Policy, Planning, and Research

WORKING PAPERS

Women In Development

Population and Human Resources
Department
The World Bank
December 1988
WPS 130

Maternal Education and the Vicious Cycle of High Fertility and Malnutrition

An Analytic Survey

Matthew Lockwood
and
Paul Collier

To break the vicious cycle of poor nutrition and high fertility — reinforced by women's low status — maternal and child health policy, including family planning, should be integrated into public policy and linked to education.

Policy, Planning, and Research

WORKING PAPERS

Women In Development

Women can be viewed as an underused resource (affecting efficiency) or as a disadvantaged target group (getting an inequitable share of health, education, material advantages, status, and leisure time). Within the household, they are burdened not only with the physical demands associated with reproduction but also with obligations that do not commensurate with their rights. At the societal level, they are discriminated against in their access to public services and jobs, and they lack role models for economic advancement.

Much public policy affects men and women differently, in ways that are not immediately apparent.

A study in rural Tanzania, for example, revealed that job discrimination against women lessened as education increased. A 36-year-old man with secondary education had a three in four chance of nonfarm wage employment; a woman of the same age and education had half the chance. A woman who had completed primary education had only a quarter the chance of a man of the same age and education. With partial primary education or less she had only one-fifth the chance. The policy implication: general expansion of the education system may reduce the aggregate incidence of discrimination if it enables women to continue their schooling.

However, other factors are at work, too. For example, women are less likely to get the many public sector jobs available in rural areas because they are poorly placed to lobby for patronage.

Self-employed women are also at a disadvantage. The credit market is intrinsically male-biased. Lacking the autonomy to build up credit ratings, women must rely on savings — and, as managers of the household, they have a greater need than men for liquid assets. Public support of savings institutions to reach small-scale farmers or entrepreneurs tends to improve women's lot.

Some public services tend to be gender-biased. To the extent that certain jobs tend to be done by women, public policy can easily be targeted to benefit women. Rural water, fuel, and health services tend to benefit women more than men. Pricing firewood substitutes, for example, affects women disproportionately because women spend a lot of time gathering firewood. Piped water in effect increases women's time for other productive activities (or even for leisure) because they traditionally spend much time fetching water. Education and extension services (as currently administered) tend to benefit men more than women.

Food subsidies directly benefit net purchasers of food (namely, urban households, for which the population is disproportionately male). Indirectly, some of the subsidy may accrue to sellers, who, at least in Africa, are disproportionately women. Income taxes tend to fall more heavily on males, and expenditure taxes on females. Generalized sales taxes tend to be biased against women but male and female spending patterns are different, so sales taxes can be gender-targeted.

By increasing entry-level wages relative to wages at senior levels, minimum wage laws tend to favor women. To the extent that minimum wages are falling, the wage structure is becoming less favorable to women.

This paper is a product of the Women in Development Division, Population and Human Resources Department. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Johanna Klous, room S9-121, extension 33745

Produced at the PPR Dissemination Center

Contents

1. Introduction

It has long been recognised by observers of public health and population policy that the nutritional condition of individual mothers and children, and the fertility histories of individual women, are strongly associated with the position or status of those individuals in their society. Increasingly it is now suggested that changes in status induce multiple, often mutually re-inforcing changes in the determinants of welfare[1], and conversely that direct, uni-dimensional policies such as supplemental feeding programmes have little chance of eradicating malnutrition (Mosley (1985) p 124, Lamptey and Sai (1985) p 126, FField (1983) p 76)

The implication is a call for maternal and child health policy with its attendant family planning policy to be fully integrated into public policy, and particularly into education. To be operationalised this requires investigation of the multiple routes by which public policy `status' variables, especially education, may influence welfare. There is already a large body of research on fertility, education and nutrition inter-relationships, and a review of this research forms part of

---

[1]For an account of the 'social synergy' of women's education and public health see Mosley (1985), who argues that such education beneficially affects mortality through several routes. For an account of the mutliple interactions of women's education and employment and the resulting effect on fertility serr Youssef (1982).

this paper. What is often missing, however, is a systematic categorisation of the routes by which key variables (and hence sometimes public policy) may affect welfare. Thus our other aim is to provide such a categorisation, based on an analysis of the welfare of individual women and children - in most cases the dyad of mother and child. Such an approach reflects the interdependency of this group in nutrition and health (Jelliffe and Jelliffe (1983) p 81).

Implicit in many discussions of fertility, maternal education and nutrition in developing countries is the notion of a `vicious circle of poor nutrition and high fertility reinforced by the low status of women as evinced by their low levels of education and lack of access to markets or activities outside the home. The obverse of this, of course, is a supposed `virtuous circle' of low fertility, better nutrition (and hence lower mortality), together with higher status for women, better education and more economic power. The detailed examination of the evidence for these relationships reveals that the 'vicious circle' is made up of a large number of steps or stages, each of which may sustain or break it depending on the factors involved. Thus, for example, maternal employment may potentially bring more income to the mother-child dyad and hence increase welfare in a `virtuous circle', but if the employment is incompatible with childcare, the net effect on child welfare may be negative (Ware (1984)).

We propose a four-fold categorisation of the many `stages' in the cycle, treating the ultimate effect of each influence on welfare as affecting either (i) constraints to total welfare attainable;

or (ii) trade-offs between maternal and child welfare; or (iii) factors determining the efficiency of decisions, especially information and its use; or (iv) preferences. The large existing body of research can then be organised more coherently into a form which shows what has already been achieved and where evidence is still weak.

