	Duration of Attendance	6.37	24.57	24.57	7.70	6.65	8.65	30.17	6.69	26.39	6.23	7.91	26.67	6.72	25.17
	Positive relationship	3.22	24.29	24.29	4.66	3.54	5.57	27.97	3.57	24.15	3.08	4.76	24.47	3.61	22.93
	Punitiveness	3.22	24.29	24.29	4.66	3.54	5.57	27.97	3.57	24.15	3.08	4.76	24.47	3.61	22.93
	Permissiveness	3.22	24.29	24.29	4.66	3.54	5.57	27.97	3.57	24.15	3.08	4.76	24.47	3.61	22.93
	Detachment	3.22	24.29	24.29	4.66	3.54	5.57	27.97	3.57	24.15	3.08	4.76	24.47	3.61	22.93
	ECERS-R	2.35	23.77	23.77	3.82	2.66	4.69	27.44	2.70	23.59	2.21	3.96	23.91	2.73	22.37
	ECERS-E	2.35	23.77	23.77	3.82	2.66	4.69	27.44	2.70	23.59	2.21	3.96	23.91	2.73	22.37
	No. of Children	2.35	23.77	23.77	3.82	2.66	4.69	27.44	2.70	23.59	2.21	3.96	23.91	2.73	22.37
	Manager's Greatest Childcare Qualifications	7.63	27.93	27.93	9.10	7.95	9.80	31.68	7.98	28.00	7.49	9.24	28.39	8.02	27.02
	Manager's Greatest Academic Qualifications	7.63	27.93	27.93	9.10	7.95	9.80	31.68	7.98	28.00	7.49	9.24	28.39	8.02	27.02
	Mean Staff Age	14.35	33.08	33.08	15.65	14.53	16.21	36.19	14.63	32.90	14.21	15.72	33.29	14.63	31.99
	Mean Staff Greatest Academic Qualifications	13.02	31.75	31.75	14.28	13.20	14.91	35.49	13.30	31.96	12.88	14.32	32.52	13.30	31.29
	Mean Staff Greatest Childcare Qualifications	12.74	31.43	31.43	13.97	12.92	14.70	35.28	13.02	31.78	12.60	14.04	32.34	13.02	31.15
	No. of Staff	3.22	24.57	24.57	4.69	3.54	5.57	28.25	3.57	24.36	3.08	4.83	24.71	3.61	23.17
Measures of Cognitive Development	**Baseline:** General Cognitive Ability	5.43	26.04	26.04	6.76	5.74	7.70	29.79	5.78	26.08	5.32	6.86	26.25	5.78	24.75
	Reception: General cognitive ability composite	11.31	28.98	28.98	12.64	11.59	13.44	34.06	11.59	30.45	11.17	12.71	30.84	11.62	29.40
	Primary Year 1: reading	14.91	30.10	30.10	16.28	15.19	16.91	36.23	15.19	32.66	14.81	16.35	32.87	15.23	31.61
	Maths	15.19	30.38	30.38	16.56	15.47	17.19	36.40	15.47	32.83	15.09	16.63	33.04	15.51	31.82

Measures of Social/Behavioural Development	**Primary Year 2:** Reading	16.03	31.15	31.15	17.29	16.31	18.13	36.93	16.31	33.67	15.89	17.50	33.81	16.35	32.62
	Writing	18.13	32.97	32.97	19.32	18.41	20.20	38.54	18.38	35.25	17.99	19.57	35.42	18.41	34.23
	Maths	17.61	32.27	32.27	18.90	17.89	19.67	38.08	17.85	34.83	17.47	19.01	35.00	17.89	33.81
	Baseline: Co-Operation and Conformity	2.77	24.08	24.08	4.24	3.08	5.08	27.69	3.12	23.91	2.63	4.38	24.22	3.15	22.65
	Confidence	2.73	24.05	24.05	4.20	3.05	5.04	27.65	3.08	23.87	2.59	4.34	24.19	3.12	22.61
	Anti-social (reversed)	2.87	24.15	24.15	4.34	3.19	5.18	27.76	3.22	23.98	2.73	4.48	24.29	3.26	22.72
	Worried/Upset (reversed)	2.77	24.08	24.08	4.24	3.08	5.08	27.69	3.12	23.91	2.63	4.38	24.22	3.15	22.65
	Peer sociability	2.73	24.05	24.05	4.20	3.05	5.04	27.65	3.08	23.87	2.59	4.34	24.19	3.12	22.61
	Reception: Self Regulation	11.66	28.35	28.35	12.92	11.94	13.76	33.67	11.97	30.07	11.52	13.16	30.28	12.01	28.95
	Anti-social / Worried	11.45	28.18	28.18	12.71	11.73	13.58	33.57	11.76	29.93	11.31	12.95	30.17	11.80	28.77
	Year 1: Prosocial Behaviour	17.36	31.92	31.92	18.69	17.68	19.25	37.98	17.64	34.48	17.26	18.69	34.69	17.68	33.43
	Hyperactivity	17.36	31.92	31.92	18.69	17.68	19.22	37.98	17.64	34.48	17.26	18.69	34.69	17.68	33.43
	Emotional Symptoms	17.47	31.96	31.96	18.80	17.78	19.32	38.01	17.75	34.51	17.36	18.80	34.72	17.78	33.46
	Conduct Problems	17.89	32.34	32.34	19.22	18.20	19.74	38.36	18.17	34.86	17.78	19.22	35.07	18.20	33.81
	Peer Problems	17.29	31.85	31.85	18.62	17.61	19.15	37.91	17.57	34.41	17.19	18.62	34.62	17.61	33.36
	Year 2: Prosocial behaviour	18.27	32.45	32.45	19.46	18.52	20.23	38.61	18.59	35.28	18.13	19.60	35.42	18.62	34.20
	Hyperactivity	18.24	32.38	32.38	19.43	18.48	20.20	38.57	18.55	35.25	18.10	19.57	35.39	18.59	34.16
	Emotional Symptoms	18.24	32.41	32.41	19.43	18.48	20.23	38.61	18.55	35.28	18.10	19.57	35.42	18.59	34.20
	Conduct Problems	18.24	32.38	32.38	19.43	18.48	20.23	38.61	18.55	35.28	18.10	19.57	35.42	18.59	34.20
	Peer Problems	18.24	32.38	32.38	19.43	18.48	20.23	38.61	18.55	35.28	18.10	19.57	35.42	18.59	34.20

Table 7.7 Bivariate Pattern of Missing Data shared between Descriptive Measures of Pre-school and all other Variables used in this investigation

		Pre-school Measures (% Missing)													
		Duration	Positive relationship	Punitiveness	Permissiveness	Detachment	ECERS-R	ECERS-E	No. of Children	Manager's Greatest Childcare Qualifications	Manager's Greatest Academic Qualifications	Mean Staff Age	Mean Staff Greatest Academic Qualifications	Mean Staff Greatest Childcare Qualifications	No. of Staff
Child Level Risks	Premature?	6.37	3.29	3.29	3.29	3.29	2.42	2.42	2.42	7.67	7.67	14.39	13.06	12.78	3.29
	Birthweight	7.63	4.52	4.52	4.52	4.52	3.68	3.68	3.68	8.89	8.89	15.47	14.21	13.93	4.52
	Birth Order	6.58	3.47	3.47	3.47	3.47	2.59	2.59	2.59	7.88	7.88	14.56	13.23	12.95	3.47
	"Any event affected development?"	6.55	3.47	3.47	3.47	3.47	2.59	2.59	2.59	7.84	7.84	14.53	13.20	12.92	3.47
	Dummy coded Ethnic Minority: Black?	5.01	1.05	1.05	1.05	1.05	0.11	0.11	0.11	5.53	5.53	12.46	11.06	10.78	1.02
	Other?	5.01	1.05	1.05	1.05	1.05	0.11	0.11	0.11	5.53	5.53	12.46	11.06	10.78	1.02
	Indian?	5.01	1.05	1.05	1.05	1.05	0.11	0.11	0.11	5.53	5.53	12.46	11.06	10.78	1.02
	Pakistani?	5.01	1.05	1.05	1.05	1.05	0.11	0.11	0.11	5.53	5.53	12.46	11.06	10.78	1.02
	Bangladeshi?	5.01	1.05	1.05	1.05	1.05	0.11	0.11	0.11	5.53	5.53	12.46	11.06	10.78	1.02
	Mixed?	5.01	1.05	1.05	1.05	1.05	0.11	0.11	0.11	5.53	5.53	12.46	11.06	10.78	1.02
Family Level Risks	2 Parent Family?	6.37	3.22	3.22	3.22	3.22	2.35	2.35	2.35	7.63	7.63	14.35	13.02	12.74	3.22
	Either Parent Working?	24.57	24.29	24.29	24.29	24.29	23.77	23.77	23.77	27.93	27.93	33.08	31.75	31.43	24.57
	Family Salary	24.57	24.29	24.29	24.29	24.29	23.77	23.77	23.77	27.93	27.93	33.08	31.75	31.43	24.57
	Home Learning Environment	7.70	4.66	4.66	4.66	4.66	3.82	3.82	3.82	9.10	9.10	15.65	14.28	13.97	4.69
	Highest Parental Social Class	6.65	3.54	3.54	3.54	3.54	2.66	2.66	2.66	7.95	7.95	14.53	13.20	12.92	3.54
	Greatest Mother Academic Qualification	8.65	5.57	5.57	5.57	5.57	4.69	4.69	4.69	9.80	9.80	16.21	14.91	14.70	5.57

	Greatest Father Academic Qualification	30.17	27.97	27.97	27.97	27.97	27.44	27.44	27.44	31.68	31.68	36.19	35.49	35.28	28.25
	Mother's Employment	6.69	3.57	3.57	3.57	3.57	2.70	2.70	2.70	7.98	7.98	14.63	13.30	13.02	3.57
	Father's Employment	26.39	24.15	24.15	24.15	24.15	23.59	23.59	23.59	28.00	28.00	32.90	31.96	31.78	24.36
	No. Non Parental Carers	6.23	3.08	3.08	3.08	3.08	2.21	2.21	2.21	7.49	7.49	14.21	12.88	12.60	3.08
	Mother's Social Class	7.91	4.76	4.76	4.76	4.76	3.96	3.96	3.96	9.24	9.24	15.72	14.32	14.04	4.83
	Father's Social Class	26.67	24.47	24.47	24.47	24.47	23.91	23.91	23.91	28.39	28.39	33.29	32.52	32.34	24.71
	Mother's Age at Child's Birth	6.72	3.61	3.61	3.61	3.61	2.73	2.73	2.73	8.02	8.02	14.63	13.30	13.02	3.61
	Father's Age at Child's Birth	25.17	22.93	22.93	22.93	22.93	22.37	22.37	22.37	27.02	27.02	31.99	31.29	31.15	23.17
	Duration of Attendance	4.97	5.85	5.85	5.85	5.85	4.97	4.97	4.97	10.08	10.08	16.66	15.26	14.95	5.85
	Positive relationship	5.85	0.95	0.95	0.95	0.95	0.95	0.95	0.95	6.37	6.37	13.30	10.96	10.68	1.86
	Punitiveness	5.85	0.95	0.95	0.95	0.95	0.95	0.95	0.95	6.37	6.37	13.30	10.96	10.68	1.86
	Permissiveness	5.85	0.95	0.95	0.95	0.95	0.95	0.95	0.95	6.37	6.37	13.30	10.96	10.68	1.86
	Detachment	5.85	0.95	0.95	0.95	0.95	0.95	0.95	0.95	6.37	6.37	13.30	10.96	10.68	1.86
	ECERS-R	4.97	0.95	0.95	0.95	0.95	0.00	0.00	0.00	5.43	5.43	12.36	10.96	10.68	0.91
	ECERS-E	4.97	0.95	0.95	0.95	0.95	0.00	0.00	0.00	5.43	5.43	12.36	10.96	10.68	0.91
Pre-school Measures	No. of Children	4.97	0.95	0.95	0.95	0.95	0.00	0.00	0.00	5.43	5.43	12.36	10.96	10.68	0.91
	Manager's Greatest Childcare Qualifications	10.08	6.37	6.37	6.37	6.37	5.43	5.43	5.43	5.43	5.43	13.83	11.90	11.62	5.43
	Manager's Greatest Academic Qualifications	10.08	6.37	6.37	6.37	6.37	5.43	5.43	5.43	5.43	5.43	13.83	11.90	11.62	5.43
	Mean Staff Age	16.66	13.30	13.30	13.30	13.30	12.36	12.36	12.36	13.83	13.83	12.36	15.96	15.68	12.36
	Mean Staff Greatest Academic Qualifications	15.26	10.96	10.96	10.96	10.96	10.96	10.96	10.96	11.90	11.90	15.96	10.96	11.90	10.96
	Mean Staff Greatest Childcare Qualifications	14.95	10.68	10.68	10.68	10.68	10.68	10.68	10.68	11.62	11.62	15.68	11.90	10.68	10.68
	No. of Staff	5.85	1.86	1.86	1.86	1.86	0.91	0.91	0.91	5.43	5.43	12.36	10.96	10.68	0.91
Measures of Cognitive Development	Baseline: General Cognitive Ability	7.77	4.20	4.20	4.20	4.20	3.26	3.26	3.26	8.54	8.54	15.23	14.14	13.90	4.17
	Reception: General cognitive ability composite	10.19	10.78	10.78	10.78	10.78	9.91	9.91	9.91	14.53	14.53	20.65	19.18	18.90	10.29
	Primary Year 1: reading	14.39	14.60	14.60	14.60	14.60	13.76	13.76	13.76	18.52	18.52	24.36	23.17	22.96	14.63
	Maths	14.70	14.91	14.91	14.91	14.91	14.07	14.07	14.07	18.83	18.83	24.64	23.49	23.28	14.95

Measures of Social/Behavioural Development	Primary Year 2: Reading	15.72	15.54	15.54	15.54	15.54	14.70	14.70	14.70	19.29	19.29	24.54	24.22	24.01	15.58
	Writing	17.85	17.61	17.61	17.61	17.61	16.91	16.91	16.91	21.46	21.46	26.32	26.11	25.90	17.78
	Maths	17.22	16.98	16.98	16.98	16.98	16.28	16.28	16.28	20.72	20.72	25.76	25.38	25.24	17.12
	Baseline: Co-Operation and Conformity	5.39	1.30	1.30	1.30	1.30	0.53	0.53	0.53	5.92	5.92	12.85	11.27	10.99	1.44
	Confidence	5.36	1.26	1.26	1.26	1.26	0.49	0.49	0.49	5.88	5.88	12.81	11.24	10.96	1.40
	Anti-social (reversed)	5.50	1.40	1.40	1.40	1.40	0.63	0.63	0.63	6.02	6.02	12.95	11.38	11.10	1.54
	Worried/Upset (reversed)	5.39	1.30	1.30	1.30	1.30	0.53	0.53	0.53	5.92	5.92	12.85	11.27	10.99	1.44
	Peer sociability	5.36	1.26	1.26	1.26	1.26	0.49	0.49	0.49	5.88	5.88	12.81	11.24	10.96	1.40
	Reception: Self Regulation	10.75	10.96	10.96	10.96	10.96	10.33	10.33	10.33	15.30	15.30	21.67	19.99	19.67	11.20
	Anti-social / Worried	10.54	10.75	10.75	10.75	10.75	10.12	10.12	10.12	15.09	15.09	21.49	19.78	19.46	10.99
	Year 1: Prosocial Behaviour	16.91	17.12	17 12	17.12	17 12	16.24	16.24	16.24	21.04	21.04	26.60	25.83	25.59	17 12
	Hyperactivity	16.91	17.12	17.12	17 12	17 12	16.24	16.24	16.24	21.04	21.04	26.60	25.76	25.59	17.12
	Emotional Symptoms	17.01	17.22	17.22	17.22	17.22	16.35	16.35	16.35	21.14	21.14	26.71	25.83	25.69	17.22
	Conduct Problems	17.43	17.64	17.64	17.64	17.64	16.77	16.77	16.77	21.56	21.56	27 13	25.87	26.11	17.64
	Peer Problems	16.84	17.05	17.05	17.05	17.05	16.17	16.17	16.17	20.97	20.97	26.53	25.73	25.52	17.05
	Year 2: Prosocial behaviour	17.54	17.82	17.82	17.82	17.82	16.98	16.98	16.98	21.46	21.46	27.09	25.90	26.04	17.75
	Hyperactivity	17.47	17.75	17.75	17.75	17.75	16.91	16.91	16.91	21.42	21.42	27.06	25.90	26.04	17.68
	Emotional Symptoms	17.50	17.78	17.78	17.78	17.78	16.94	16.94	16.94	21.42	21.42	27.06	25.90	26.04	17.71
	Conduct Problems	17.47	17.75	17.75	17.75	17.75	16.91	16.91	16.91	21.39	21.39	27.02	25.87	26.01	17.68
	Peer Problems	17.47	17.75	17.75	17.75	17.75	16.91	16.91	16.91	21.39	21.39	27.06	25.87	26.01	17.68

Table 7.8 Bivariate Pattern of Missing Data shared between Measures of Young Children's Cognitive Development and all other Variables used in this investigation

		Measures of Cognitive Development						
		Baseline: General Cognitive Ability	Reception: General Cognitive Ability	Primary Year 1: reading	Maths	Primary Year 2: Reading	Writing	Maths
Child Level Risks	Premature?	5.46	11.31	14.98	15.26	16.00	18.10	17.57
	Birthweight	6.58	12.53	16.07	16.35	16.98	19.04	18.55
	Birth Order	5.71	11.48	15.12	15.40	16.24	18.34	17.82
	"Any event affected development?"	5.67	11.48	15.12	15.40	16.17	18.27	17.75
	Dummy coded Ethnic Minority: Black?	3.33	9.98	13.83	14.14	14.77	16.98	16.35
	Other?	3.33	9.98	13.83	14.14	14.77	16.98	16.35
	Indian?	3.33	9.98	13.83	14.14	14.77	16.98	16.35
	Pakistani?	3.33	9.98	13.83	14.14	14.77	16.98	16.35
	Bangladeshi?	3.33	9.98	13.83	14.14	14.77	16.98	16.35
	Mixed?	3.33	9.98	13.83	14.14	14.77	16.98	16.35
Family Level Risks	2 Parent Family?	5.43	11.31	14.91	15.19	16.03	18.13	17.61
	Either Parent Working?	26.04	28.98	30.10	30.38	31.15	32.97	32.27
	Family Salary	26.04	28.98	30.10	30.38	31.15	32.97	32.27
	Home Learning Environment	6.76	12.64	16.28	16.56	17.29	19.32	18.90
	Highest Parental Social Class	5.74	11.59	15.19	15.47	16.31	18.41	17.89
	Greatest Mother Academic Qualification	7.70	13.44	16.91	17.19	18.13	20.20	19.67
	Greatest Father Academic Qualification	29.79	34.06	36.23	36.40	36.93	38.54	38.08
	Mother's Employment	5.78	11.59	15.19	15.47	16.31	18.38	17.85
	Father's Employment	26.08	30.45	32.66	32.83	33.67	35.25	34.83
	No. Non Parental Carers	5.32	11.17	14.81	15.09	15.89	17.99	17.47
	Mother's Social Class	6.86	12.71	16.35	16.63	17.50	19.57	19.01

Pre-school Measures	Father's Social Class	26.25	30.84	32.87	33.04	33.81	35.42	35.00
	Mother's Age at Child's Birth	5.78	11.62	15.23	15.51	16.35	18.41	17.89
	Father's Age at Child's Birth	24.75	29.40	31.61	31.82	32.62	34.23	33.81
	Duration of Attendance	7.77	10.19	14.39	14.70	15.72	17.85	17.22
	Positive relationship	4.20	10.78	14.60	14.91	15.54	17.61	16.98
	Punitiveness	4.20	10.78	14.60	14.91	15.54	17.61	16.98
	Permissiveness	4.20	10.78	14.60	14.91	15.54	17.61	16.98
	Detachment	4.20	10.78	14.60	14.91	15.54	17.61	16.98
	ECERS-R	3.26	9.91	13.76	14.07	14.70	16.91	16.28
	ECERS-E	3.26	9.91	13.76	14.07	14.70	16.91	16.28
	No. of Children	3.26	9.91	13.76	14.07	14.70	16.91	16.28
	Manager's Greatest Childcare Qualifications	8.54	14.53	18.52	18.83	19.29	21.46	20.72
	Manager's Greatest Academic Qualifications	8.54	14.53	18.52	18.83	19.29	21.46	20.72
	Mean Staff Age	15.23	20.65	24.36	24.64	24.54	26.32	25.76
	Mean Staff Greatest Academic Qualifications	14.14	19.18	23.17	23.49	24.22	26.11	25.38
	Mean Staff Greatest Childcare Qualifications	13.90	18.90	22.96	23.28	24.01	25.90	25.24
	No. of Staff	4.17	10.29	14.63	14.95	15.58	17.78	17.12
Measures of Cognitive Development	Baseline: General Cognitive Ability	3.26	12.43	16.42	16.73	17.26	19.29	18.73
	Reception: General cognitive ability composite	12.43	9.91	19.22	19.53	20.44	22.58	21.95
	Primary Year 1: reading	16.42	19.22	13.76	14.21	21.14	23.17	22.44
	Maths	16.73	19.53	14.21	14.07	21.35	23.24	22.72
	Primary Year 2: Reading	17.26	20.44	21.14	21.35	14.70	16.94	16.56
	Writing	19.29	22.58	23.17	23.24	16.94	16.91	18.62
	Maths	18.73	21.95	22.44	22.72	16.56	18.62	16.28
Measures of Social/Behavioural Development	Baseline: Co-Operation and Conformity	3.71	10.36	14.21	14.53	15.16	17.29	16.70
	Confidence	3.68	10.33	14.18	14.49	15.12	17.26	16.66
	Anti-social (reversed)	3.82	10.47	14.32	14.63	15.26	17.40	16.80
	Worried/Upset (reversed)	3.71	10.36	14.21	14.53	15.16	17.29	16.70
	Peer sociability	3.68	10.33	14.18	14.49	15.12	17.26	16.66
	Reception: Self Regulation	13.16	15.54	18.69	18.97	19.99	21.84	21.46
	Anti-social / Worried	12.95	15.37	18.48	18.76	19.81	21.67	21.28
	Year 1: Prosocial Behaviour	18.48	21.49	17.08	17.36	23.07	25.10	24.33

Hyperactivity	18.48	21.53	17.08	17.36	23.07	25.13	24.33
Emotional Symptoms	18.55	21.63	17.19	17.47	23.17	25.27	24.43
Conduct Problems	18.97	22.02	17.57	17.85	23.52	25.62	24.78
Peer Problems	18.41	21.46	17.01	17.29	23.00	25.10	24.26
Year 2: Prosocial behaviour	19.36	21.95	22.58	22.89	20.16	22.26	21.53
Hyperactivity	19.29	21.88	22.51	22.82	20.09	22.19	21.46
Emotional Symptoms	19.32	21.91	22.54	22.86	20.13	22.23	21.46
Conduct Problems	19.29	21.88	22.51	22.82	20.09	22.19	21.42
Peer Problems	19.29	21.88	22.51	22.82	20.09	22.19	21.46

8: Complete documentation of results testing whether the qualities of pre-school can protect measures of development at exit from pre-school
Appendices

Positive Relationships

Table 7.9 Child-level risk-moderating effects of staff-child Positive Relationships upon children's developmental abilities at exit from pre-school

Predictor variables *(Unstandardised coefficients, β)*	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
	Models testing only **Child** level developmental risk				
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.65***	0.65***	0.64***	0.65***	0.65***
ild level risk	-0.05***	-0.06***	-0.06***	-0.05***	-0.05***
itive Relationships	0.03	0.04	0.03	0.02	0.03
ration	0.10***	0.10***	0.09***	0.10***	0.10***
sted interaction term	-	**0.04***	-0.01	0.02	0.00
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
seline: Co-operation					
d conformity	0.30***	0.30***	0.31***	0.30***	0.30***
er sociability	0.01	0.01	0.01	0.01	0.01
nfidence	0.01	0.00	0.01	0.00	0.01
ti-social behaviour	-0.04	-0.04	-0.04	-0.04	-0.04
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
ild level risk	-0.09***	-0.10***	-0.09***	-0.09***	-0.09***
itive Relationships	0.07*	0.08**	0.07*	0.07*	0.07*
ration	0.05	0.05	0.03	0.05	0.05
sted interaction term	-	-0.01	-0.01	-0.01	**0.04****
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline: Co-operation					
d conformity	-0.31***	-0.31***	-0.32***	-0.31***	-0.31***
er sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.15***	0.15***	0.15***	0.16***	0.15***
ti-social behaviour	0.12***	0.12***	0.13***	0.12***	0.12***
rried/upset behaviour	0.03	0.03	0.03	0.03	0.03
ild level risk	-0.01	-0.01	0.00	-0.01	-0.01
itive Relationships	-0.02	-0.02	-0.02	-0.02	-0.02
ration	0.02	0.02	0.03	0.02	0.02
sted interaction term	-	0.00	**0.04***	0.07**	**-0.06*****

$*p < .05$; $**p < .01$; $***p < .001$

Table 7.10 Family-level risk-moderating effects of staff-child Positive Relationships upon children's developmental abilities at exit from pre-school

	Models testing only **Familial** level developmental risk				
	model testing: direct effects	Separate Models testing: (risk x quality)	(risk x duration)	(quality x duration)	model testing: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.57***	0.57***	0.57***	.0.57***	0.57***
mily level risk	-0.11***	-0.11***	-0.10***	-0.10***	-0.11***
sitive Relationships	0.01	-0.01	0.01	0.01	0.01
ration	0.08***	0.07***	0.07***	0.08***	0.08***
sted interaction term	-	0.01	-0.01	0.02	0.01
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
seline: Co-operation					
d conformity	0.29***	0.29***	0.30***	0.29***	0.29***
er sociability	0.03	0.03	0.03	0.03	0.03
nfidence	-0.03	-0.03	-0.02	-0.03	-0.03
ti-social behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
rried/upset behaviour	-0.03	-0.04	-0.03	-0.04	-0.04
mily level risk	-0.14***	-0.14***	-0.15***	-0.14***	-0.14***
sitive Relationships	0.06*	0.06*	0.06*	0.06*	0.06*
ration	0.03	0.03	0.03	0.03	0.03
sted interaction term	-	0.00	0.03	-0.02	0.00
cial Models 2 *(with anti-social worried behaviour at pre-school exit as the dependent variable)*					
seline: Co-operation					
d conformity	-0.30***	-0.30***	-0.30***	-0.30***	-0.30***
er sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.16***	0.16***	0.16***	0.16***	0.16***
ti-social behaviour	0.12***	0.12***	0.13***	0.12***	0.12***
rried/upset behaviour	0.04	0.04	0.04	0.04	0.04
mily level risk	0.04*	0.05*	0.04*	0.04*	0.04*
sitive Relationships	-0.02	-0.01	-0.02	-0.02	-0.02
ration	0.03	0.03	0.03	0.03	0.03
sted interaction term	-	0.00	-0.01	0.06**	-0.03

$*p < .05$; $**p < .01$; $***p < .001$

Punitiveness

Table 7.11 Child-level risk-moderating effects of staff-child Punitive Relationships upon children's developmental abilities at exit from pre-school

	Models testing only **Child** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.65***	0.65***	0.64***	0.65***	0.65***
ild level risk	-0.06***	-0.06***	-0.06***	-0.05***	-0.06***
nitiveness	-0.04	-0.04	-0.04	-0.04	-0.04
ration	0.10***	0.10***	0.09***	0.10***	0.10***
sted interaction term	-	-0.01	-0.01	-0.03	-0.01
cial **Models 1** *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	0.30***	0.30***	0.31***	0.30***	0.30***
er sociability	0.01	0.01	0.01	0.01	0.01
nfidence	0.00	0.00	0.01	0.00	0.00
ti-social behaviour	-0.04	-0.04	-0.04	-0.04	-0.04
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
ild level risk	-0.09***	-0.10***	-0.09***	-0.09***	-0.09***
nitiveness	-0.06	-0.06	-0.06	-0.07*	-0.07*
ration	0.04	0.04	0.03	0.04	0.04
sted interaction term	-	0.01	-0.01	0.03	**-0.04*****
cial **Models 2** *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	-0.31***	-0.31***	-0.32***	-0.31***	-0.31***
er sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.15***	0.15***	0.15***	0.16***	0.16***
ti-social behaviour	0.12***	0.12***	0.13***	0.12***	0.12***
rried/upset behaviour	0.03	0.03	0.03	0.03	0.03
ild level risk	-0.01	-0.01	0.00	-0.01	-0.01
nitiveness	0.03	0.03	0.04	0.04	0.03
ration	0.02	0.02	0.03	0.02	0.02
sted interaction term	-	0.02	**0.04***	-0.05*	0.03

*$p < .05$; **$p < .01$; ***$p < .001$

Table 7.12 Family-level risk-moderating effects of staff-child Punitive Relationships upon children's developmental abilities at exit from pre-school

	Models testing only **Familial** level developmental risk				
	Model testing only direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with **GCA at** pre-school exit as the dependent variable)*					
seline: GCA	0.57***	0.57***	0.57***	0.57***	0.57***
mily level risk	-0.10***	-0.11***	-0.10***	-0.10***	-0.10***
nitiveness	-0.02	0.00	-0.02	-0.02	-0.03
ration	0.08***	0.07***	0.07***	0.08***	0.08***
sted interaction term	-	-0.01	-0.01	-0.03	-0.01
cial Models 1 *(with **self-regulation at** pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	0.30***	0.30***	0.30***	0.30***	0.30***
er sociability	0.03	0.03	0.03	0.03	0.03
nfidence	-0.03	-0.03	-0.02	-0.03	-0.03
ti-social behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
mily level risk	-0.14***	-0.14***	-0.15***	-0.14***	-0.14***
nitiveness	-0.05	-0.04	-0.05	-0.05	-0.05
ration	0.02	0.02	0.03	0.02	0.02
sted interaction term	-	0.00	0.03	0.02	-0.02
cial Models 2 *(with **anti-social/worried behaviour at** pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	-0.30***	-0.30***	-0.30***	-0.30***	-0.30***
er sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.16***	0.16***	0.16***	0.16***	0.16***
ti-social behaviour	0.12***	0.12***	0.13***	0.12***	0.12***
rried/upset behaviour	0.04	0.04	0.04	0.04	0.04
mily level risk	0.04*	0.05*	0.04*	0.04*	0.05*
nitiveness	0.02	0.02	0.02	0.03	0.02
ration	0.03	0.03	0.03	0.03	0.03
sted interaction term	-	0.01	-0.01	-0.04*	0.00

$*p < .05$; $**p < .01$; $***p < .001$

Permissiveness

Table 7.13 Child-level risk-moderating effects of staff-child Permissive Relationships upon children's developmental abilities at exit from pre-school

	Models testing only **Child** level developmental risk				
	Model testing only direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
eline: GCA	0.64***	0.65***	0.64***	0.65***	0.64***
ild level risk	-0.06***	-0.06***	-0.06***	-0.05***	-0.05***
missiveness	-0.05*	-0.05*	-0.05*	-0.05*	-0.05*
ration	0.10***	0.10***	0.09***	0.10***	0.10***
ted interaction term	-	0.00	-0.01	-0.04	-0.04
ial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
eline:					
operation and nformity	0.30***	0.30***	0.31***	0.30***	0.30***
er sociability	0.00	0.00	0.01	0.00	0.00
nfidence	0.01	0.02	0.01	0.02	0.02
ti-social behaviour	-0.04	-0.04	-0.04	-0.04	-0.04
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
ild level risk	-0.09***	-0.10***	-0.09***	-0.09***	-0.09***
missiveness	-0.07**	-0.07**	-0.07**	-0.07**	-0.08**
ration	0.04	0.04	0.03	0.04	0.04
sted interaction term	-	0.01	-0.01	0.00	-0.02
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
operation and nformity	-0.32***	-0.32***	-0.32***	-0.32***	-0.32***
er sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.15***	0.15***	0.15***	0.15***	0.15***
ti-social behaviour	0.12***	0.12***	0.13***	0.12***	0.12***
rried/upset behaviour	0.03	0.03	0.03	0.03	0.03
ild level risk	-0.01	-0.01	0.00	-0.01	-0.01
missiveness	-0.01	-0.02	-0.01	-0.01	-0.01
ration	0.02	0.02	0.03	0.02	0.02
sted interaction term	-	-0.03	**0.04***	-0.02	0.04

*$p < .05$; **$p < .01$; ***$p < .001$

Table 7.14 Family-level risk-moderating effects of staff-child Permissive Relationships upon children's developmental abilities at exit from pre-school