From among the many possible determinants and indicators of female and maternal status, we focus here primarily on education, dealing with its interaction with employment, bargaining power within the domestic group, and fertility. More particularly, we are concerned with the effect of maternal education on maternal and child welfare, asking: by what possible routes can education, acting through fertility, labor, bargaining power and information, influence maternal and child health and nutrition ? A more detailed discussion follows below, but, in summary, these routes are:

(i) by relaxing the constraints on welfare. There are two senses of welfare constraint here. One is straightforward and familiar, involving available resources. Education can improve access to the labor market and income obtained therefrom. It can also enhance a woman's position in conflicts over control of resources, which may be especially important as families and households move from subsistence production of food to consumption based on money income. A better bargaining position may also enable a mother to utilise information requiring departures from existing practices. Another class of constraints is based on transformations of capabilities due to nutritional

and health status changes. The latter are shown to be sensitive to patterns of fertility, which are in turn related inter alia to education. Educated women have fewer children and marry later, protecting their and their children's health. However, the relationship is not straightforward: at elementary levels of education women tend to breast feed for shorter periods and have their earlier births closer together, both being detrimental to health.

(ii) by altering the trade-offs between child status and maternal welfare. This is consequent inter alia upon both the opportunity cost of time spent in child care, which increases with the wage rate and hence with education under most labor market conditions, and also the degree of incompatibility of the work involved with childcare. The effects on child welfare and maternal resources depend in turn on the availability and quality of substitutes for maternal time.

(iii) by improving the efficiency of decision making by the mother. This can be because the content of education directly provides new information, but it can also be because what is important to the mother changes - for example, a cultural shift in the acceptance of the germ theory of disease.

(iv) by changing the values of the mother. Educational content can change the subjective aims of the mother, increasing or decreasing her valuation of her child's well-being relative to her own or other members of the household.

The paper is divided into three sections. The first outlines our analytical framework and discusses its application to the problem

of maternal and child welfare. The second section selectively reviews the literature on the links between education, fertility, nutrition and mortality. Fertility being prior to the formation of the dyad and hence to the analysis of its welfare, the evidence and theory of fertility determination is rather extensively examined. Finally, in the third part we address the implications for both policy and for research. Taking in turn the relevant policy options, we consider their relative merits as discernable from research to date, and identify the major gaps in our knowledge which must currently qualify any such ranking of policies.

2. Analytical Framework

The basis of our approach is the definition of a set of joint utility possibilities, representing attainable combinations of child and maternal welfare outcomes, for given determinants of those outcomes. The set of possibilities will be defined both by constraints (such as income, bargaining power within the domestic group, the availability of food and health services, and initial states of nutrition and health which affect ability to utilise resources), and by objective trade-offs between maternal and child welfare (such as interdependence between maternal and child nutrition and between maternal employment and child care). The process of reaching a certain welfare outcome also involves decisions about the use of food and the treatment of the child made by the mother (or substitute mother). These decisions will

depend on access to, and the use of information, and upon the preferences of the mother.

Before considering the application of this approach to the categorisation of the effects of changes in `status', a number of qualifications and clarifications are in order. These concern the treatment of `welfare', and the influence of age and gender.

2.1: Welfare Concepts

The concept of welfare or utility used in this analysis follows that of `well-being' developed by Sen (1985a). For the convenience of graphical representation it is assumed to be expressible as a scalar, but this is only supposed to reflect a subjective valuation of the functioning of the individual (Sen (1985a) p 13). The welfare of the mother and child should be seen as generated by their respective capabilities to function. This is partly a matter of choice (Sen (1985a) pp 26-27), but it is also a matter of available resources and of the ability of the person to utilise those resources, which in turn depends partly on his or her nutrition and health (Sen p 19 and below).

The `capabilities' approach has been used most extensively in the examination of `basic needs' functionings, such as survival, freedom from morbidity and malnutrition, and being clothed and housed adequately (e.g. Kynch and Sen (1983)). This is particularly useful here, as it means that we can include a key indicator of capability - survivorship[2] - as a determinant of

---

[2] i.e. 1 - the age-specific mortality rate.

welfare. Thus any influences on mortality rates will be relevant to the analysis.

Another aspect of the capabilities approach is that it makes valuation an explicit and open-ended issue (Sen (1985a) p 30). Thus we must be explicit as to whose valuation of the mother-child dyad capabilities we are considering. We cannot assume that the decision maker - the mother - is maximising a social welfare function identical to that of the policy maker, since her views on what is important may be quite different. In particular, we have to be aware that in some cases, the valuation of functioning (even life) of either of the dyad may be very low. An example of this is the relatively low value placed on the capabilities of female children in parts of Asia, by both parents (Chen et al (1981)), as opposed to the valuation of public policy agencies which is (in theory) gender neutral.

An even more extreme example of low self valuation are practices such as suttee. In cases such as these, it is clear that decisions are made with reference to rules or interests outside those of the dyad, and obversely, that much of what is decided about dyad outcomes is determined by others. Thus we have to be able to represent preferences in a very general form. In many cases, the mother will be concerned with her own and her child's welfare, among other things. We can then represent her as having some sort of social welfare function (SWF) as her objective function, which will include her own and her children's utilities. In other cases, these concerns may be considered less relevant, outweighed by others' interest or utility. Thus as a

general case we can represent the mother's objective function as a SWF with weighted utilities as arguments, weights reflecting the relative valuation of different persons' interests.[3]