	Models testing only **Familial** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.57***	0.57***	0.57***	0.57***	0.57***
mily level risk	-0.10***	-0.10***	-0.10***	-0.10***	-0.10***
rmissiveness	-0.04	-0.04	-0.04	-0.04	-0.04
ration	0.08***	0.08***	0.07***	0.09***	0.08***
sted interaction term	-	-0.00	-0.01	-0.04*	-0.02
cial **Models 1** *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	0.30***	0.30***	0.30***	0.30***	0.30***
er *sociability*	0.02	0.02	0.03	0.02	0.02
nfidence	-0.02	-0.02	-0.02	-0.02	-0.02
ti-*social behaviour*	-0.03	-0.03	-0.03	-0.03	-0.03
rried/*upset behaviour*	-0.03	-0.03	-0.03	-0.03	-0.03
mily level risk	-0.14***	-0.14***	-0.15***	-0.14***	-0.14***
rmissiveness	-0.06**	-0.06**	-0.06**	-0.06**	-0.06**
ration	0.03	0.03	0.03	0.02	0.03
sted interaction term	-	0.00	0.03	0.01	0.00
cial **Models 2** *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	-0.30***	-0.30***	-0.30***	-0.30***	0.30***
er *sociability*	0.02	0.02	0.02	0.02	0.02
nfidence	0.16***	0.16***	0.16***	0.16***	0.16***
ti-*social behaviour*	0.12***	0.12***	0.13***	0.12***	0.12***
rried/*upset behaviour*	0.04	0.04	0.04	0.04	0.04
mily level risk	0.05*	0.05*	0.04*	0.05*	0.05*
rmissiveness	-0.01	-0.01	-0.01	-0.01	-0.01
ration	0.03	0.03	0.03	0.03	0.03
sted interaction term	-	0.00	-0.01	-0.02	-0.01

*$*p < .05$; **$p < .01$; ***$p < .001$*

Detachment

Table 7.15 Child-level risk-moderating effects of staff-child Detached Relationships upon children`s developmental abilities at exit from pre-school

	Models testing only **Child** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.65***	0.65***	0.64***	0.65***	0.65***
ild level risk	-0.06***	-0.06***	-0.06***	-0.05***	-0.06***
achment	-0.05*	-0.06**	-0.05*	-0.05*	-0.05*
ration	0.10***	0.10***	0.09***	0.10***	0.10***
sted interaction term	-	**-0.03***	-0.01	-0.01	-0.02
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	0.30***	0.30***	0.31***	0.30***	0.30***
er sociability	0.01	0.01	0.01	0.01	0.01
nfidence	0.01	0.01	0.01	0.00	0.01
ti-social behaviour	-0.04	-0.04	-0.04	-0.04	-0.05
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
ild level risk	-0.09***	-0.10***	-0.09***	-0.09***	-0.09***
tachment	-0.07**	-0.07**	-0.07*	-0.07*	-0.07**
ration	0.04	0.04	0.03	0.04	0.04
sted interaction term	-	-0.01	-0.01	0.03	**-0.04****
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	-0.31***	-0.31***	-0.32***	-0.32***	-0.31***
er sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.15***	0.15***	0.15***	0.16***	0.15***
ti-social behaviour	0.12***	0.12***	0.13***	0.12***	0.12***
rried/upset behaviour	0.03	0.03	0.03	0.03	0.03
ild level risk	-0.01	-0.01	0.00	-0.01	-0.01
tachment	0.02	0.01	0.02	0.03	0.02
ration	0.02	0.02	0.03	0.02	0.02
sted interaction term	-	-0.01	**0.04***	-0.07**	**0.06****

$*p < .05$; $**p < .01$; $***p < .001$

Table 7.16 Family-level risk-moderating effects of staff-child Detached Relationships upon children`s developmental abilities at exit from pre-school

	Models testing only **Familial** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.57***	0.57***	0.57***	0.57***	0.57***
mily level risk	-0.10***	-0.10***	-0.10***	-0.10***	-0.10***
tachment	-0.04	-0.04	-0.04	-0.03	-0.04
ration	0.08***	0.08***	0.07***	0.09***	0.08***
sted interaction term	-	-0.01	-0.01	-0.02	-0.01
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
-operation and formity	0.30***	0.30***	0.30***	0.30***	0.30***
r sociability	0.03	0.03	0.03	0.03	0.03
nfidence	-0.02	-0.02	-0.02	-0.03	-0.02
ti-social behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
mily level risk	-0.14***	-0.13**	-0.15***	-0.14***	-0.14***
tachment	-0.06*	-0.05*	-0.06*	-0.06*	-0.05
ration	0.03	0.03	0.03	0.03	0.03
sted interaction term	-	-0.01	0.03	0.03	-0.01
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	-0.30***	-0.30***	-0.30***	0.30***	-0.30***
r sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.16***	0.16***	0.16***	0.16***	0.16***
ti-social behaviour	0.12***	0.12***	0.13***	0.12***	0.12***
rried/upset behaviour	0.04	0.04	0.04	0.04	0.04
mily level risk	0.04*	0.05*	0.04*	0.04*	0.04*
tachment	0.01	0.01	0.02	0.03	0.02
ration	0.03	0.03	0.03	0.03	0.03
sted interaction term	-	0.00	-0.01	-0.06**	0.02

$*p < .05$; $**p < .01$; $***p < .001$

Global Quality

Table 7.17 Child-level risk-moderating effects of Global Quality upon children's developmental abilities at exit from pre-school

	Models testing only **Child** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
ognitive Models *(with GCA at pre-school exit as the dependent variable)*					
aseline: GCA	0.64***	0.64***	0.64***	0.64***	0.64***
ild level risk	-0.06***	-0.06***	-0.06***	-0.05***	-0.06***
obal quality	-0.01	0.00	0.00	-0.01	-0.01
ration	0.09***	0.09***	0.09***	0.09***	0.09***
sted interaction term	-	0.02	-0.01	0.02	-0.02
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
aseline:					
-operation and formity	0.30***	0.30***	0.31***	0.30***	0.30***
r sociability	0.01	0.01	0.01	0.01	0.01
nfidence	0.01	0.01	0.01	0.01	0.01
ti-social behaviour	-0.04	-0.04	-0.04	-0.05	-0.04
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
ild level risk	-0.09***	-0.09***	-0.09***	-0.09***	-0.09***
obal quality	0.03	0.03	0.03	0.03	0.03
ration	0.04	0.03	0.03	0.03	0.04
sted interaction term	-	0.00	-0.01	0.02	0.02
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
aseline:					
-operation and nformity	-0.32***	-0.31***	-0.32***	-0.32***	-0.32***
r sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.15***	0.15***	0.15***	0.16***	0.15***
ti-social behaviour	0.13***	0.13***	0.13***	0.12***	0.13***
rried/upset behaviour	0.03	0.03	0.03	0.03	0.03
ild level risk	-0.01	-0.01	0.00	-0.01	-0.01
obal quality	-0.04	-0.05	-0.04	-0.04	-0.04
ration	0.01	0.01	0.03	0.00	0.01
sted interaction term	-	-0.02	**0.04***	0.07**	-0.02

*$p < .05$; **$p < .01$; ***$p < .001$

Table 7.18 Family-level risk-moderating effects of Global Quality upon children's developmental abilities at exit from pre-school

	Models testing only **Familial** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.57***	0.57***	0.57***	0.57***	0.57***
mily level risk	-0.10***	-0.10***	-0.10***	-0.10***	-0.10***
obal quality	-0.01	-0.01	-0.01	-0.01	-0.01
ration	0.07***	0.07***	0.07***	0.08***	0.08***
sted interaction term	-	**0.03****	-0.01	0.02	0.00
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	0.30***	0.30***	0.30***	0.30**	0.30***
r sociability	0.03	0.03	0.03	0.03	0.03
nfidence	-0.02	-0.02	-0.02	-0.02	-0.02
ti-social behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
mily level risk	-0.14***	-0.14***	-0.15***	-0.14***	-0.14***
obal quality	0.02	0.02	0.02	0.02	0.02
ration	0.03	0.02	0.03	0.02	0.03
sted interaction term	-	-0.03	0.03	0.02	0.03
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
o-operation and nformity	-0.30***	-0.30***	-0.30***	-0.30***	-0.30***
r sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.16***	0.16***	0.16***	0.16***	0.16***
ti-social behaviour	0.13***	0.13***	0.13***	0.12***	0.13***
rried/upset behaviour	0.04	0.04	0.04	0.04	0.04
mily level risk	0.04*	0.05*	0.04*	0.04*	0.04*
obal quality	-0.04	-0.04	-0.04	-0.04	-0.05
ration	0.02	0.02	0.02	0.01	0.01
sted interaction term	-	0.03	-0.01	0.06**	-0.02

*$*p < .05$; **$p < .01$; ***$p < .001$*

Educational Quality

Table 7.19 Child-level risk-moderating effects of Educational Quality upon children's developmental abilities at exit from pre-school

	Models testing only **Child** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.64***	0.64***	0.64***	0.64***	0.64***
ild level risk	-0.06***	-0.06***	-0.06***	-0.05***	-0.06***
ucational quality	0.03	0.04	0.04	0.03	0.03
ration	0.10***	0.10***	0.09***	0.10***	0.10***
ted interaction term	-	**0.02***	-0.01	0.01	-0.01
cial **Models 1** *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
operation and					
formity	0.30***	0.30***	0.31***	0.30***	0.30***
r sociability	0.01	0.01	0.01	0.01	0.01
nfidence	0.01	0.01	0.01	0.01	0.01
ti-social behaviour	-0.04	-0.04	-0.04	-0.04	-0.04
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
ild level risk	-0.09***	-0.10***	-0.09***	-0.09***	-0.09***
ucational quality	0.06*	0.06*	0.06*	0.06*	0.06*
ration	0.05	0.05	0.03	0.05	0.05
sted interaction term	-	0.02	-0.01	0.01	0.02
cial **Models 2** *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
operation and					
nformity	-0.32***	-0.32***	-0.32***	-0.32***	-0.32***
r sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.15***	0.15***	0.15***	0.16***	0.15***
ti-social behaviour	0.12***	0.12***	0.13***	0.12***	0.13***
rried/upset behaviour	0.03	0.03	0.03	0.03	0.03
ild level risk	-0.01	-0.01	0.00	-0.01	-0.02
ucational quality	-0.01	-0.01	-0.01	-0.01	-0.01
ration	0.02	0.02	0.03	0.02	0.02
sted interaction term	-	-0.01	**0.04***	0.06*	**-0.05***

$*p < .05$; $**p < .01$; $***p < .001$

Table 7.20 Family-level risk-moderating effects of Educational Quality upon children's developmental abilities at exit from pre-school

	Models testing only **Familial** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
eline: GCA	0.57***	0.57***	0.57***	0.57***	0.57***
ily level risk	-0.10***	-0.10***	-0.10***	-0.10***	-0.10***
cational quality	0.02	0.02	0.02	0.02	0.02
ration	0.08***	0.08***	0.07***	0.09***	0.09***
ted interaction term	-	**0.02****	-0.01	0.01	0.00
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
eline:					
operation and formity	0.30***	0.30***	0.30***	0.30***	0.30***
r sociability	0.03	0.03	0.03	0.03	0.03
fidence	-0.03	-0.03	-0.02	-0.03	-0.03
ti-social behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
ried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
ily level risk	-0.14***	-0.14***	-0.15***	-0.14***	-0.14***
ucational quality	0.04	0.04	0.04	0.04	0.04
ration	0.03	0.03	0.03	0.03	0.03
ted interaction term	-	-0.02	0.03	0.00	-0.01
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
operation and formity	-0.30***	-0.30***	-0.30***	-0.30***	-0.30***
r sociability	0.02	0.02	0.02	0.02	0.02
fidence	0.16***	0.16***	0.16***	0.16***	0.16***
ti-social behaviour	0.13***	0.13***	0.13***	0.12***	0.12***
ried/upset behaviour	0.04	0.04	0.04	0.04	0.04
ily level risk	0.04*	0.05*	0.04*	0.05*	0.04*
ucational quality	-0.01	-0.01	-0.01	-0.01	-0.01
ration	0.02	0.02	0.02	0.03	0.02
ted interaction term	-	0.01	-0.01	0.06*	-0.03

*$p < .05$; **$p < .01$; ***$p < .001$

Manager's Greatest Childcare Qualification

Table 7.21 Child-level risk-moderating effects of pre-school manager's greatest childcare qualification upon children's developmental abilities at exit from pre-school

	Models testing only **Child** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.65***	0.65***	0.64***	0.65***	0.65***
ild level risk	-0.06***	-0.06***	-0.06***	-0.06***	-0.05***
nager's Greatest ildcare (CC) alification	-0.01	-0.01	-0.01	-0.01	-0.02
ration	0.10***	0.10***	0.09***	0.10***	0.10***
ted interaction term		0.02	-0.01	0.05*	**0.03****
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	0.31***	0.31***	0.31***	0.31***	0.31***
er sociability	0.01	0.01	0.01	0.01	0.01
nfidence	0.01	0.01	0.01	0.01	0.01
ti-social behaviour	-0.04	-0.04	-0.04	-0.04	-0.04
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
ild level risk	-0.09***	-0.10***	-0.09***	-0.09***	-0.10***
nager's Greatest CC alification	0.07*	0.07*	0.07*	0.07*	0.07*
ration	0.08**	0.08**	0.03	0.08**	0.07**
ted interaction term	-	0.00	-0.01	0.03	0.01
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	-0.32***	-0.32***	-0.32***	-0.32***	-0.32***
er sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.15***	0.15***	0.15***	0.15***	0.15***
ti-social behaviour	0.13***	0.13***	0.13***	0.13***	0.13***
rried/upset behaviour	0.03	0.03	0.03	0.03	0.03
ild level risk	-0.02	-0.02	0.00	0.02	-0.02
nager's Greatest CC alification	-0.02	-0.01	-0.02	-0.02	-0.02
ration	0.01	0.00	0.03	0.01	0.00
ted interaction term		0.01	**0.04***	0.02	0.00

*$*p < .05$; **$p < .01$; ***$p < .001$*

Table 7.22 Family-level risk-moderating effects of pre-school manager's greatest childcare qualification upon children's developmental abilities at exit from pre-school

	Models testing only **Familial** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
geline: GCA	0.58***	0.58***	0.57***	0.58***	0.57***
nily level risk	-0.10***	-0.10***	-0.10***	-0.10***	-0.10***
nager's Greatest ldcare (CC)					
lification	-0.04	-0.04	-0.04	-0.03	-0.03
ration	0.08***	0.07***	0.07***	0.08***	0.07***
ted interaction term	-	0.01	-0.01	0.05*	0.01
ial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
eline:					
operation and formity	0.30***	0.31***	0.30***	0.31***	0.31***
r sociability	0.03	0.03	0.03	0.03	0.03
fidence	-0.02	-0.02	-0.02	-0.02	-0.02
ti-social behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
ried/upset behaviour	-0.03	-0.04	-0.03	-0.04	-0.04
nily level risk	-0.14***	-0.14***	-0.15***	-0.14***	-0.14***
nager's Greatest CC alification	0.05	0.05	0.05	0.05	0.05
ration	0.05*	0.05*	0.03	0.05*	0.05
ted interaction term	-	**-0.04***	0.03	0.03	-0.01
cial Models 2 *(with anti-social worried behaviour at pre-school exit as the dependent variable)*					
seline:					
operation and nformity	-0.30***	-0.30***	-0.30***	-0.30**	-0.30***
er sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.16***	0.16***	0.16***	0.16***	0.16***
ti-social behaviour	0.13***	0.13***	0.13***	0.13***	0.13***
ried/upset behaviour	0.03	0.03	0.04	0.03	0.03
nily level risk	0.04*	0.04*	0.04*	0.04*	0.04
nager's Greatest CC alification	-0.01	-0.01	-0.01	-0.01	-0.01
ration	0.02	0.01	0.01	0.02	0.02
ted interaction term	-	0.02	-0.01	0.01	-0.01

$*p < .05$; $**p < .01$; $***p < .001$

Manager's Greatest Academic Qualification

Table 7.23 Child-level risk-moderating effects of pre-school manager's greatest academic qualification upon children's developmental abilities at exit from pre-school

	Models testing only **Child** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.65***	0.65***	0.64***	0.65***	0.65***
ild level risk	-0.06***	-0.06***	-0.06***	-0.05***	-0.05**
nager's Greatest demic (AC) lification	-0.02	-0.02	-0.02	-0.02	-0.02
ration	0.09***	0.09***	0.09***	0.09***	0.09***
ted interaction term	-	0.01	-0.01	0.04	**0.03***
ial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
-operation and formity	0.31***	0.31***	0.31***	0.31***	0.31***
r sociability	0.01	0.01	0.01	0.01	0.01
nfidence	0.01	0.01	0.01	0.01	0.01
ti-social behaviour	-0.04	-0.04	-0.04	-0.04	-0.04
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
ild level risk	-0.09***	-0.10***	-0.09***	-0.09***	-0.09***
nager's Greatest AC lification	0.08	0.08*	0.08*	0.08*	0.08*
ration	0.07*	0.07*	0.03	0.07*	0.07*
sted interaction term	-	0.01	-0.01	-0.02	0.02
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
-operation and formity	-0.32***	-0.32***	-0.32***	-0.32***	-0.32***
r sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.15***	0.15***	0.15***	0.15***	0.15***
ti-social behaviour	0.13***	0.13***	0.13***	0.13***	0.13***
rried/upset behaviour	0.03	0.03	0.03	0.03	0.03
ild level risk	-0.01	-0.01	0.00	-0.02	0.02
nager's Greatest AC lification	0.00	0.00	0.00	0.00	0.00
ration	0.01	0.01	0.03	0.02	0.01
sted interaction term	-	-0.01	**0.04***	0.05	-0.02

*$p < .05$; **$p < .01$, ***$p < .001$

Table 7.24 Family-level risk-moderating effects of pre-school manager's greatest academic qualification upon children's developmental abilities at exit from pre-school

	Models testing only **Familial** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.57***	0.57***	0.57***	0.58***	0.57***
mily level risk	-0.10***	-0.10***	-0.10***	-0.10***	-0.11***
nager's Greatest demic (AC) alification	-0.05*	-0.04*	-0.05*	-0.05*	-0.07***
ration	0.07***	0.06**	0.07***	0.07**	0.06**
ted interaction term	-	0.00	-0.01	0.04	0.00
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	0.31***	0.31***	0.30***	0.31***	0.31***
r sociability	0.03	0.03	0.03	0.03	0.03
nfidence	-0.02	-0.02	-0.02	-0.02	-0.02
ti-social behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
rried/upset behaviour	-0.04	-0.04	-0.03	-0.04	-0.04
mily level risk	-0.14***	-0.14***	-0.15***	-0.14***	-0.14***
nager's Greatest AC alification	0.05	0.05	0.05	0.05	0.05
ration	0.04	0.05	0.03	0.04	0.04
sted interaction term		-0.03	0.03	-0.02	0.00
cial Models 2 *(with anti-social worried behaviour at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	-0.30***	-0.30***	-0.30***	-0.30***	-0.30***
r sociability	0.02	0.02	0.02	0.03	0.02
nfidence	0.16***	0.16***	0.16***	0.16***	0.16***
ti-social behaviour	0.13***	0.13***	0.13***	0.13***	0.13***
rried/upset behaviour	0.03	0.03	0.04	0.03	0.04
mily level risk	0.04*	0.04*	0.04*	0.04*	0.03
nager's Greatest AC alification	0.00	0.00	0.00	0.00	0.00
ration	0.02	0.02	0.02	0.03	0.02
sted interaction term	-	0.01	-0.01	0.05	-0.02

*$p < .05$; **$p < .01$; ***$p < .001$

Mean Staff Age

Table 7.25 Child-level risk-moderating effects of the mean age of pre-school staff upon children's developmental abilities at exit from pre-school

	Models testing only **Child** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.64***	0.64***	0.64***	0.64***	0.64***
ild level risk	-0.06***	-0.06***	-0.06***	-0.05***	-0.06***
an Staff Age	0.00	0.00	0.00	0.00	0.00
ration	0.10***	0.10***	0.09***	0.10***	0.10***
ted interaction term	-	**0.02****	-0.01	-0.01	**-0.03***
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
-operation and formity	0.34***	0.34***	0.34***	0.34***	0.34***
r sociability	0.02	0.02	0.02	0.02	0.02
nfidence	-0.01	-0.01	0.01	-0.01	-0.01
ti-social behaviour	-0.01	-0.03	-0.03	-0.03	-0.03
rried upset behaviour	-0.02	-0.02	-0.02	-0.02	-0.02
ild level risk	-0.09	-0.09***	-0.09***	-0.08***	-0.09***
ean Staff Age	0.04*	0.04*	0.04*	0.04*	0.04*
ration	0.05*	0.05	0.03	0.05	0.05*
sted interaction term	-	0.00	-0.01	-0.02	0.00
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	-0.32***	-0.32***	-0.32***	-0.34***	-0.34***
r sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.16***	0.16***	0.15***	0.16***	0.16***
ti-social behaviour	0.13***	0.13***	0.13***	0.12***	0.13***
rried/upset behaviour	0.02	0.02	0.03	0.02	0.02
ild level risk	-0.01	-0.01	0.00	-0.01	-0.02
ean Staff Age	-0.04	-0.04	-0.03	-0.03	-0.04
ration	0.01	-0.01	0.03	0.00	0.00
sted interaction term	-	0.01	**0.04***	0.01	-0.02

*$p < .05$; **$p < .01$; ***$p < .001$

Table 7.26 Family-level risk-moderating effects of the mean age of pre-school staff upon children's developmental abilities at exit from pre-school

	Models testing only **Familial** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
itive Models *(with GCA at pre-school exit as the dependent variable)*					
line: GCA	0.58***	0.58***	0.57***	0.58***	0.57***
ily level risk	-0.10***	-0.10***	-0.10***	-0.09***	-0.10***
n Staff Age	0.01	0.01	0.00	0.00	-0.01
ation	0.08***	0.08***	0.07***	0.09***	0.08***
ed interaction term	-	0.01	-0.01	-0.01	-0.01
al Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
eline:					
operation and formity	0.33***	0.33***	0.33***	0.33***	0.33***
r sociability	0.04	0.04	0.03	0.04	0.04
fidence	-0.04	-0.04	-0.02	-0.04	-0.04
i-social behaviour	*0.02	-0.02	-0.03	-0.02	-0.02
ried upset behaviour	-0.02	-0.02	-0.03	-0.02	-0.02
ily level risk	-0.14***	-0.14***	-0.15***	-0.14***	-0.15***
an Staff Age	0.04*	0.04*	0.04*	0.04*	0.04*
ation	0.04	0.04	0.03	0.04	0.05
ted interaction term	-	-0.01	0.03	-0.01	**-0.05***
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
-operation and formity	-0.33***	-0.33***	-0.33***	-0.33***	-0.33***
er sociability	0.02	0.02	0.02	0.03	0.02
nfidence	0.16***	0.16***	0.16***	0.16***	0.16***
ti-social behaviour	0.13***	0.13***	0.13***	0.12***	0.13***
ried/upset behaviour	0.03	0.03	0.04	0.03	0.03
mily level risk	0.04	0.04	0.04	0.04	0.04
an Staff Age	-0.04	-0.04	-0.04	-0.04	-0.04
ration	0.00	0.00	0.00	0.00	0.00
ted interaction term	-	0.00	-0.01	0.01	-0.01

*$*p < .05$; **$p < .01$; ***$p < .001$*

Mean Staff Greatest Academic Qualification

Table 7.27 Child-level risk-moderating effects of the great average academic qualification of pre-school staff upon children's developmental abilities at exit from pre-school

	Models testing only **Child** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
geline: GCA	0.66***	0.66***	0.65***	0.66***	0.66***
ild level risk	-0.06***	-0.06***	-0.06***	-0.05***	-0.06***
an Staff Greatest ademic (AC) alification	-0.01	-0.01	-0.01	-0.01	-0.01
ration	0.09***	0.09***	0.09***	0.09***	0.09***
sted interaction term	-	0.01	-0.01	-0.02	-0.01
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	0.32***	0.32***	0.31***	0.32***	0.32***
er sociability	0.00	0.00	0.01	0.00	0.00
nfidence	0.02	0.02	0.01	0.01	0.01
ti-social behaviour	-0.05	-0.05	-0.04	-0.05	-0.05
rried/upset behaviour	-0.02	-0.02	-0.03	-0.02	-0.02
ild level risk	-0.09***	-0.09***	-0.09***	-0.09***	-0.09***
an Staff Greatest Qualification	0.01	0.01	0.01	0.01	0.01
ration	0.04	0.04	0.03	0.04	0.04
sted interaction term	-	0.02	-0.01	0.01	-0.02
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	-0.33***	-0.33***	-0.32***	-0.33***	-0.33***
r sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.15***	0.15***	0.15***	0.15	0.15***
i-social behaviour	0.13***	0.13***	0.13***	0.13***	0.13***
ried/upset behaviour	0.03	0.03	0.03	0.03	0.03
ld level risk	-0.01	-0.01	0.00	-0.01	-0.01
an Staff Greatest Qualification	0.02	0.02	0.02	0.02	0.02
ation	0.02	0.01	0.03	0.02	0.01
ted interaction term	-	0.00	**0.04***	0.01	0.02

$*p < .05$; $**p < .01$; $***p < .001$

Table 7.28 Family-level risk-moderating effects of the great average academic qualification of pre-school staff upon children's developmental abilities at exit from pre-school

	Models testing only **Familial** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.58***	0.58***	0.57***	0.58***	0.58***
mily level risk	-0.10***	-0.10***	-0.10***	-0.10***	-0.11***
ean Staff Greatest ademic (AC) alification	-0.02	-0.03	0.00	0.00	-0.02
ration	0.08***	0.08***	0.07***	0.08***	0.08***
ted interaction term	-	-0.03	-0.01	-0.01	0.00
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	0.32***	0.32***	0.32***	0.32***	0.32***
r sociability	0.02	0.02	0.03	0.02	0.02
nfidence	-0.02	-0.02	-0.02	-0.01	-0.01
i-social behaviour	-0.04	-0.04	-0.03	-0.04	-0.04
rried upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
mily level risk	-0.14***	-0.14***	-0.14***	-0.14***	-0.14***
ean Staff Greatest C Qualification	0.01	0.01	0.01	0.01	0.01
ration	0.03	0.03	0.03	0.03	0.03
sted interaction term	-	-0.02	0.03	0.03	-0.01
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	-0.31***	-0.31***	-0.30***	-0.31***	-0.31***
r sociability	0.03	0.03	0.02	0.03	0.03
nfidence	0.16***	0.16***	0.16***	0.16***	0.16***
i-social behaviour	0.13***	0.13***	0.13***	0.13***	0.13***
rried/upset behaviour	0.04	0.04	0.04	0.04	0.04
mily level risk	0.05*	0.05*	0.04*	0.05*	0.05*
ean Staff Greatest C Qualification	0.02	0.02	0.02	0.02	0.02
ration	0.03	0.03	0.03	0.03	0.03
sted interaction term		0.00	-0.01	0.01	0.02

*$*p < .05$; **$p < .01$; ***$p < .001$*

Mean Staff Greatest Childcare Qualification

Table 7.29 Child-level risk-moderating effects of the great average childcare qualification of pre-school staff upon children's developmental abilities at exit from pre-school

	Models testing only **Child** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.65***	0.65***	0.64***	0.65***	0.65***
ild level risk	-0.06***	-0.06***	-0.06***	-0.05***	-0.06***
an Staff Greatest ildcare (CC) alification	-0.01	-0.01	-0.01	-0.01	-0.02
ration	0.09***	0.09***	0.09***	0.10***	0.09***
sted interaction term	-	0.02	-0.01	-0.05*	**-0.03***
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	0.31***	0.31***	0.31***	0.31***	0.31***
er sociability	0.01	0.01	0.01	0.01	0.01
nfidence	0.01	0.01	0.01	0.01	0.01
ti-social behaviour	-0.05*	-0.05*	-0.05*	-0.05*	-0.05*
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
ild level risk	-0.09***	-0.09***	-0.09***	-0.09***	-0.09***
ean Staff Greatest C Qualification	0.01	0.01	0.01	0.01	0.01
ration	0.04	0.04	0.03	0.04	0.04
sted interaction term	-	0.01	-0.01	0.01	-0.01
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	-0.32***	-0.32***	-0.32***	-0.32***	-0.32***
er sociability	0.01	0.01	0.02	0.01	0.01
nfidence	0.15***	0.15***	0.15***	0.15***	0.15***
ti-social behaviour	0.14***	0.14***	0.13***	0.14***	0.14***
rried/upset behaviour	0.03	0.03	0.03	0.03	0.03
ild level risk	-0.01	-0.01	0.00	-0.01	-0.01
ean Staff Greatest C Qualification	0.01	0.01	0.01	0.00	0.01
ration	0.01	0.01	0.03	0.01	0.01
sted interaction term	-	0.01	**0.04***	-0.02	0.03

$*p < .05$; $**p < .01$; $***p < .001$

Table 7.30 Family-level risk-moderating effects of the great average childcare qualification of pre-school staff upon children's developmental abilities at exit from pre-school

	Models testing only **Familial** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.58***	0.58***	0.57***	0.58***	0.58***
mily level risk	-0.10***	-0.11***	-0.10***	-0.10***	-0.10***
ean Staff Greatest hildcare (CC) ualification	0.00	0.01	-0.01	-0.01	0.00
uration	0.08***	0.08***	0.07***	0.08***	0.09***
sted interaction term	-	0.00	-0.01	-0.03	**-0.02***
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
seline: *-operation and nformity*	0.31***	0.31***	0.30***	0.31***	0.31***
er sociability	0.03	0.03	0.03	0.03	0.03
nfidence	-0.02	-0.02	-0.02	-0.02	-0.02
ti-social behaviour	-0.04	-0.04	-0.03	-0.04	-0.04
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
mily level risk	-0.14***	-0.14***	-0.14***	-0.14***	-0.14***
ean Staff Greatest C Qualification	0.01	0.01	0.01	0.02	0.01
uration	0.03	0.03	0.03	0.03	0.03
sted interaction term	-	-0.02	0.03	0.03	0.01
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline: *-operation and nformity*	-0.30***	-0.30***	-0.30***	-0.30***	-0.30***
er sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.16***	0.16***	0.16***	0.16***	0.16***
ti-social behaviour	0.14***	0.14***	0.13***	0.14***	0.14***
rried/upset behaviour	0.04	0.04	0.04	0.04	0.04
mily level risk	0.05*	0.05*	0.04*	0.05*	0.05*
ean Staff Greatest C Qualification	0.01	0.01	0.01	0.01	0.01
uration	0.02	0.02	0.02	0.02	0.02
sted interaction term	-	0.01	-0.01	-0.02	0.00

*$*p < .05$; **$p < .01$; ***$p < .001$*

Number of Staff

Table 7.31 Child-level risk-moderating effects of the number of pre-school staff upon children's developmental abilities at exit from pre-school

	Models testing only **Child** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.64***	0.64***	0.64***	0.64***	0.64***
ild level risk	-0.06***	-0.06***	-0.06***	-0.05***	-0.06***
. of Staff	0.00	0.00	0.00	0.00	0.00
ration	0.10***	0.10***	0.09***	0.10***	0.10***
sted interaction term	-	0.01	-0.01	-0.02	-0.01
cial **Models 1** *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	0.31***	0.31***	0.31***	0.31***	0.31***
er sociability	0.00	0.00	0.01	0.00	0.00
nfidence	0.01	0.01	0.01	0.02	0.02
ti-social behaviour	-0.05	-0.05	-0.04	-0.05	-0.05
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
ild level risk	-0.09***	-0.10***	-0.09***	-0.09***	-0.09***
. of Staff	0.00	0.00	0.00	0.00	0.00
ration	0.03	0.03	0.03	0.03	0.03
sted interaction term	-	0.01	-0.01	0.00	-0.01
cial **Models 2** *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	-0.32***	-0.32***	-0.32***	-0.32***	-0.32***
er sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.15***	0.15***	0.15***	0.15***	0.15***
ti-social behaviour	0.13***	0.13***	0.13***	0.13***	0.13***
rried/upset behaviour	0.03	0.03	0.03	0.03	0.03
ild level risk	-0.01	-0.01	0.00	-0.01	-0.01
. of Staff	0.03	0.02	0.03	0.03	0.03
ation	0.01	0.01	0.03	0.02	0.01
ted interaction term	-	0.01	**0.04***	-0.02	0.01

$*p < .05$; $**p < .01$; $***p < .001$

Table 7.32 Family-level risk-moderating effects of the number of pre-school staff upon children's developmental abilities at exit from pre-school