Many discussions of womens' education, fertility and nutrition, focus not on 'capabilities' but upon 'status'. However, the notion of 'status' in conventional use is often vague, and defined differently in different situations and according to different value systems (El-Hamamsy (1977) pp 438-9). Several analysts (El-Hamamsy (1977), Dyson and Moore (1983), Epstein (1982) and Safilios-Rothschild (1982) p 117) have decomposed the overall notion of status into constituent parts. In particular, they separate the wider and less precise notion of 'status', which includes the idea of the valuation of the agent by others, from 'role' (El-Hamamsy (1977) pp 438-9), 'autonomy' (Dyson and Moore (1983) pp 45-46) or 'power' (Safilios-Rothschild (1982) p 117) which correspond much more closely to our concept of capability aready developed above. 'Status' is always culture-specific, and is determined by a number of factors which are structurally related as a system that cannot easily be abstracted from (Goody (1976), Dyson and Moore (1983)). In comparative work, therefore, it is more fruitful to use concepts which define or affect capabilities, ('roles', 'autonomy', 'power'), in any particular cultural context, recongnising that

---

[3]In terms of the graphical representation we develop below, a SWF with child's and mother's utilities will be representable as isoquants in (U_c, U_m) space. The existence of other person's utility as further arguments in the SWF will require the isoquant map to be extended into further dimensions.

the choice of concepts will always be a value judgement.
In our subsequent discussion we consider education, fertility, work and bargaining power. By the inclusion of bargaining power we retain that part of the meaning of 'status' which distinguishes it from capabilities, namely the evaluation of the agent by others with whom she interacts (Dyson and Moore (1983)). The focus on the capacity of an individual member of a domestic group to bargain over group resources implies a view of the family or household as an institution in which action is both co-operative and conflicting (Sen (1985b)). One of the features of such co-operative conflicts is that any person's degree of control over common resources will increase if (i) that person's perceived contributiion to group opulence increases, or (ii) that person's alternative activity to co-operation in the grooup becomes more favourable (Sen (1985b) p 203-204). Thus a change of either type will increase the total resources available to mothers and hence their capabilitites[4]. However, for some areas of consumption bargaining power can be less important: there are many societies where, aside from the common purse, individual family or household members legitimately retain what they earn as individuals (e.g. Whitehead (1981)).
Thus we can specify 'status' in terms of certain factors determining capabilities, plus others that determine the valuation of women and hence their bargaining power.

---

[4]The importance of a household or family member's relationships with people outside the group for their intra-group position has recently been explored by Whitehead (1984).

2.2: Age and Reproductive History

A significant quality of the utilities or valuations considered here is that they are dated; the mother and child will be of particular age in each case considered, and the mother will have had a particular reproductive history.
Child age is relevant because it influences the maternal-child welfare trade-off. During certain stages in the child's development, an increase in the proportion of resources going to the child will not be beneficial to the child, beyond a certain point. This is most applicable for those infants (aged 0 - 11 months), who are breast fed and so directly dependent on the mother for sustenance.

Maternal age and reproductive history affect the analysis for four reasons. Two relate to the `status' of a woman. We have argued that much of what comprises the 'status' of an individual is determined by her capabilities (see pg 8). Much of the analysis is then about how variables such as education determine these capabilities. However, the power of any individual woman within a specific cultural context will also vary with her reproductive history and age, as Epstein (1982) has demonstrated in a review of the anthropological literature. Such power will typically be used within the domestic group to obtain a larger part of the resources of the group, and may be seen to arise partly from an improvement in the perception of the woman's

contribution (Sen (1985b) and below). This in turn will bear on welfare because it affects the resources available to the mother and child.

In addition, lifecycle stage may affect the legitimacy of a woman's participation in labor outside the home, changing the ease of access to markets and activities. This will alter the set of feasible outcomes via bargaining power (for a given level of domestic group resources) and via income. It will also affect the trade-off between child welfare and maternal welfare, since the possibility of working outside the home may increase both the opportunity cost of child care and the maginal loss of child welfare per unit of maternal time, (if the kind of employment made possible is less compatible with, say, breast feeding).

The third consequence of maternal age and reproductive history (especially parity[5] and birth spacing) is their effects on maternal health. More detailed discussion is given below, but briefly, there is much evidence that high parity, short birth intervals and pregnancy at too young or too old an age can have deleterious effects on maternal health (this effect being stronger for poor, less well-nourished populations), which can be passed on to the child as prematurity, low birth weight (LBW) and poor lactation. In turn, poor health and birth status constrain the ability of the individual to function. A primary effect is on the ability to benefit from food: the greater vunerability to infection arising from these conditions leads to a reduced

[5]Parity is the number of live births a woman has had.

ability to utilise nutritional resources (Sen (1985a) p 9).

Since health and birth status are complements to the consumption of other goods, poor health also differentially reduces the well-being derived from them.

The fourth, and perhaps most important effect is that age, parity and birth spacing can strongly influence survivorship probabilities, affecting the capability to survive, and hence expected utility.

2.3 :A graphical exposition

A useful aid to understanding the framework is the representation of the mother-child dyad set of welfare outcomes in graphical form (Fig 1).