	Models testing only **Familial** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
eline: GCA	0.57***	0.57***	0.57***	0.57***	0.57***
nily level risk	-0.10***	-0.10***	-0.10***	-0.10***	-0.10***
. of Staff	-0.01	-0.01	0.00	-0.01	0.00
ration	0.08***	0.08***	0.07***	0.09***	0.08***
sted interaction term	-	0.00	-0.01	-0.02	**-0.01***
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	0.30***	0.30***	0.30***	0.30***	0.30***
er sociability	0.02	0.02	0.03	0.02	0.02
nfidence	-0.02	-0.02	-0.02	-0.02	-0.02
ti-social behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.04
mily level risk	-0.14***	-0.14***	-0.15***	-0.14***	-0.14***
o. of Staff	0.00	0.00	0.00	-0.01	0.00
ration	0.02	0.02	0.03	0.02	0.02
sted interaction term		0.01	0.03	0.00	0.01
cial Models 2 *(with anti-social worried behaviour at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	-0.30***	-0.30***	-0.30***	-0.30***	-0.30***
er sociability	0.03	0.03	0.02	0.03	0.03
nfidence	0.16***	0.16***	0.16***	0.16***	0.16***
ti-social behaviour	0.13***	0.13***	0.13***	0.13***	0.13***
rried/upset behaviour	0.04	0.04	0.04	0.04	0.04
mily level risk	0.04*	0.04*	0.04*	0.04*	0.04*
o. of Staff	0.03	0.03	0.03	0.03	0.02
ration	0.02	0.02	0.02	0.03	0.02
sted interaction term	-	0.01	-0.01	-0.02	0.00

*$p < .05$; **$p < .01$; ***$p < .001$

Number of Children

Table 7.33 Child-level risk-moderating effects of the number of children within a pre-school upon their developmental abilities at exit

	Models testing only **Child** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.64***	0.64***	0.64***	0.64***	0.64***
ild level risk	-0.05***	0.03	-0.06***	-0.05***	-0.06***
. of Children	0.33	0.43	0.34	0.30	0.33
ration	0.10***	0.10***	0.09***	0.14	0.14
sted interaction term	-	0.28	-0.01	0.10	0.04
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
-operation and formity	0.31***	0.31***	0.31***	0.31***	0.31***
er sociability	0.01	0.01	0.01	0.01	0.01
nfidence	0.01	0.01	0.01	0.01	0.01
ti-social behaviour	-0.04	-0.04	-0.04	-0.04	-0.04
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
ild level risk	-0.09***	-0.02	-0.09***	-0.09***	-0.09***
. of Children	1.11*	1.08*	1.10*	1.11*	1.05*
ration	0.05	0.06*	0.03	-0.08	0.05
sted interaction term	-	0.23	-0.01	-0.40	0.05
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
-operation and formity	-0.32***	-0.32***	-0.32***	-0.32***	-0.32***
er sociability	0.02	0.02	0.02	0.02	0.02
nfidence	0.15***	0.15***	0.15***	0.15***	0.15***
ti-social behaviour	0.13***	0.13***	0.13***	0.13***	0.13***
rried/upset behaviour	0.03	0.03	0.03	0.03	0.03
ild level risk	-0.01	-0.07	0.00	-0.01	0.00
. of Children	-0.10	-0.10	-0.11	-0.27	-0.11
ration	0.03	0.02	0.03	0.37**	0.03
sted interaction term	-	-0.19	**0.04***	1.02**	**-0.11***

$*p < .05$; $**p < .01$; $***p < .001$

Table 7.34 Family-level risk-moderating effects of the number of children within a pre-school upon their developmental abilities at exit

	Models testing only **Familial** level developmental risk				
	Model testing: direct effects	Separate models testing 2-way interaction terms: (risk x quality)	(risk x duration)	(quality x duration)	Model testing 3-way interaction term: (risk x quality x duration)
gnitive Models *(with GCA at pre-school exit as the dependent variable)*					
seline: GCA	0.57***	0.57***	0.57***	0.57***	0.57***
mily level risk	-0.10***	0.03	-0.10***	-0.10***	-0.10***
o. of Children	0.10	0.16	0.11	0.07	0.12
ration	0.08***	0.08***	0.07***	0.14	0.08***
sted interaction term	-	**0.38****	-0.01	0.18	0.03
cial Models 1 *(with self-regulation at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	0.30***	0.30***	0.30***	0.30***	0.30***
er sociability	0.03	0.03	0.03	0.03	0.03
nfidence	-0.02	-0.02	-0.02	-0.02	-0.02
ti-social behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
rried/upset behaviour	-0.03	-0.03	-0.03	-0.03	-0.03
mily level risk	-0.15***	-0.17	-0.15***	-0.14***	-0.15***
o. of Children	0.75	0.73	0.75	0.81	0.74
ration	0.04	0.04	0.03	-0.08	0.05
sted interaction term	-	-0.09	0.03	-0.33	-0.08
cial Models 2 *(with anti-social/worried behaviour at pre-school exit as the dependent variable)*					
seline:					
-operation and nformity	-0.30***	-0.30***	-0.30***	-0.30***	-0.30***
er sociability	0.02	0.02	0.02	0.03	0.02
nfidence	0.16***	0.16***	0.16***	0.16***	0.16***
ti-social behaviour	0.03***	0.12***	0.13***	0.13***	0.13***
rried/upset behaviour	0.04	0.04	0.04	0.04	0.04
mily level risk	0.05*	0.04*	0.04*	0.04*	0.05*
o. of Children	0.01	-0.03	-0.01	-0.21	0.00
ration	0.03	0.03	0.03	0.36**	0.03
sted interaction term	-	-0.14	-0.01	0.98**	0.00

*$*p < .05$; **$p < .01$, ***$p < .001$*

9: Full computer output of the developmental pathways statistical path analysis

```
Mplus VERSION 4.0
MUTHEN & MUTHEN
03/10/2009   3:46 PM

INPUT INSTRUCTIONS

  TITLE: developmental path analysis 2008:

    DATA: FILE IS "F:\PROCESS.txt";
    !SPSS file=baseprimaryCENT;

    VARIABLE: NAMES ARE
    childid centreid pisibs pieal piprem pibweigh piborder pievent
    startage female black other indian pakist bangla mixed twoadult HOME
     employg salary hleindex hleindxg pihsocio pimqual1 pifqual1
     pimempl1 pifempl1 picarer pimsocio pifsocio q53am q53bf pre_chg
     dose2 fac_pr fac_pun fac_prm fac_det ecers_r
     ecers_e PG PN NC NS CC bblockm bverbm bpicnm bpicsm bgcam bsncm
     bfac1 bfac2 bfac3 bfac4 bfac5 bbasv bbasnv basefac4 basefac5
    basefa4r basefa5r basefac2 baseme45 basef2ri basem45r rgcam rcsbqf1
    rcsbqf2 rcsbqf3 rcsbqf4 rcsbqf5 rcsbqf6 preschol y1read y1math y1eal1a
    y1eal1b y2rhighd y2writl y2mtestd y1goodf5 y1goodf3 y1goodf1 y1goodf2
    y1goodf4 y1goodf6 y2goodf1 y2goodf2 y2goodf3 y2goodf4 y2goodf5
    y2goodf6 DURECR DURECE DURPR DURPUN DURPRM DURDET;

    USEV=
    bgcam bfac1 bfac3 basefa4r basefa5r basefac2
    rgcam !GCA at entry to reception
    rcsbqf1 !self-regulation at entry to reception
    rcsbqf4
    y1read y1math
    y1goodf5 y1goodf3 y1goodf1 y1goodf2 y1goodf4
    y2rhighd y2writl y2mtestd
    y2goodf1 y2goodf2 y2goodf3 y2goodf4 y2goodf5  ;

    MISSING ARE ALL (-999);
    idvariable =childid;
    CLUSTER = centreid:

    ANALYSIS: TYPE = complex missing h1;

    MODEL:
  !within cognitive domain:
  y2rhighd y2writl y2mtestd on y1read y1math rgcam;
  y1read y1math on rgcam;
  rgcam on bgcam@0.68; ! '@' indicates fixed values to ease convergence

  !within social domain:
```

```
y2goodf1 y2goodf2 y2goodf3 y2goodf4 y2goodf5 on
y1goodf5 y1goodf3 y1goodf1 y1goodf2 y1goodf4 rcsbqf1 rcsbqf4;
y1goodf5 y1goodf3 y1goodf1 y1goodf2 y1goodf4 on rcsbqf1 rcsbqf4;
rcsbqf1 on bfac1@0.26;
rcsbqf1 on bfac3@-0.04;
rcsbqf1 on basefa4r@0.06;
rcsbqf1 on basefa5r*0;! '*' indicates starting values to ease convergence
rcsbqf1 on basefac2*0;
rcsbqf4 on bfac1;
rcsbqf4 on bfac3;
rcsbqf4 on basefa4r;
rcsbqf4 on basefa5r;
rcsbqf4 on basefac2;

!!between: cognitive on social:
y2rhighd y2writl y2mtestd on
y1goodf5 y1goodf3 y1goodf1 y1goodf2 y1goodf4 rcsbqf1 rcsbqf4;
y1read y1math on rcsbqf1 rcsbqf4;
rgcam on bfac1;
rgcam on bfac3;
rgcam on basefac2;
rgcam on basefa4r@0;
rgcam on basefa5r@0;

!!between: social on cognitive:
y2goodf1 y2goodf2 y2goodf3 y2goodf4 y2goodf5 on
y1read y1math rgcam;
y1goodf5 y1goodf3 y1goodf1 y1goodf2 y1goodf4 on rgcam;
rcsbqf1 on bgcam@0.32;
rcsbqf4 on bgcam;

!!between: social with cog, and cog with social:
y2goodf1 y2goodf2 y2goodf3 y2goodf4 y2goodf5 with
y2rhighd y2writl y2mtestd;
y1goodf5 y1goodf3 y1goodf1 y1goodf2 y1goodf4 with
y1read y1math;
rcsbqf1 with rgcam;
rcsbqf4 with rgcam;
bfac1 bfac3 basefa5r basefac2 with bgcam;
basefa4r with bgcam*0;

!!within timepoint correlations:
y2goodf1 with y2goodf2 y2goodf3 y2goodf4 y2goodf5;
y2goodf2 with y2goodf3 y2goodf4 y2goodf5;
y2goodf3 with y2goodf4 y2goodf5;
y2goodf4 with y2goodf5;

y1goodf1 with y1goodf2 y1goodf3 y1goodf4 y1goodf5;
y1goodf2 with y1goodf3 y1goodf4 y1goodf5;
y1goodf3 with y1goodf4;
```

```
y1goodf3 with y1goodf5;
y1goodf4 with y1goodf5;

rcsbqf1 with rcsbqf4;

bfac1 with bfac3 basefa4r basefa5r basefac2;
bfac3 with basefa4r basefa5r basefac2;
basefa4r with basefa5r;
basefa4r with basefac2*0;
basefa5r with basefac2;

y2rhighd with y2writl y2mtestd;
y2writl with y2mtestd;

y1read with y1math;

!!INDIRECT EFFECTS OF INTERACTION ON DEVELOPMENT:
MODEL INDIRECT:
y2rhighd IND rgcam;
y2writl IND rgcam;
y2mtestd IND rgcam;
y2goodf1 IND rgcam;
y2goodf2 IND rgcam;
y2goodf3 IND rgcam;
y2goodf4 IND rgcam;
y2goodf5 IND rgcam;
y2rhighd IND rcsbqf1;
y2writl IND rcsbqf1;
y2mtestd IND rcsbqf1;
y2goodf1 IND rcsbqf1;
y2goodf2 IND rcsbqf1;
y2goodf3 IND rcsbqf1;
y2goodf4 IND rcsbqf1;
y2goodf5 IND rcsbqf1;
y2rhighd IND rcsbqf4;
y2writl IND rcsbqf4;
y2mtestd IND rcsbqf4;
y2goodf1 IND rcsbqf4;
y2goodf2 IND rcsbqf4;
y2goodf3 IND rcsbqf4;
y2goodf4 IND rcsbqf4;
y2goodf5 IND rcsbqf4;

  OUTPUT: stand TECH1 TECH4 modindices;


INPUT READING TERMINATED NORMALLY
```

developmental path analysis 2008:

SUMMARY OF ANALYSIS

Number of groups 1
Number of observations 2857

Number of dependent variables 18
Number of independent variables 6
Number of continuous latent variables 0

Observed dependent variables

Continuous
RGCAM RCSBQF1 RCSBQF4 Y1READ Y1MATH Y1GOODF5
Y1GOODF3 Y1GOODF1 Y1GOODF2 Y1GOODF4 Y2RHIGHD
Y2WRITL
Y2MTESTD Y2GOODF1 Y2GOODF2 Y2GOODF3 Y2GOODF4
Y2GOODF5

Observed independent variables
BGCAM BFAC1 BFAC3 BASEFA4R BASEFA5R BASEFAC2

Variables with special functions
Cluster variable CENTREID
ID variable CHILDID

Estimator MLR
Information matrix OBSERVED
Maximum number of iterations 1000
Convergence criterion 0.500D-04
Maximum number of steepest descent iterations 20
Maximum number of iterations for H1 2000
Convergence criterion for H1 0.100D-03

Input data file(s)
F:\PROCESS.txt

Input data format FREE

SUMMARY OF DATA

Number of patterns 125
Number of clusters 141

Size (s) Cluster ID with Size s

6	415
8	122
10	201 202 305 311 315
11	218 406
12	10 18 24 117 318 416
13	102 304 310 316 320 404
14	115 119 307 314
15	35 121 221 313 321
16	12 14 15 20 113 118 123 215 405 407
17	1 6 23 200 213 308 312 317 409 411 414
18	16 110 116 219 402 408
19	51 114 120 211 306 309
20	7 205 220 403 412 418 419
21	4 22 107 111 208 420
22	109 216 302 401
23	3 13 108 112 214 217 222 223 303
24	8 19 21 49 128 400 410
25	5 9 11 17 48 100 101 105 127 206 212 224 227 228 300 422 423
26	104 106 207 209 301 322 417 424
27	50 125 126 204 210 226 229 324 326 413
28	103 124 203 319 325 421 425 426
30	323
35	225

COVARIANCE COVERAGE OF DATA

Minimum covariance coverage value 0.100

PROPORTION OF DATA PRESENT

Covariance Coverage

	RGCAM	RCSBQF1	RCSBQF4	Y1READ	Y1MATH
RGCAM	0.901				
RCSBQF1	0.845	0.897			
RCSBQF4	0.846	0.896	0.898		
Y1READ	0.808	0.813	0.815	0.862	
Y1MATH	0.805	0.810	0.812	0.858	0.859
Y1GOODF5	0.785	0.790	0.792	0.829	0.826
Y1GOODF3	0.785	0.790	0.792	0.829	0.826
Y1GOODF1	0.784	0.790	0.791	0.828	0.825

Y1GOODF2	0.780	0.785	0.787	0.824	0.821
Y1GOODF4	0.785	0.791	0.793	0.830	0.827
Y2RHIGHD	0.796	0.800	0.802	0.789	0.786
Y2WRITL	0.774	0.782	0.783	0.768	0.768
Y2MTESTD	0.781	0.785	0.787	0.776	0.773
Y2GOODF1	0.781	0.783	0.784	0.775	0.771
Y2GOODF2	0.781	0.783	0.785	0.775	0.772
Y2GOODF3	0.781	0.783	0.785	0.775	0.772
Y2GOODF4	0.781	0.783	0.785	0.775	0.772
Y2GOODF5	0.781	0.783	0.784	0.774	0.771
BGCAM	0.876	0.868	0.870	0.836	0.833
BFAC1	0.896	0.892	0.894	0.858	0.855
BFAC3	0.897	0.893	0.894	0.858	0.855
BASEFA4R	0.895	0.891	0.893	0.857	0.854
BASEFA5R	0.896	0.892	0.894	0.858	0.855
BASEFAC2	0.897	0.893	0.894	0.858	0.855

Covariance Coverage

	Y1GOODF5	Y1GOODF3	Y1GOODF1	Y1GOODF2	Y1GOODF4
Y1GOODF5	0.838				
Y1GOODF3	0.837	0.838			
Y1GOODF1	0.835	0.836	0.837		
Y1GOODF2	0.831	0.832	0.832	0.832	
Y1GOODF4	0.837	0.838	0.837	0.832	0.838
Y2RHIGHD	0.769	0.769	0.768	0.765	0.770
Y2WRITL	0.749	0.749	0.747	0.744	0.749
Y2MTESTD	0.757	0.757	0.756	0.752	0.757
Y2GOODF1	0.754	0.754	0.753	0.753	0.754
Y2GOODF2	0.754	0.754	0.753	0.753	0.755
Y2GOODF3	0.754	0.754	0.753	0.753	0.755
Y2GOODF4	0.754	0.754	0.753	0.753	0.755
Y2GOODF5	0.753	0.753	0.753	0.753	0.754
BGCAM	0.815	0.815	0.814	0.810	0.816
BFAC1	0.833	0.833	0.832	0.828	0.834
BFAC3	0.833	0.833	0.832	0.828	0.834
BASEFA4R	0.832	0.832	0.831	0.827	0.833
BASEFA5R	0.833	0.833	0.832	0.828	0.834
BASEFAC2	0.833	0.833	0.832	0.828	0.834