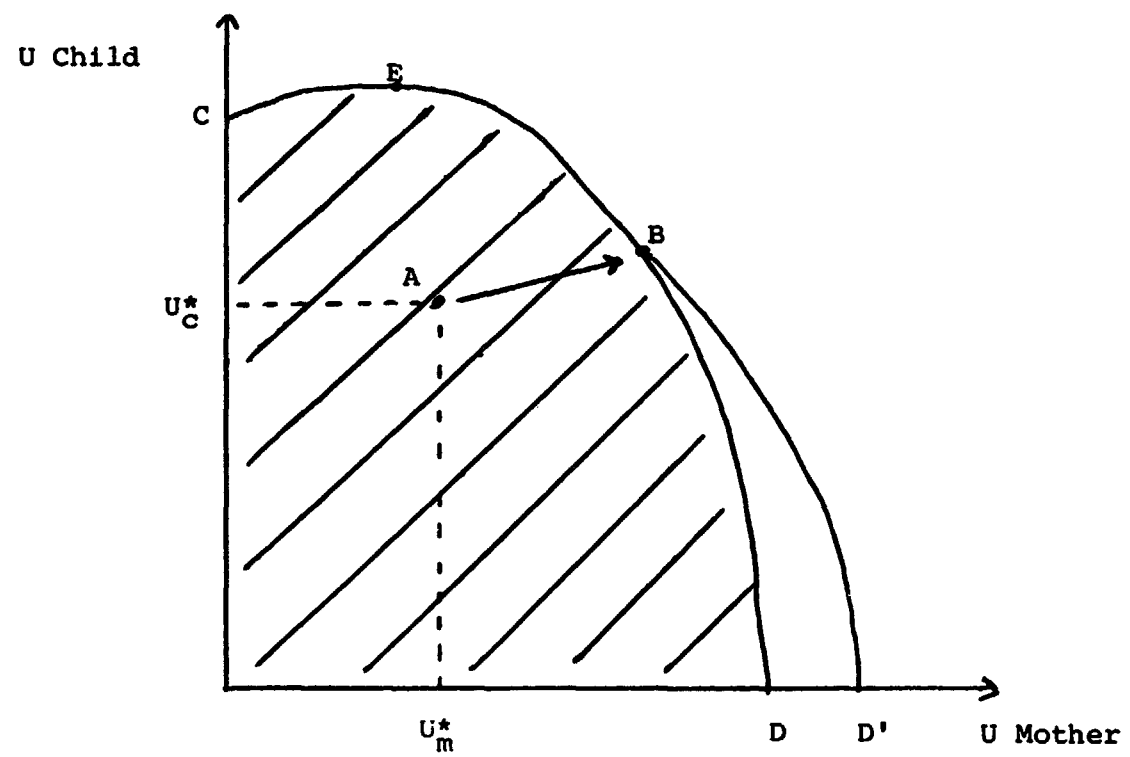

Figure 1

The shaded area in figure 1 represents the set of possible outcomes for mother and child, measured along two axes which represent child's utility and mother's utility respectively. Thus any current state of the dyad will be defined by two utilities. For example, the position at A is given by:-

$$A = (U_m^*, U_c^*)$$

The set is bounded by the two axes, and by the line of furthest extension of the set in the positive quadrant, the utility possibility frontier (UPF), CEBD.

The three determining influences are now readily illustrated. Constraints affect the size of the utility possibility set, i.e. the extension of the shaded area. Trade-offs affect the slope of the UPF over all or any section of its length. For example, an increase in the opportunity cost of the mother's time will decrease the slope of the UPF over the negatively sloping section; for a given loss of child welfare through lack of maternal care, the mother's gain in welfare (assuming a positively sloping labour supply curve) is larger. This can be represented as a shift such as that from BD to BD'.

Changes in choices unbounded by constraints, due to access to new information, can be represented as a movement from the interior of the set towards the UPF (e.g. A to B) - a move from inefficiency to efficiency.

Finally the preferences of the mother - characterised as a social

its arguments, can be represented as an indifference map. As discussed above (pp 7) these utility isoquants may be in (U_c, U_m) space only, or in further dimensions representing the interests of others in addition.

3. An Analytic Survey of the Literature

Many observers have stressed that maternal education is a key variable which appears to interact with a number of other factors to produce a synergistic improvement in maternal and child nutrition and mortality (Mosley (1985), Ware (1984)). The implied multiple etiology of malnutrition has been posited as a major reason for the relative lack of success of straightforward supplemental feeding programmes (Mosley (1985), Lamptey and Sai (1985)). We now investigate how education can work both directly and in interaction with other factors in three kinds of alterations to the possible set of maternal and child welfare outcomes.

However, as discussed above, the influence of education cannot be treated simply as acting on the capabilities of any particular woman in a timeless way. We are typically comparing groups of women at various stages in their lives who have had different educational experiences. Education is usually prior to any fertility history, and the current status of woman and child is likely to be subsequent to both[6]. This section is organised to

---

[6]Beneria (1979) (p 203) has argued that fertility is theoretically prior to capabilities and hence to educational experience since the process underlying women's disadvantage is women's special role in reproduction.

relationships between education and fertility, and consider the range of models of fertility determination that can be called upon to account for the generation of the mother-child dyad. Given the existence of the mother and child, we then consider in more detail the routes by which maternal education may affect their welfare.

3.1 Fertility and Maternal Education

3.1.1 Theories

While it is impossible to do justice here to the wide range of theories of fertility which have been proposed, let alone adjudicate decisively between them, one fundamental point is relevant to our analysis. In the generation of the fertility event - the live birth of a child whose welfare determination we must analyse - we can distinguish between natural fertility and regulated fertility. According to the available historical and contemporary evidence, pre-transitional societies are characterised by a lack of conscious, parity-specific fertility limitation; that is, they were and are natural fertility regimes .

While this does not mean that there are no fertility differentials in such societies, it does mean that fertility

---

[7]For an account of the concept of natural fertility see Louis Henry (1961) and H. Leridon (1977).

determination models which make fertility a choice variable for a household unit are unlikely to b8 very useful. Analysing people's choices at an individual level makes sense only if we know that they have the information and ability to consider the event they face as a choice. This may also be seen at the level of definition of the decision unit. Models which focus on child costs and benefits often presume the existence of a person or group of persons who both bear costs and receive benefits, and also take decisions about fertility. In a post-transitional, regulated fertility population, this is often the Western-nuclear family. But in both historical and contemporary pre-transitional societies, there is plenty of evidence that such groups are often the exception (Goode (1963), Smith (1981), Caplan (1984), Kreager (1980)).