Covariance Coverage

	Y2RHIGHD	Y2WRITL	Y2MTESTD	Y2GOODF1	Y2GOODF2
Y2RHIGHD	0.853				
Y2WRITL	0.831	0.831			
Y2MTESTD	0.834	0.814	0.837		

Y2GOODF1	0.799	0.778	0.785	0.831	
Y2GOODF2	0.799	0.778	0.786	0.831	0.831
Y2GOODF3	0.799	0.778	0.785	0.830	0.830
Y2GOODF4	0.799	0.778	0.785	0.830	0.831
Y2GOODF5	0.798	0.777	0.785	0.830	0.830
BGCAM	0.827	0.807	0.813	0.807	0.807
BFAC1	0.848	0.827	0.833	0.826	0.826
BFAC3	0.849	0.827	0.833	0.826	0.827
BASEFA4R	0.847	0.826	0.832	0.825	0.826
BASEFA5R	0.848	0.827	0.833	0.826	0.826
BASEFAC2	0.849	0.827	0.833	0.826	0.827

Covariance Coverage

	Y2GOODF3	Y2GOODF4	Y2GOODF5	BGCAM	BFAC1
Y2GOODF3	0.831				
Y2GOODF4	0.831	0.831			
Y2GOODF5	0.830	0.830	0.830		
BGCAM	0.807	0.807	0.806	0.967	
BFAC1	0.826	0.826	0.826	0.963	0.995
BFAC3	0.827	0.827	0.826	0.963	0.995
BASEFA4R	0.826	0.826	0.825	0.962	0.994
BASEFA5R	0.826	0.826	0.826	0.963	0.995
BASEFAC2	0.827	0.827	0.826	0.963	0.995

Covariance Coverage

	BFAC3	BASEFA4R	BASEFA5R	BASEFAC2
BFAC3	0.995			
BASEFA4R	0.994	0.994		
BASEFA5R	0.995	0.994	0.995	
BASEFAC2	0.995	0.994	0.995	0.995

THE MODEL ESTIMATION TERMINATED NORMALLY

TESTS OF MODEL FIT

Chi-Square Test of Model Fit

Value	353.371*
Degrees of Freedom	97
P-Value	0.0000
Scaling Correction Factor for MLR	1.122

* The chi-square value for MLM, MLMV, MLR, ULS, WLSM and WLSMV cannot be used
for chi-square difference tests. MLM, MLR and WLSM chi-square difference testing is described in the Mplus Technical Appendices at www.statmodel.com. See chi-square difference testing in the index of the Mplus User's Guide.

Chi-Square Test of Model Fit for the Baseline Model

Value	18932.579
Degrees of Freedom	261
P-Value	0.0000

CFI/TLI

CFI	0.986
TLI	0.963

Loglikelihood

H0 Value	71295.800
H0 Scaling Correction Factor for MLR	1.574
H1 Value	-71097.588
H1 Scaling Correction Factor for MLR	1.439

Information Criteria

Number of Free Parameters	227
Akaike (AIC)	143045.600
Bayesian (BIC)	144397.959
Sample-Size Adjusted BIC (n* = (n + 2) / 24)	143676.700

RMSEA (Root Mean Square Error Of Approximation)

Estimate	0.030

SRMR (Standardised Root Mean Square Residual)

Value	0.031

MODEL RESULTS

	Estimates	S.E.	Est./S.E.	Std	StdYX
Y2RHIGHD ON					

Y1READ	0.307	0.020	15.118	0.307	0.317
Y1MATH	0.229	0.027	8.415	0.229	0.231
RGCAM	0.224	0.022	10.385	0.224	0.229
Y1GOODF5	-0.022	0.021	-1.067	-0.022	-0.023
Y1GOODF3	-0.127	0.024	-5.249	-0.127	-0.132
Y1GOODF1	-0.023	0.018	-1.291	-0.023	-0.023
Y1GOODF2	-0.047	0.025	-1.835	-0.047	-0.048
Y1GOODF4	-0.004	0.018	-0.212	-0.004	-0.004
RCSBQF1	0.061	0.020	3.000	0.061	0.063
RCSBQF4	0.033	0.017	1.940	0.033	0.035
Y2WRITL ON					
Y1READ	0.218	0.023	9.310	0.218	0.224
Y1MATH	0.266	0.029	9.180	0.266	0.266
RGCAM	0.159	0.025	6.284	0.159	0.162
Y1GOODF5	-0.001	0.026	-0.056	-0.001	-0.001
Y1GOODF3	-0.128	0.028	-4.515	-0.128	-0.133
Y1GOODF1	-0.022	0.022	-0.997	-0.022	-0.023
Y1GOODF2	-0.038	0.033	-1.139	-0.038	-0.039
Y1GOODF4	-0.027	0.021	-1.282	-0.027	-0.028
RCSBQF1	0.072	0.025	2.841	0.072	0.073
RCSBQF4	0.043	0.022	1.985	0.043	0.044
Y2MTESTD ON					
Y1READ	0.175	0.019	9.219	0.175	0.178
Y1MATH	0.362	0.028	12.827	0.362	0.359
RGCAM	0.203	0.024	8.325	0.203	0.204
Y1GOODF5	-0.029	0.021	-1.369	-0.029	-0.030
Y1GOODF3	-0.092	0.023	-3.951	-0.092	-0.094
Y1GOODF1	-0.032	0.017	-1.928	-0.032	-0.032
Y1GOODF2	-0.018	0.024	-0.725	-0.018	-0.018
Y1GOODF4	-0.008	0.017	-0.461	-0.008	-0.008
RCSBQF1	0.070	0.024	2.866	0.070	0.070
RCSBQF4	0.013	0.020	0.657	0.013	0.013
Y1READ ON					
RGCAM	0.407	0.026	15.536	0.407	0.403
RCSBQF1	0.173	0.027	6.379	0.173	0.171
RCSBQF4	0.063	0.023	2.759	0.063	0.063
Y1MATH ON					
RGCAM	0.506	0.024	21.184	0.506	0.514
RCSBQF1	0.215	0.027	7.830	0.215	0.218
RCSBQF4	0.046	0.022	2.108	0.046	0.047
RGCAM ON					
BGCAM	0.680	0.000	0.000	0.680	0.697
BFAC1	0.060	0.018	3.346	0.060	0.061
BFAC3	0.076	0.021	3.658	0.076	0.077
BASEFAC2	-0.047	0.022	-2.177	-0.047	-0.048

BASEFA4R	0.000	0.000	0.000	0.000	0.000
BASEFA5R	0.000	0.000	0.000	0.000	0.000
Y2GOODF1 ON					
Y1GOODF5	-0.011	0.032	-0.343	-0.011	-0.011
Y1GOODF3	-0.060	0.032	-1.863	-0.060	-0.061
Y1GOODF1	0.240	0.025	9.636	0.240	0.236
Y1GOODF2	-0.017	0.032	-0.526	-0.017	-0.017
Y1GOODF4	0.050	0.027	1.879	0.050	0.050
RCSBQF1	-0.002	0.034	-0.044	-0.002	-0.001
RCSBQF4	0.061	0.029	2.114	0.061	0.062
Y1READ	-0.046	0.029	-1.625	-0.046	-0.046
Y1MATH	-0.071	0.037	-1.920	-0.071	-0.070
RGCAM	-0.045	0.030	-1.515	-0.045	-0.045
Y2GOODF2 ON					
Y1GOODF5	-0.013	0.026	-0.491	-0.013	-0.013
Y1GOODF3	0.101	0.031	3.208	0.101	0.102
Y1GOODF1	-0.104	0.022	-4.789	-0.104	-0.101
Y1GOODF2	0.404	0.036	11.284	0.404	0.405
Y1GOODF4	0.019	0.023	0.830	0.019	0.019
RCSBQF1	-0.004	0.029	-0.139	-0.004	-0.004
RCSBQF4	0.159	0.026	6.066	0.159	0.159
Y1READ	-0.010	0.026	-0.404	-0.010	-0.010
Y1MATH	-0.010	0.030	-0.345	-0.010	-0.010
RGCAM	-0.024	0.023	-1.034	-0.024	-0.023
Y2GOODF3 ON					
Y1GOODF5	0.006	0.025	0.228	0.006	0.006
Y1GOODF3	0.380	0.026	14.486	0.380	0.380
Y1GOODF1	-0.108	0.018	-5.958	-0.108	-0.104
Y1GOODF2	0.168	0.025	6.782	0.168	0.166
Y1GOODF4	0.020	0.020	0.984	0.020	0.020
RCSBQF1	-0.123	0.024	-5.129	-0.123	-0.120
RCSBQF4	0.073	0.021	3.455	0.073	0.073
Y1READ	-0.066	0.022	-2.985	-0.066	-0.065
Y1MATH	-0.082	0.027	-3.075	-0.082	-0.079
RGCAM	-0.039	0.022	-1.765	-0.039	-0.038
Y2GOODF4 ON					
Y1GOODF5	0.016	0.027	0.614	0.016	0.017
Y1GOODF3	0.016	0.032	0.515	0.016	0.017
Y1GOODF1	0.014	0.023	0.627	0.014	0.014
Y1GOODF2	0.131	0.030	4.340	0.131	0.133
Y1GOODF4	0.271	0.030	9.059	0.271	0.271
RCSBQF1	-0.071	0.034	-2.114	-0.071	-0.071
RCSBQF4	0.079	0.028	2.765	0.079	0.080
Y1READ	-0.018	0.030	-0.607	-0.018	-0.018
Y1MATH	-0.007	0.032	-0.221	-0.007	-0.007
RGCAM	-0.056	0.028	-1.997	-0.056	-0.056

Y2GOODF5 ON					
Y1GOODF5	0.243	0.026	9.173	0.243	0.242
Y1GOODF3	-0.126	0.029	-4.327	-0.126	-0.128
Y1GOODF1	0.045	0.022	2.046	0.045	0.044
Y1GOODF2	-0.121	0.028	-4.383	-0.121	-0.121
Y1GOODF4	-0.024	0.022	-1.053	-0.024	-0.023
RCSBQF1	0.071	0.027	2.635	0.071	0.070
RCSBQF4	-0.069	0.025	-2.825	-0.069	-0.070
Y1READ	0.012	0.027	0.433	0.012	0.012
Y1MATH	0.000	0.031	-0.006	0.000	0.000
RGCAM	0.037	0.028	1.310	0.037	0.036
Y1GOODF5 ON					
RCSBQF1	0.255	0.025	10.043	0.255	0.252
RCSBQF4	-0.135	0.028	-4.916	-0.135	-0.136
RGCAM	0.078	0.024	3.176	0.078	0.077
Y1GOODF3 ON					
RCSBQF1	-0.376	0.022	-16.711	-0.376	-0.367
RCSBQF4	0.157	0.022	7.015	0.157	0.157
RGCAM	-0.184	0.023	-8.152	-0.184	-0.180
Y1GOODF1 ON					
RCSBQF1	-0.072	0.032	-2.298	-0.072	-0.073
RCSBQF4	0.002	0.026	0.071	0.002	0.002
RGCAM	-0.070	0.025	-2.759	-0.070	-0.071
Y1GOODF2 ON					
RCSBQF1	-0.161	0.030	-5.447	-0.161	-0.158
RCSBQF4	0.294	0.032	9.215	0.294	0.295
RGCAM	-0.098	0.032	-3.063	-0.098	-0.096
Y1GOODF4 ON					
RCSBQF1	-0.193	0.030	-6.408	-0.193	-0.193
RCSBQF4	0.036	0.028	1.280	0.036	0.037
RGCAM	-0.077	0.027	-2.850	-0.077	-0.077
RCSBQF1 ON					
BFAC1	0.260	0.000	0.000	0.260	0.263
BFAC3	-0.040	0.000	0.000	-0.040	-0.041
BASEFA4R	0.060	0.000	0.000	0.060	0.061
BASEFA5R	0.016	0.018	0.883	0.016	0.016
BASEFAC2	0.006	0.017	0.356	0.006	0.006
BGCAM	0.320	0.000	0.000	0.320	0.329
RCSBQF4 ON					
BFAC1	-0.291	0.023	-12.711	-0.291	-0.289
BFAC3	0.169	0.026	6.534	0.169	0.168
BASEFA4R	-0.138	0.025	-5.543	-0.138	-0.137

BASEFA5R	-0.036	0.024	-1.500	-0.036	-0.036
BASEFAC2	0.026	0.028	0.947	0.026	0.026
BGCAM	-0.079	0.021	-3.685	-0.079	-0.079
Y2GOODF1 WITH					
Y2RHIGHD	-0.052	0.015	-3.428	-0.052	-0.054
Y2WRITL	-0.067	0.017	-3.910	-0.067	-0.070
Y2MTESTD	-0.097	0.018	-5.423	-0.097	-0.099
Y2GOODF2	0.149	0.025	5.938	0.149	0.149
Y2GOODF3	0.152	0.018	8.209	0.152	0.150
Y2GOODF4	0.317	0.028	11.404	0.317	0.322
Y2GOODF5	-0.104	0.021	-4.959	-0.104	-0.104
Y2GOODF2 WITH					
Y2RHIGHD	-0.044	0.014	-3.101	-0.044	-0.045
Y2WRITL	-0.039	0.015	-2.631	-0.039	-0.041
Y2MTESTD	-0.049	0.016	-3.110	-0.049	-0.050
Y2GOODF3	0.253	0.020	12.400	0.253	0.249
Y2GOODF4	0.240	0.026	9.407	0.240	0.243
Y2GOODF5	-0.331	0.022	-15.082	-0.331	-0.330
Y2GOODF3 WITH					
Y2RHIGHD	-0.081	0.012	-6.605	-0.081	-0.082
Y2WRITL	-0.094	0.015	-6.415	-0.094	-0.095
Y2MTESTD	-0.067	0.012	-5.562	-0.067	-0.068
Y2GOODF4	0.162	0.018	8.861	0.162	0.161
Y2GOODF5	-0.267	0.018	-15.011	-0.267	-0.263
Y2GOODF4 WITH					
Y2RHIGHD	-0.023	0.014	-1.628	-0.023	-0.024
Y2WRITL	-0.053	0.017	-3.157	-0.053	-0.055
Y2MTESTD	-0.052	0.013	-4.045	-0.052	-0.053
Y2GOODF5	-0.269	0.023	-11.900	-0.269	-0.272
Y2GOODF5 WITH					
Y2RHIGHD	0.025	0.012	2.114	0.025	0.025
Y2WRITL	0.035	0.015	2.288	0.035	0.036
Y2MTESTD	0.021	0.013	1.615	0.021	0.021
Y1GOODF5 WITH					
Y1READ	0.048	0.018	2.655	0.048	0.048
Y1MATH	0.071	0.017	4.242	0.071	0.073
Y1GOODF3 WITH					
Y1READ	-0.138	0.017	-7.945	-0.138	-0.137
Y1MATH	-0.131	0.016	-8.378	-0.131	-0.133
Y1GOODF4	0.184	0.017	11.108	0.184	0.184
Y1GOODF5	-0.361	0.018	-19.542	-0.361	-0.357
Y1GOODF1 WITH					

Y1READ	-0.088	0.020	-4.408	-0.088	-0.090
Y1MATH	-0.082	0.019	-4.323	-0.082	-0.086
Y1GOODF2	0.103	0.020	5.084	0.103	0.105
Y1GOODF3	0.099	0.016	6.053	0.099	0.100
Y1GOODF4	0.283	0.024	11.663	0.283	0.293
Y1GOODF5	-0.059	0.020	-2.908	-0.059	-0.060
Y1GOODF2 WITH					
Y1READ	-0.037	0.021	-1.784	-0.037	-0.037
Y1MATH	-0.044	0.019	-2.344	-0.044	-0.045
Y1GOODF3	0.368	0.020	18.341	0.368	0.363
Y1GOODF4	0.245	0.025	9.960	0.245	0.247
Y1GOODF5	-0.425	0.023	-18.460	-0.425	-0.423
Y1GOODF4 WITH					
Y1READ	-0.034	0.019	-1.815	-0.034	-0.035
Y1MATH	-0.031	0.018	-1.735	-0.031	-0.033
Y1GOODF5	-0.297	0.021	-14.313	-0.297	-0.301
RCSBQF1 WITH					
RGCAM	0.147	0.013	11.249	0.147	0.150
RCSBQF4	-0.391	0.020	-19.897	-0.391	-0.393
RCSBQF4 WITH					
RGCAM	-0.034	0.012	-2.801	-0.034	-0.034
BFAC1 WITH					
BGCAM	0.327	0.029	11.105	0.327	0.322
BFAC3	0.398	0.034	11.613	0.398	0.398
BASEFA4R	0.448	0.027	16.750	0.448	0.448
BASEFA5R	0.496	0.029	16.909	0.496	0.496
BASEFAC2	0.501	0.029	17.168	0.501	0.501
BFAC3 WITH					
BGCAM	0.293	0.027	10.892	0.293	0.289
BASEFA4R	-0.074	0.024	-3.028	-0.074	-0.074
BASEFA5R	0.070	0.025	2.828	0.070	0.071
BASEFAC2	0.691	0.033	21.127	0.691	0.691
BASEFA5R WITH					
BGCAM	0.075	0.022	3.444	0.075	0.074
BASEFAC2	0.142	0.026	5.504	0.142	0.142
BASEFAC2 WITH					
BGCAM	0.305	0.026	11.577	0.305	0.300
BASEFA4R WITH					
BGCAM	0.038	0.022	1.692	0.038	0.037
BASEFA5R	0.505	0.030	17.069	0.505	0.506
BASEFAC2	-0.038	0.024	-1.605	-0.038	-0.038

Y2RHIGHD WITH					
Y2WRITL	0.278	0.019	14.382	0.278	0.296
Y2MTESTD	0.160	0.016	10.229	0.160	0.168
Y2WRITL WITH					
Y2MTESTD	0.168	0.016	10.426	0.168	0.175
Y1READ WITH					
Y1MATH	0.258	0.018	14.316	0.258	0.265
Means					
BGCAM	-0.027	0.041	-0.664	-0.027	-0.027
BFAC1	0.000	0.039	-0.001	0.000	0.000
BFAC3	-0.001	0.037	-0.019	-0.001	-0.001
BASEFA4R	-0.002	0.031	-0.060	-0.002	-0.002
BASEFA5R	-0.001	0.033	-0.016	-0.001	-0.001
BASEFAC2	0.000	0.036	-0.008	0.000	0.000
Intercepts					
RGCAM	0.081	0.024	3.376	0.081	0.081
RCSBQF1	0.049	0.023	2.179	0.049	0.050
RCSBQF4	0.003	0.026	0.118	0.003	0.003
Y1READ	0.004	0.030	0.134	0.004	0.004
Y1MATH	0.002	0.024	0.090	0.002	0.002
Y1GOODF5	-0.009	0.025	-0.353	-0.009	-0.009
Y1GOODF3	0.030	0.021	1.457	0.030	0.030
Y1GOODF1	-0.017	0.026	-0.663	-0.017	-0.018
Y1GOODF2	0.026	0.023	1.163	0.026	0.026
Y1GOODF4	-0.014	0.028	-0.512	-0.014	-0.015
Y2RHIGHD	0.008	0.017	0.459	0.008	0.008
Y2WRITL	-0.002	0.020	-0.084	-0.002	-0.002
Y2MTESTD	-0.011	0.020	-0.538	-0.011	-0.011
Y2GOODF1	0.016	0.025	0.638	0.016	0.016
Y2GOODF2	0.002	0.022	0.090	0.002	0.002
Y2GOODF3	0.030	0.019	1.548	0.030	0.030
Y2GOODF4	0.007	0.024	0.279	0.007	0.007
Y2GOODF5	-0.006	0.026	-0.242	-0.006	-0.006
Variances					
BGCAM	1.030	0.036	28.221	1.030	1.000
BFAC1	0.999	0.037	26.760	0.999	1.000
BFAC3	1.000	0.042	24.100	1.000	1.000
BASEFA4R	0.999	0.042	23.543	0.999	1.000
BASEFA5R	0.997	0.036	27.370	0.997	1.000
BASEFAC2	1.002	0.033	30.734	1.002	1.000
Residual Variances					
RGCAM	0.459	0.019	24.108	0.459	0.468
RCSBQF1	0.734	0.023	31.514	0.734	0.753

RCSBQF4	0.852	0.029	29.096	0.852	0.841
Y1READ	0.759	0.034	22.349	0.759	0.760
Y1MATH	0.571	0.023	24.508	0.571	0.601
Y1GOODF5	0.853	0.025	34.201	0.853	0.854
Y1GOODF3	0.693	0.021	33.159	0.693	0.677
Y1GOODF1	0.943	0.039	24.274	0.943	0.985
Y1GOODF2	0.813	0.050	16.277	0.813	0.807
Y1GOODF4	0.911	0.042	21.820	0.911	0.934
Y2RHIGHD	0.393	0.018	21.627	0.393	0.420
Y2WRITL	0.509	0.029	17.435	0.509	0.538
Y2MTESTD	0.465	0.032	14.762	0.465	0.481
Y2GOODF1	0.900	0.046	19.744	0.900	0.908
Y2GOODF2	0.665	0.043	15.624	0.665	0.664
Y2GOODF3	0.546	0.020	27.199	0.546	0.532
Y2GOODF4	0.788	0.039	20.063	0.788	0.807
Y2GOODF5	0.738	0.024	30.800	0.738	0.735

R-SQUARE

Observed Variable	R-Square
RGCAM	0.532
RCSBQF1	0.247
RCSBQF4	0.159
Y1READ	0.240
Y1MATH	0.399
Y1GOODF5	0.146
Y1GOODF3	0.323
Y1GOODF1	0.015
Y1GOODF2	0.193
Y1GOODF4	0.066
Y2RHIGHD	0.580
Y2WRITL	0.462
Y2MTESTD	0.519
Y2GOODF1	0.092
Y2GOODF2	0.336
Y2GOODF3	0.468
Y2GOODF4	0.193
Y2GOODF5	0.265

TOTAL, TOTAL INDIRECT, SPECIFIC INDIRECT, AND DIRECT EFFECTS

	Estimates	S.E.	Est./S.E.	Std	StdYX

Effects from RGCAM to Y2RHIGHD

Total	0.493	0.021	23.125	0.493	0.504
Total indirect	0.269	0.019	13.987	0.269	0.275
Specific indirect					
Y2RHIGHD Y1READ RGCAM	0.125	0.012	10.139	0.125	0.128
Y2RHIGHD Y1MATH RGCAM	0.116	0.016	7.449	0.116	0.119
Y2RHIGHD Y1GOODF5 RGCAM	-0.002	0.002	-1.016	-0.002	-0.002
Y2RHIGHD Y1GOODF3 RGCAM	0.023	0.005	4.663	0.023	0.024
Y2RHIGHD Y1GOODF1 RGCAM	0.002	0.001	1.157	0.002	0.002
Y2RHIGHD Y1GOODF2 RGCAM	0.005	0.003	1.543	0.005	0.005
Y2RHIGHD Y1GOODF4 RGCAM	0.000	0.001	0.210	0.000	0.000
Direct					
Y2RHIGHD RGCAM	0.224	0.022	10.385	0.224	0.229

Effects from RCSBQF1 to Y2RHIGHD

Total	0.215	0.026	8.369	0.215	0.220
Total indirect	0.154	0.015	10.235	0.154	0.157
Specific indirect					
Y2RHIGHD Y1READ RCSBQF1	0.053	0.009	6.099	0.053	0.054
Y2RHIGHD					

Y1MATH					
RCSBQF1	0.049	0.008	6.307	0.049	0.050
Y2RHIGHD					
Y1GOODF5					
RCSBQF1	-0.006	0.005	-1.070	-0.006	-0.006
Y2RHIGHD					
Y1GOODF3					
RCSBQF1	0.048	0.009	5.112	0.048	0.049
Y2RHIGHD					
Y1GOODF1					
RCSBQF1	0.002	0.002	1.086	0.002	0.002
Y2RHIGHD					
Y1GOODF2					
RCSBQF1	0.007	0.004	1.753	0.007	0.008
Y2RHIGHD					
Y1GOODF4					
RCSBQF1	0.001	0.003	0.213	0.001	0.001
Direct					
Y2RHIGHD					
RCSBQF1	0.061	0.020	3.000	0.061	0.063

Effects from RCSBQF4 to Y2RHIGHD

Total	0.032	0.022	1.474	0.032	0.034
Total indirect	-0.001	0.014	-0.083	-0.001	-0.001

Specific indirect

Y2RHIGHD					
Y1READ					
RCSBQF4	0.019	0.007	2.838	0.019	0.020
Y2RHIGHD					
Y1MATH					
RCSBQF4	0.010	0.005	1.996	0.010	0.011
Y2RHIGHD					
Y1GOODF5					
RCSBQF4	0.003	0.003	1.046	0.003	0.003
Y2RHIGHD					
Y1GOODF3					
RCSBQF4	-0.020	0.005	-4.038	-0.020	-0.021

Y2RHIGHD Y1GOODF1 RCSBQF4	0.000	0.001	-0.072	0.000	0.000
Y2RHIGHD Y1GOODF2 RCSBQF4	-0.014	0.008	-1.776	-0.014	-0.014
Y2RHIGHD Y1GOODF4 RCSBQF4	0.000	0.001	-0.209	0.000	0.000
Direct					
Y2RHIGHD RCSBQF4	0.033	0.017	1.940	0.033	0.035

Effects from RGCAM to Y2WRITL

Total	0.413	0.025	16.707	0.413	0.420
Total indirect	0.254	0.021	12.295	0.254	0.258
Specific indirect					
Y2WRITL Y1READ RGCAM	0.089	0.012	7.313	0.089	0.090
Y2WRITL Y1MATH RGCAM	0.134	0.017	8.009	0.134	0.137
Y2WRITL Y1GOODF5 RGCAM	0.000	0.002	-0.056	0.000	0.000
Y2WRITL Y1GOODF3 RGCAM	0.024	0.006	4.150	0.024	0.024
Y2WRITL Y1GOODF1 RGCAM	0.002	0.002	0.937	0.002	0.002
Y2WRITL Y1GOODF2 RGCAM	0.004	0.004	1.006	0.004	0.004
Y2WRITL					

Y1GOODF4					
RGCAM	0.002	0.002	1.153	0.002	0.002
Direct					
Y2WRITL					
RGCAM	0.159	0.025	6.284	0.159	0.162

Effects from RCSBQF1 to Y2WRITL

Total	0.227	0.028	8.161	0.227	0.231
Total indirect	0.155	0.015	10.076	0.155	0.158
Specific indirect					
Y2WRITL					
Y1READ					
RCSBQF1	0.038	0.007	5.504	0.038	0.038
Y2WRITL					
Y1MATH					
RCSBQF1	0.057	0.009	6.545	0.057	0.058
Y2WRITL					
Y1GOODF5					
RCSBQF1	0.000	0.007	-0.056	0.000	0.000
Y2WRITL					
Y1GOODF3					
RCSBQF1	0.048	0.011	4.399	0.048	0.049
Y2WRITL					
Y1GOODF1					
RCSBQF1	0.002	0.002	0.847	0.002	0.002
Y2WRITL					
Y1GOODF2					
RCSBQF1	0.006	0.005	1.132	0.006	0.006
Y2WRITL					
Y1GOODF4					
RCSBQF1	0.005	0.004	1.300	0.005	0.005
Direct					
Y2WRITL					
RCSBQF1	0.072	0.025	2.841	0.072	0.073

Effects from RCSBQF4 to Y2WRITL

Total	0.037	0.024	1.536	0.037	0.038
Total indirect	-0.006	0.013	-0.470	-0.006	-0.006
Specific indirect					
Y2WRITL Y1READ RCSBQF4	0.014	0.005	2.831	0.014	0.014
Y2WRITL Y1MATH RCSBQF4	0.012	0.006	2.063	0.012	0.013
Y2WRITL Y1GOODF5 RCSBQF4	0.000	0.003	0.056	0.000	0.000
Y2WRITL Y1GOODF3 RCSBQF4	-0.020	0.005	-3.722	-0.020	-0.021
Y2WRITL Y1GOODF1 RCSBQF4	0.000	0.001	-0.072	0.000	0.000
Y2WRITL Y1GOODF2 RCSBQF4	-0.011	0.010	-1.120	-0.011	-0.012
Y2WRITL Y1GOODF4 RCSBQF4	-0.001	0.001	-0.906	-0.001	-0.001
Direct					
Y2WRITL RCSBQF4	0.043	0.022	1.985	0.043	0.044

Effects from RGCAM to Y2MTESTD

Total	0.476	0.029	16.154	0.476	0.479
Total indirect	0.274	0.020	13.710	0.274	0.275
Specific indirect					
Y2MTESTD Y1READ RGCAM	0.071	0.009	7.760	0.071	0.072
Y2MTESTD					

Y1MATH					
RGCAM	0.183	0.017	10.819	0.183	0.184
Y2MTESTD					
Y1GOODF5					
RGCAM	-0.002	0.002	-1.219	-0.002	-0.002
Y2MTESTD					
Y1GOODF3					
RGCAM	0.017	0.005	3.695	0.017	0.017
Y2MTESTD					
Y1GOODF1					
RGCAM	0.002	0.001	1.623	0.002	0.002
Y2MTESTD					
Y1GOODF2					
RGCAM	0.002	0.002	0.700	0.002	0.002
Y2MTESTD					
Y1GOODF4					
RGCAM	0.001	0.001	0.451	0.001	0.001
Direct					
Y2MTESTD					
RGCAM	0.203	0.024	8.325	0.203	0.204

Effects from RCSBQF1 to Y2MTESTD

Total	0.212	0.029	7.252	0.212	0.213
Total indirect	0.142	0.015	9.229	0.142	0.142

Specific indirect

Y2MTESTD					
Y1READ					
RCSBQF1	0.030	0.006	4.993	0.030	0.030
Y2MTESTD					
Y1MATH					
RCSBQF1	0.078	0.010	7.579	0.078	0.078
Y2MTESTD					
Y1GOODF5					
RCSBQF1	-0.007	0.005	-1.387	-0.007	-0.008
Y2MTESTD					
Y1GOODF3					
RCSBQF1	0.035	0.009	3.819	0.035	0.035

Y2MTESTD Y1GOODF1 RCSBQF1	0.002	0.002	1.362	0.002	0.002
Y2MTESTD Y1GOODF2 RCSBQF1	0.003	0.004	0.713	0.003	0.003
Y2MTESTD Y1GOODF4 RCSBQF1	0.002	0.003	0.462	0.002	0.002
Direct					
Y2MTESTD RCSBQF1	0.070	0.024	2.866	0.070	0.070

Effects from RCSBQF4 to Y2MTESTD

Total	0.025	0.023	1.081	0.025	0.025
Total indirect	0.011	0.013	0.887	0.011	0.012
Specific indirect					
Y2MTESTD Y1READ RCSBQF4	0.011	0.004	2.594	0.011	0.011
Y2MTESTD Y1MATH RCSBQF4	0.017	0.008	2.122	0.017	0.017
Y2MTESTD Y1GOODF5 RCSBQF4	0.004	0.003	1.332	0.004	0.004
Y2MTESTD Y1GOODF3 RCSBQF4	-0.014	0.004	-3.543	-0.014	-0.015
Y2MTESTD Y1GOODF1 RCSBQF4	0.000	0.001	-0.071	0.000	0.000
Y2MTESTD Y1GOODF2 RCSBQF4	-0.005	0.007	-0.721	-0.005	-0.005
Y2MTESTD					

Y1GOODF4					
RCSBQF4	0.000	0.001	-0.444	0.000	0.000
Direct					
Y2MTESTD					
RCSBQF4	0.013	0.020	0.657	0.013	0.013

Effects from RGCAM to Y2GOODF1

Total	-0.109	0.029	-3.744	-0.109	-0.108
Total indirect	-0.064	0.017	-3.858	-0.064	-0.063
Specific indirect					
Y2GOODF1					
Y1READ					
RGCAM	-0.019	0.012	-1.614	-0.019	-0.019
Y2GOODF1					
Y1MATH					
RGCAM	-0.036	0.019	-1.922	-0.036	-0.036
Y2GOODF1					
Y1GOODF5					
RGCAM	-0.001	0.003	-0.337	-0.001	-0.001
Y2GOODF1					
Y1GOODF3					
RGCAM	0.011	0.006	1.772	0.011	0.011
Y2GOODF1					
Y1GOODF1					
RGCAM	-0.017	0.006	-2.756	-0.017	-0.017
Y2GOODF1					
Y1GOODF2					
RGCAM	0.002	0.003	0.518	0.002	0.002
Y2GOODF1					
Y1GOODF4					
RGCAM	-0.004	0.002	-1.552	-0.004	-0.004
Direct					
Y2GOODF1					
RGCAM	-0.045	0.030	-1.515	-0.045	-0.045