The cost of trying to produce a general model is having to explain wide variation, for developing countries encompasses a range of fertility regimes from the almost completely natural to the thoroughly regulated[8]. What is clear however, is that the key shift from natural to regulated fertility regimes which is a necessary component of permanent fertility dxecline is only possible with the thorough dispersion of information about contraception and of the cultural values that lead to its adoptin. This dispersion has, in the modern era, been intimately linked to education (Caldwell (1982), Cleland and Wilson (1987)).

---

[8]See, for example, the U.N. Demographic Yearbook and the WFS studies for information on fertility rates and contraceptive prevalence.

Until recently, the dominant form of fertility theory was the 'demand theory' form (Cleland and Wilson (1987)), in which micro-economic factors affecting the 'demand' for children, especially child costs and benefits, were seen as the central determinants of fertility levels. This view has historically developed under the macro-level umbrella of 'transition theory'[9]. Early explanations of fertility determination were based on crude models of Western-type households, with the aim of linking declining fertility in the post-war Western world to increasing female labor participation rates and increasing child costs (Becker (1965), Willis (1973), Becker and Lewis (1973)). More sophisticated bargaining analyses and hazard models have since become available (Clemhout and Wan (1977), Manser and Brown (1980), Newman and McCulloch (1984), Razin (1980)).

Within this type of model, education lowers fertility because of effects on the value of a woman's time through her involvement, either actual or potential, in employment (see Becker (1981) for the theoretical underpinnings from a neo-classical viewpoint, and DeTray (1976) for an application). The idea is that as a woman's time (the value of which is measured in the female labor market, or is imputed) becomes more expensive, the shadow price of children, which includes the costs in terms of time spent in childcare, increases, making children more costly. This can be seen diagramatically in Fig 1 as a trade-off effect, determining the slope of the UPF. The trade-off between childcare which we

---

[9]One of the earliest statements of transition theory may be found in Notestein (1945).

assume to be beneficial to the child's welfare) and maternal earnings is thus equivalent to a marginal rate of transformation of child's utility into mother's. Thus an hour's childcare for a mother in an unrenumerative occupation, such as off-peak season non-wage agriculture is much cheaper than the same hour for a mother in a highly paid office or marketing job, for example. Although it ignores many further issues of compatibility of work and care, and the indivisibility and discontinuity of labor time organisation, this shadow price approach is the basis of the fertility-employment model.

Early applications of the microeconomic theory to fertility in developing countries produced seemingly paradoxical results involving parents' 'irrationally' in maintaining high fertility (Mueller (1976)). This provoked a heated response from those theorists who had been developing fertility models based on different conceptual traditions (e.g. Caldwell (1978), (1982), MacFarlane (1978), Mamdani (1972)).

These traditions emphasise a second possible route by which education might affect fertility, namely a cultural one. Education both changes attitudes to fertility, and enhances control of the environment leading to lower infant and child mortality and hence lower fertility (Bulatao (1984), Caldwell (1982), Schultz (1976), Cochrane and Zachariah (1983)). The processes involved are not well understood, not least because little research has been done relating education content to fertility and mortality change (El-Hamamsy (1977)) (although see Caldwell (1982) p 317), or on the contribution of literacy in

societies with extremely limited distribution of printed material. However, it has been argued, on the basis of a strong relationship between maternal education and lower child mortality (see below), that female education, at least in Africa, acts on fertility and mortality primarily through fundamental shifts in values - shifts that enhance the relative status of women and children in society, and that bring about a nuclearisation of family forms (Caldwell (1979)).

Although Caldwell placed most emphasis upon the impact of education via culture, he also pointed to evidence that children in traditional societies had a low cost and a high benefit, through their participation in agricultural work from an early age, and their support to parents in old age (Caldwell (1978), Cain (1977), Ho (1979), White (1975), Nag, White and Peet (1978)). He argued that the mass education of children was the key determinant of the timing of fertility decline, for it brought a new set of cultural ideals and also reduced the potential economic benefits of children (and increased their costs).

3.1.2 Evidence

Evidence that higher levels of female education reduce fertility is somewhat variable, reflecting the different intervening processes involved, and the correlation of education with other factors such as income and employment. However, there is in general a negative relationship between female education (or literacy) and fertility (Rodriguez and Cleland (1981), Cutright (1983), Simmons (1985), Zachariah and Patel (1984)). The

relationship observed in the World Fertility Survey (WFS) data is fairly robust to controls for household income, husband's occupation and urban/rural residence (Rodriguez and Cleland (1981)). On the other hand, there are complications in the relationship. For some surveys, the negative relationship is observed only over part of the educational spectrum, usually at higher levels. Indeed, for certain populations there is an "inverted-U" shape relationship , fertility increasing with education at low educational levels (Cochrane (1978), Graaf (1979), Ashurst, Balkaran and Casterline (1984)).

The most recently available and representative WFS data enable some further investigation of the relationship, subject to the qualification that certain weaknesses in data quality, especially age reporting, must reduce the ability of the WFS data to bear conclusions (Goldman, Rutstein and Singh (1985)). Examination of fertility differentials across educational subgroups for different countries with different overall fertility levels shows how specific patterns of differentials are associated with particular stages in demographic transition to low fertility (Singh and Casterline (1985), Cochrane (1983), Timur (1977)). For countries with high overall fertility, fertility remains constant or even increases with higher levels of female education, until the threshold of secondary education, where it falls rapidly. This pattern is often to be observed in countries in sub-Saharan Africa, and some in Asia. For those countries (e.g. in the Middle East and South America) which have reached the beginning of a decline in fertility, we find that the education/fertility

relationship has become monotonically decreasing, and that the fertility of the middle educational group is reduced by a much larger proportion of the differential between the lowest and the highest groups. Finally, for those countries well into the transition (especially in Latin America and some in Asia), we find a monotonically decreasing relationship again, but with a much smaller gradient, because for these countries fertility reduction has permeated even to the groups of women with only partial primary or no education (Ashurst, Balkaran and Casterline (1984)).

The influence of education on marital fertility is age-specific, identifiable as a change in the tempo of childbearing at different durations from the start of marriage (or union). Generally, women with a higher level of education have the same fertility, or higher, than women with little or no education early on in their unions. It is only after 5 - 10 years of union duration that the fertility of more educated women begins to fall off (Singh and Casterline (1985)). To understand the forces at work here we must turn to analyses of the proximate determinants of fertility for all these subgroups. These are available from the WFS data, and tend to confirm the results of earlier surveys (Cochrane (1978)). Analysis of the proximate determinants of fertility attempts to allocate the total difference between actual fertility and the biologically possible maximum for any given population to factors such as marriage, contraception, post-partum infecundability due to lactational amenorrhoea, and

sterility (see Bongaarts and Potter (1983) for a comprehensive account). Data from the WFS show clear patterns, again according to how far a country has progressed into transition.

First, in all countries, prevalence of contraceptive practice increases monotonically with higher levels of education, while the fertility inhibition due to post-partum infecundability decreases (Casterline et al (1985)).

When comparing countries at different stages of transition, we find that the further a country has gone in the transition, the further down the "educational ladder" contraceptive use is diffused (Singh and Casterline (1985) pg 210, Casterline et al (1984) pg 27). This has implications for family planning policy which are considered below.

The effects of nuptuality have a similar pattern, except that they are relatively more important in Asia than in the Americas, and everywhere, apart from Africa (where the effects of contraception are much weaker), are more restricted to the higher levels of maternal education (Bongaarts, Frank and Lestahaeghe (1984), pg 518).

In summary, at the risk of severe over-simplification, the WFS evidence suggests that for countries firmly into the demographic transition, such as some in the Americas, educational fertility differentials are equally due to later age at marriage and the use of contraception (ealier termination of child bearing). In much of Asia, early and universal marriage persists for all but the highest educational subgroup, and differentials are more due to different contraception use rates. Finally, for African

countries the biggest differential, which is for the highest subgroup, is largely due to delayed marriage. For many African and Asian countries, these negative effects are offset by increased fertility associated with shorter post-partum infecundability (Bongaarts et al (1984), Dyson and Murphy (1985), pg425, Page and Lesthaeghe (1981), Rindfuss et al (1984), pp 13-14).

This suggests that the shifts in educational fertility differential patterns over the transition are associated with a key change in age at first marriage - the further is a country into the transition, the more likely that women with a little education marry later. That the key variable is household formation rather than a fertility decision of the household tends to support the cultural as opposed to the labor market theory of causation.

At a general level, culture certainly does seem to have a large part to play in the reduction of fertility. Historical evidence shows that the sometimes very rapid drops in fertility that occured in 18th and 19th century Europe often closely followed cultural and linguistic boundaries. On the other hand, there is little evidence that drops in fertility were systematically preceded by drops in mortality (Knodel and van de Walle (1979), Cleland and Wilson (1987)), implying that the standard transition model whereby mortality decline always precedes fertility decline

cannot be applied to the European transition at least[10]. This type of consideration implies that when looking at the links between the status of women and fertility, it may not be enough merely to examine the common indicators of status such as education and employment, since the causal factors involved may be quite different, if less easily measurable[11].

The evidence on fertility and employment is extremely difficult to interpret; while some have taken the lack of an overall strongly consistent negative relationship to argue against the education/employment route (Cleland and Wilson (1987)), other surveys of the literature are more equivocal (Simmons (1985), Youssef (1982), Standing (1976)). In general, negative relationships between fertility and female employment have been observed more in urban employment than in rural employment, more in non-agricultural than in agricultural employment, and more at higher levels of occupational status. Further, a commonly observed differential is that fertility for women who have worked only after marriage is higher than for women who have worked before marriage. In the urban professional sector the incompatibility of work with child care is an important factor in

---

[10]By contrast, the contemporary transition in non-European populations would appear at first sight to follow the more classical pattern, fertility decline not starting until morality levels have reached a relatively low level (e.g. Bulatao (1984) pp 18-19). However, mortality data from the developing world is even less complete than fertility data, and so these statements must be treated with caution (Brass (1975) p 50, Mott (1982) pp 7-8).

[11]See Kreager (1986) and Polgar (1972).

women having fewer children, (see Goldstein (1972) for an example, Simmons (1985) for a survey, and Singh and Casterline (1985) on the significance of substitutes for maternal attention). The opportunity costs and benefits for women of working clearly depend on the social structure of both household and kin, but these in turn depend partly on aspects of the work itself; hours, location, and accommodation arrangements, (see Section 4.3). In the production sector women tend to participate either when young, unmarried, and childless, as in SE Asia, or as married home workers as in Latin America and the Caribbean. In SE Asia, (and occasionally elsewhere), the preferred type of worker is female, under twenty-five, unmarried and childless, (Safa (1983), Arizpe and Aranda (1986), Wong (1986), Hein (1984), Pearson (1986b)). Here women's earnings primarily contribute to their parents' households, (Pearson (1986b p71). As a result, until recently, work before marriage has been associated with the postponement of marriage and so lower total fertility rather than lower marital fertility, (Wong (1986) p221, Leete (1987) p193). By contrast, in Latin America and the Caribbean, reproductive roles are more easily adaptable to wage labor and so it is low conjugal household income which drives women into work, (Pearson (1986b)). Production is organised in a way which is more compatible with domestic labor, namely through subcontracting and outworking, (on Brazil see Saba (1983), and more generally Pearson (1986b) and Wong (1986)). This pattern is associated with a different kind of fertility decline. Rather than further increases in female age at first marriage, marital fertility

falls, (Humphrey (1984) p241)[12].