Effects from RCSBQF1 to Y2GOODF1

Total	-0.030	0.034	-0.870	-0.030	-0.029
Total indirect	-0.028	0.013	-2.102	-0.028	-0.028
Specific indirect					
Y2GOODF1 Y1READ RCSBQF1	-0.008	0.005	-1.549	-0.008	-0.008
Y2GOODF1 Y1MATH RCSBQF1	-0.015	0.008	-1.888	-0.015	-0.015
Y2GOODF1 Y1GOODF5 RCSBQF1	-0.003	0.008	-0.343	-0.003	-0.003
Y2GOODF1 Y1GOODF3 RCSBQF1	0.023	0.012	1.867	0.023	0.022
Y2GOODF1 Y1GOODF1 RCSBQF1	-0.017	0.008	-2.176	-0.017	-0.017
Y2GOODF1 Y1GOODF2 RCSBQF1	0.003	0.005	0.525	0.003	0.003
Y2GOODF1 Y1GOODF4 RCSBQF1	-0.010	0.005	-1.829	-0.010	-0.010
Direct					
Y2GOODF1 RCSBQF1	-0.002	0.034	-0.044	-0.002	-0.001

Effects from RCSBQF4 to Y2GOODF1

Total	0.045	0.027	1.641	0.045	0.045
Total indirect	-0.017	0.011	-1.489	-0.017	-0.017
Specific indirect					
Y2GOODF1 Y1READ RCSBQF4	-0.003	0.002	-1.424	-0.003	-0.003
Y2GOODF1					

Y1MATH					
RCSBQF4	-0.003	0.002	-1.559	-0.003	-0.003
Y2GOODF1					
Y1GOODF5					
RCSBQF4	0.001	0.004	0.338	0.001	0.002
Y2GOODF1					
Y1GOODF3					
RCSBQF4	-0.009	0.005	-1.783	-0.009	-0.010
Y2GOODF1					
Y1GOODF1					
RCSBQF4	0.000	0.006	0.071	0.000	0.000
Y2GOODF1					
Y1GOODF2					
RCSBQF4	-0.005	0.009	-0.527	-0.005	-0.005
Y2GOODF1					
Y1GOODF4					
RCSBQF4	0.002	0.002	1.102	0.002	0.002
Direct					
Y2GOODF1					
RCSBQF4	0.061	0.029	2.114	0.061	0.062

Effects from RGCAM to Y2GOODF2

Total	-0.086	0.028	-3.129	-0.086	-0.085
Total indirect	-0.063	0.019	-3.241	-0.063	-0.062
Specific indirect					
Y2GOODF2					
Y1READ					
RGCAM	-0.004	0.010	-0.405	-0.004	-0.004
Y2GOODF2					
Y1MATH					
RGCAM	-0.005	0.015	-0.345	-0.005	-0.005
Y2GOODF2					
Y1GOODF5					
RGCAM	-0.001	0.002	-0.477	-0.001	-0.001
Y2GOODF2					
Y1GOODF3					
RGCAM	-0.019	0.006	-3.020	-0.019	-0.018

Y2GOODF2					
Y1GOODF1					
RGCAM	0.007	0.003	2.476	0.007	0.007
Y2GOODF2					
Y1GOODF2					
RGCAM	-0.039	0.014	-2.866	-0.039	-0.039
Y2GOODF2					
Y1GOODF4					
RGCAM	-0.001	0.002	-0.770	-0.001	-0.001
Direct					
Y2GOODF2					
RGCAM	-0.024	0.023	-1.034	-0.024	-0.023

Effects from RCSBQF1 to Y2GOODF2

Total	-0.110	0.030	-3.687	-0.110	-0.109
Total indirect	-0.106	0.017	-6.278	-0.106	-0.105
Specific indirect					
Y2GOODF2					
Y1READ					
RCSBQF1	-0.002	0.004	-0.402	-0.002	-0.002
Y2GOODF2					
Y1MATH					
RCSBQF1	-0.002	0.006	-0.347	-0.002	-0.002
Y2GOODF2					
Y1GOODF5					
RCSBQF1	-0.003	0.007	-0.489	-0.003	-0.003
Y2GOODF2					
Y1GOODF3					
RCSBQF1	-0.038	0.012	-3.126	-0.038	-0.037
Y2GOODF2					
Y1GOODF1					
RCSBQF1	0.008	0.004	2.115	0.008	0.007
Y2GOODF2					
Y1GOODF2					
RCSBQF1	-0.065	0.012	-5.264	-0.065	-0.064
Y2GOODF2					

Y1GOODF4					
RCSBQF1	-0.004	0.004	-0.845	-0.004	-0.004
Direct					
Y2GOODF2					
RCSBQF1	-0.004	0.029	-0.139	-0.004	-0.004

Effects from RCSBQF4 to Y2GOODF2

Total	0.294	0.032	9.323	0.294	0.296
Total indirect	0.136	0.017	7.760	0.136	0.137
Specific indirect					
Y2GOODF2					
Y1READ					
RCSBQF4	-0.001	0.002	-0.404	-0.001	-0.001
Y2GOODF2					
Y1MATH					
RCSBQF4	0.000	0.001	-0.350	0.000	0.000
Y2GOODF2					
Y1GOODF5					
RCSBQF4	0.002	0.004	0.488	0.002	0.002
Y2GOODF2					
Y1GOODF3					
RCSBQF4	0.016	0.005	2.941	0.016	0.016
Y2GOODF2					
Y1GOODF1					
RCSBQF4	0.000	0.003	-0.071	0.000	0.000
Y2GOODF2					
Y1GOODF2					
RCSBQF4	0.119	0.018	6.753	0.119	0.120
Y2GOODF2					
Y1GOODF4					
RCSBQF4	0.001	0.001	0.704	0.001	0.001
Direct					
Y2GOODF2					
RCSBQF4	0.159	0.026	6.066	0.159	0.159

Effects from RGCAM to Y2GOODF3

Total	-0.187	0.022	-8.498	-0.187	-0.183
Total indirect	-0.148	0.018	-8.290	-0.148	-0.145
Specific indirect					
Y2GOODF3 Y1READ RGCAM	-0.027	0.009	-2.998	-0.027	-0.026
Y2GOODF3 Y1MATH RGCAM	-0.042	0.014	-3.029	-0.042	-0.041
Y2GOODF3 Y1GOODF5 RGCAM	0.000	0.002	0.229	0.000	0.000
Y2GOODF3 Y1GOODF3 RGCAM	-0.070	0.010	-7.200	-0.070	-0.068
Y2GOODF3 Y1GOODFI RGCAM	0.008	0.003	2.522	0.008	0.007
Y2GOODF3 Y1GOODF2 RGCAM	-0.016	0.005	-3.085	-0.016	-0.016
Y2GOODF3 Y1GOODF4 RGCAM	-0.002	0.002	-0.909	-0.002	-0.002
Direct					
Y2GOODF3 RGCAM	-0.039	0.022	-1.765	-0.039	-0.038

Effects from RCSBQF1 to Y2GOODF3

Total	-0.317	0.025	-12.821	-0.317	-0.309
Total indirect	-0.194	0.015	-13.335	-0.194	-0.189
Specific indirect					
Y2GOODF3 Y1READ RCSBQF1	-0.011	0.004	-2.671	-0.011	-0.011
Y2GOODF3					

Y1MATH					
RCSBQF1	-0.018	0.006	-3.057	-0.018	-0.017
Y2GOODF3					
Y1GOODF5					
RCSBQF1	0.001	0.006	0.228	0.001	0.001
Y2GOODF3					
Y1GOODF3					
RCSBQF1	-0.143	0.014	-10.419	-0.143	-0.139
Y2GOODF3					
Y1GOODF1					
RCSBQF1	0.008	0.004	2.176	0.008	0.008
Y2GOODF3					
Y1GOODF2					
RCSBQF1	-0.027	0.007	-4.123	-0.027	-0.026
Y2GOODF3					
Y1GOODF4					
RCSBQF1	-0.004	0.004	-1.011	-0.004	-0.004
Direct					
Y2GOODF3					
RCSBQF1	-0.123	0.024	-5.129	-0.123	-0.120

Effects from RCSBQF4 to Y2GOODF3

Total	0.174	0.024	7.276	0.174	0.173
Total indirect	0.101	0.013	7.611	0.101	0.100

Specific indirect

Y2GOODF3					
Y1READ					
RCSBQF4	-0.004	0.002	-2.138	-0.004	-0.004
Y2GOODF3					
Y1MATH					
RCSBQF4	-0.004	0.002	-1.878	-0.004	-0.004
Y2GOODF3					
Y1GOODF5					
RCSBQF4	-0.001	0.003	-0.229	-0.001	-0.001
Y2GOODF3					
Y1GOODF3					
RCSBQF4	0.060	0.009	6.403	0.060	0.060

Y2GOODF3 Y1GOODF1 RCSBQF4	0.000	0.003	-0.071	0.000	0.000
Y2GOODF3 Y1GOODF2 RCSBQF4	0.049	0.009	5.616	0.049	0.049
Y2GOODF3 Y1GOODF4 RCSBQF4	0.001	0.001	0.779	0.001	0.001
Direct Y2GOODF3 RCSBQF4	0.073	0.021	3.455	0.073	0.073

Effects from RGCAM to Y2GOODF4

Total	-0.104	0.027	-3.816	-0.104	-0.104
Total indirect	-0.047	0.019	-2.502	-0.047	-0.047
Specific indirect					
Y2GOODF4 Y1READ RGCAM	-0.007	0.012	-0.608	-0.007	-0.007
Y2GOODF4 Y1MATH RGCAM	-0.004	0.016	-0.221	-0.004	-0.004
Y2GOODF4 Y1GOODF5 RGCAM	0.001	0.002	0.618	0.001	0.001
Y2GOODF4 Y1GOODF3 RGCAM	-0.003	0.006	-0.510	-0.003	-0.003
Y2GOODF4 Y1GOODF1 RGCAM	-0.001	0.002	-0.616	-0.001	-0.001
Y2GOODF4 Y1GOODF2 RGCAM	-0.013	0.005	-2.576	-0.013	-0.013
Y2GOODF4					

Y1GOODF4					
RGCAM	-0.021	0.008	-2.641	-0.021	-0.021
Direct					
Y2GOODF4					
RGCAM	-0.056	0.028	-1.997	-0.056	-0.056

Effects from RCSBQF1 to Y2GOODF4

Total	-0.152	0.034	-4.472	-0.152	-0.152
Total indirect	-0.081	0.016	-5.139	-0.081	-0.081
Specific indirect					
Y2GOODF4					
Y1READ					
RCSBQF1	-0.003	0.005	-0.598	-0.003	-0.003
Y2GOODF4					
Y1MATH					
RCSBQF1	-0.002	0.007	-0.221	-0.002	-0.002
Y2GOODF4					
Y1GOODF5					
RCSBQF1	0.004	0.007	0.609	0.004	0.004
Y2GOODF4					
Y1GOODF3					
RCSBQF1	-0.006	0.012	-0.517	-0.006	-0.006
Y2GOODF4					
Y1GOODF1					
RCSBQF1	-0.001	0.002	-0.604	-0.001	-0.001
Y2GOODF4					
Y1GOODF2					
RCSBQF1	-0.021	0.006	-3.280	-0.021	-0.021
Y2GOODF4					
Y1GOODF4					
RCSBQF1	-0.052	0.010	-5.252	-0.052	-0.052
Direct					
Y2GOODF4					
RCSBQF1	-0.071	0.034	-2.114	-0.071	-0.071

Effects from RCSBQF4 to Y2GOODF4

Total	0.126	0.028	4.460	0.126	0.128
Total indirect	0.047	0.012	3.894	0.047	0.048
Specific indirect					
Y2GOODF4 Y1READ RCSBQF4	-0.001	0.002	-0.596	-0.001	-0.001
Y2GOODF4 Y1MATH RCSBQF4	0.000	0.001	-0.221	0.000	0.000
Y2GOODF4 Y1GOODF5 RCSBQF4	-0.002	0.004	-0.621	-0.002	-0.002
Y2GOODF4 Y1GOODF3 RCSBQF4	0.003	0.005	0.511	0.003	0.003
Y2GOODF4 Y1GOODF1 RCSBQF4	0.000	0.000	0.071	0.000	0.000
Y2GOODF4 Y1GOODF2 RCSBQF4	0.038	0.010	3.846	0.038	0.039
Y2GOODF4 Y1GOODF4 RCSBQF4	0.010	0.008	1.283	0.010	0.010
Direct					
Y2GOODF4 RCSBQF4	0.079	0.028	2.765	0.079	0.080

Effects from RGCAM to Y2GOODF5

Total	0.094	0.028	3.392	0.094	0.093
Total indirect	0.057	0.016	3.685	0.057	0.056
Specific indirect					
Y2GOODF5 Y1READ RGCAM	0.005	0.011	0.433	0.005	0.005
Y2GOODF5					

Y1MATH					
RGCAM	0.000	0.016	-0.006	0.000	0.000
Y2GOODF5					
Y1GOODF5					
RGCAM	0.019	0.007	2.890	0.019	0.019
Y2GOODF5					
Y1GOODF3					
RGCAM	0.023	0.006	3.841	0.023	0.023
Y2GOODF5					
Y1GOODF1					
RGCAM	-0.003	0.002	-1.698	-0.003	-0.003
Y2GOODF5					
Y1GOODF2					
RGCAM	0.012	0.005	2.366	0.012	0.012
Y2GOODF5					
Y1GOODF4					
RGCAM	0.002	0.002	0.962	0.002	0.002
Direct					
Y2GOODF5					
RGCAM	0.037	0.028	1.310	0.037	0.036

Effects from RCSBQF1 to Y2GOODF5

Total	0.203	0.027	7.401	0.203	0.200
Total indirect	0.132	0.014	9.378	0.132	0.130
Specific indirect					
Y2GOODF5					
Y1READ					
RCSBQF1	0.002	0.005	0.431	0.002	0.002
Y2GOODF5					
Y1MATH					
RCSBQF1	0.000	0.007	-0.006	0.000	0.000
Y2GOODF5					
Y1GOODF5					
RCSBQF1	0.062	0.009	6.806	0.062	0.061
Y2GOODF5					
Y1GOODF3					
RCSBQF1	0.048	0.011	4.305	0.048	0.047

Y2GOODF5 Y1GOODF1 RCSBQF1	-0.003	0.002	-1.596	-0.003	-0.003
Y2GOODF5 Y1GOODF2 RCSBQF1	0.019	0.005	3.677	0.019	0.019
Y2GOODF5 Y1GOODF4 RCSBQF1	0.005	0.004	1.049	0.005	0.004
Direct					
Y2GOODF5 RCSBQF1	0.071	0.027	2.635	0.071	0.070

Effects from RCSBQF4 to Y2GOODF5

Total	-0.158	0.026	-6.092	-0.158	-0.158
Total indirect	-0.088	0.013	-6.654	-0.088	-0.089
Specific indirect					
Y2GOODF5 Y1READ RCSBQF4	0.001	0.002	0.433	0.001	0.001
Y2GOODF5 Y1MATH RCSBQF4	0.000	0.001	-0.006	0.000	0.000
Y2GOODF5 Y1GOODF5 RCSBQF4	-0.033	0.008	-4.217	-0.033	-0.033
Y2GOODF5 Y1GOODF3 RCSBQF4	-0.020	0.005	-3.715	-0.020	-0.020
Y2GOODF5 Y1GOODF1 RCSBQF4	0.000	0.001	0.071	0.000	0.000
Y2GOODF5 Y1GOODF2 RCSBQF4	-0.035	0.010	-3.719	-0.035	-0.036
Y2GOODF5					

Y1GOODF4					
RCSBQF4	-0.001	0.001	-0.859	-0.001	-0.001
Direct					
Y2GOODF5					
RCSBQF4	-0.069	0.025	-2.825	-0.069	-0.070

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