We noted from the WFS data that for large numbers of women in the lower educational subgroups in Asia and Africa more maternal education increased the tempo of child bearing in the earlier years. This results from the conjucture of shorter post-partum infecundability and the earlier termination of child bearing consequent upon contraceptive use. This is important for the relationships between fertility and nutrition explored below.

3.2 Education and Maternal and Child Well-being

We now examine in what ways maternal education can affect the welfare of the child and its mother after birth.

As far as survivorship is concerned, there is overwhelmingly strong evidence that maternal education is almost everywhere a major determinant, if not the major determinant, of infant and child mortality in any given community (Mosley (1985), Caldwell (1979), UNICEF (1984), Preston (1978a), DaVanzo and Habicht (1986), Ware (1984), Taha (1977), Jayachandram and Jarvis (1986), Beenstock and Sturdy (1986)). The purpose of our framework is to deconstruct and categorise this association into four routes by which education may be acting on welfare.

---

[12]The association between greater female employment and reduced fertility is not always causal. In Puerto Rico, for example, both were contemporaneously induced by distinct public policies, (Pearson (1986b) p.77).

3.2.1 Decisions

Although there is far from complete and conclusive evidence, there are compelling argument that part of this association reflects the content of education and the response of others to the educated mother (Caldwell (1979), Ware (1984)). This may work in a number of ways. FIrst, education may simply provide knowledge and information about child care and nutrition that the mother otherwise would lack (Caldwell (1979) p 410). Others have suggested that education may change the attitude of mothers towards things they already know about, such as public health provision and the control of contamination of water and food (Mosley (1985) p 122, Jayachandram and Jarvis (1986) p 303). Such change may involve the abandonment, or at least the adjustment, of existing cultural belief systems concerning food, health, illness and treatment, as, for example, in the case of food prohibitions (Helman (1984)). However, beliefs concerning health and nutrition are ususally deeply contextualised in a whole system of ideas specific to a culture, so that often changing even one component is not as straightforward as it might appear. People may sometimes prefer a quite radical cultural relativism over abandonment of causal models in the face of contrary evidence - arguing, for instance, that while they themselves are vulnerable to forces in their own scheme of, say, food classification or witchcraft, ethnic outsiders may be immune.

According to these arguments, even quite a low level of maternal education could improve infant and child survivorship probabilities, without any increases in income or public health provision. This was indeed Caldwell's major finding in Nigeria. However, higher levels of general socio-economic development re-inforce the education effect (Ware (1984), Preston (1978a), Mosley (1985) p 112). Such effects of education on welfare, acting through changes in information and cultural cognition, may be seen as movements from the interior of the welfare set towards the UPF.

3.2.2 Constraints

Caldwell argues that what is important about education is not so much the supply of new information as the ability or opportunity to use that information that an education woman may have which her uneducated counterpart may not. He sees the scope for mothers to put their child care ideas into practice as constrained, through the mothers' low status in traditional society, by others in the family, household or kin group (Caldwell (1979) p 410-413).

The other relevant aspect of education is its relationship to employment, and the resulting effects on welfare. Employment has a number of effects, mainly on the shape and extent of the utility possibility set. A variety of work is important, not only formal labor market employment (Youssef (1982)). The bulk of work performed by women in Africa and Asia is agricultural,

organised on familial lines, and in its physical effects on women's health and nutritional status, it contributes to the maternal depletion syndrome (Mosley (1985) pg 124, Bantje (1980)). Education, at varying levels, can enable women to enter alternative spheres of work, which may involve different consequences for maternal and child health.

Female employment, education and family welfare are inter-related in a complex fashion, with a variety of outcomes seen consequent to an increase in femal wage earning. Female education has ncreased (Awker and Hein (1985) p 73) and this has commonly been associated with women entering formal labor markets and skilled positions (Oshima (1983) pp 590-91); see also Akadiri (1984) on female white collar employment in Africa). It is frequently observed that the contribution of working women's incomes to family household groups are crucial for the survivial of those groups. However, the impact of such earning power on the welfare possibility set of the the mother-child dyad (or the individual woman if not yet a mother) depends on the form of that earning. For example, Sen ((1985b) p 33) compares studies of women in the beedi industry in India, who gain greater status within the family through their earning, with lacemakers, who do not because their home working is regarded as a spare-time activity.

In order to understand in which context wage employment succeeds or fails to transform domestic relations and family welfare, and how female education is related to these factors, it is useful to consider the main trends in female labor makets.

As already observed, the majority of women in Asia, Africa and

Latin America are primarily involved in family based agriculture. Most also have other economic activities - usually small scale marketing, processing and craft production - which can become primary activities where women are secluded (e.g. in Northern Nigeria, Pittin (1984)). Some writers have suggested that these activities, in which women are concentrated, are being progressively displaced and marginalised by technological innovation (Sen (1985b), Boserup (1970), Ahmed (1983)).
At the same time, however, there has been a rapid female employment in factories producing for the world market, both inside and outside of EPZs, (See Nash and Kelly (1983), ILO (1984), Hein (1984), Oshima (1983), Humphrey (1984), Elson and Pearson (1981)).

A consequence of these two trends - the displacedment of women's labor and products by new technology and the growth of female factory labor forces has been the relative concentration of women within a very few occupations outside of agriculture (Anker and Hein (1985) p 75, Lim (1983) p 73, Anker and Heim (1986) p 43, Akadiri (1984) p 21 and Husain (1958) p9).
This applies even for women educated to secondary level, working in white collar or skilled sectors. For example, of female professional workers in India in 1971, 90% were either nurses or school teachers (compared to 57% of male professionals) (Anker and Heim (1985) p 75).
The relationship between female education, employment and income varies between labor markets. In East Africa, for example, higher levels of female education are associated with

dramatically higher levels of non-family and non-agricultural labor, although within the context of much higher male participation than female (Bigsten (1984) pp 34-5, Collier, Radwan and Wangwe (1986) p 90, Bevan, Collier and Gunning (forthcoming) p 696). However, female wage employment is largely white collar, and the numbers of women gaining the necessary secondary education to enter the sector are very few. Indeed in many African countries, the entire process of education and assignment of personnel to positions is controlled and regulated by the state (Akadiri (1984)).

A contrasting example is North West India where existing gender relations and female roles in reproduction prescribe female participation even when women are educated. Parents may not see education for girls as bad, rather simply as pointless (Shama (1980) p 83).

Because the demand for women's labor is commonly confined to a narrow range of occupations, the mapping from education to earnings can be very different from that for males. Women with relatively high education do not necessarily avoid low paid production work in agri-business, (Arizpe and Aranda (1986)), garment manufacture (Hein (1984)), and electronics assembly, (Pearson (1986b)). This may be reinforced by the erosion of women's earning opportunities in self-employment (as discussed above). Further, within these wage employments women commonly face lower wage rates than men. Sometimes this wage discrimination is formalised by legislation (see Hein (1984) and Humphrey (1984)).

Despite the problems encountered by women in the labor market, women who work potentially gain greater income, greater power and greater control over family expenditure. (Sen (1985b)). Furthermore, their expenditures are typically more child centred than men's. These factors will increase the extent of the welfare possibility set. This link between education and child welfare is contemporaneous: education, through employment, makes greater income possible and hence better child support. However, maternal education, child nutrition and income may be related by a reverse order of causality, and across generations (Ware (1984) pp 195-6). Educated mothers are more likely to come from richer parental households, and are thus more likely themselves to be better nourished in their childhood. In turn this will lead to their children being heavier at birth, (see below). Hence, cross-section correlations between maternal education and child nutrition will over-state the contribution of education. However, in many contexts, causality can run in the other direction, and existing gender relations and reproductive roles can determine the production roles of women within international divisions of labor. Thus microprocessor and electronics assembly has grown almost entirely within South East Asia, where workers are young, single women socialised within patriarchal family structures. Female employment in Latin America has tended to be more in the form of home working and more in agribusiness. Female workers in Latin America and the Caribbean are older, married, mothers in societies where women are traditionally perceived as breadwinners, and where child rearing and domestic

labor can be more easily shared (Pearson (1986b) pp 71-2). Thus not all redeployments of maternal labor to activities which enhance household income generate improvements in child welfare. There is much evidence that a move from subsistence to cash crop production, or to petty trading, at the level of the household (or even the individual mother), can lead to a deterioration in child nutrition (Jakobsen (1978)). There are several possible reasons for these associations, including the incompatibility of such labor with child care and breast feeding, (this being examined below). However, a likely factor is the degree to which mothers can maintain control over resources, once the focus of household economic activity moves from food to money. Thus the relevant determinant of constraints here is bargaining power. As discussed above we analyse the position of an individual or dyad as the outcome of implicit or explicit negotiation within a domestic group - a family or household. In many cases the primary protagonist is the husband. Women with some education may do better than women with less or none if this enhances their status relative to their husband (Ware (1984) p 197). In such circumstances maternal education may be both most desirable and at its most effective as an adjunct to the commercialisation of peasant agriculture, offsetting the loss of control of food supplies which would otherwise occur. However, it is also necessary to recognise two forms of autonomy for women which qualify the importance of the degree of control of the man over the woman in determining the constraints on welfare. One, especially important in sub-Saharan Africa, is the high degree of

separation and autonomy between the economies of men and women (e.g. Pittin (1984), Laplan (1984), Caldwell (1982)). The other is the prevalence of female-headed-households, a widespread form of domestic group both in Latin America and Southern Africa as a result of labor migration (see for example Murray (1980).

3.2.3 Trade-offs

One of the most important aspects of formal wage employment is that it is often incompatible with child care and breast feeding (Ware (1984)). The actual welfare consequences of this depend on the availability and adequacy of substitutes for maternal time (e.g. elder siblings, other relatives or nurseries) - which in turn depends not only on family and kinship organsiation[13], but

---

[13]One of the issues which arose in discussion of employment and child care was the availability and standard of maternal substitutes. This also reminds us of the necessity of considering cases where the dyad we must look at is not that of mother and child, but rather child and some other agent, usually a relative. On a day-to-day basis, for short periods of time, the care of children by siblings is very extensive in the developing world (Weisner and Gallinos (1977)). That the availability of sibling care is important can also be seen in the effect on mother's time - mothers with children under six with no elder siblings were found to be much more constrained in both leisure and productive use of time in the rural Philippines (Ho (1979)).
On a more long term basis, there are more or less formal fostering arrangements found in societies all over the world (Kreager (1980)). Treatment of such cases is far from straightforward. While some arrangements may best be analysed as principal-agent problems, in other situations this would be inappropriate. That is, in certain fostering relationships we should not treat the relative caring for the child as a mother-substitute, but rather accept that notions of exclusive motherhood may be alien to the culture concerned. Thus grandmothers or other relatives in loco parentis may not be seen as less concerned with the welfare of the child, or in a position of less authority or responsiblity. These cases are best treated simply as we have done above, but substituting the social mother for the biological mother in the dyad framework.

also on the nature of the employment, the hours worked, the location of the factory or farm and the arrangements made by employers for accommodation of workers and their families. The switch that often comes with increased maternal education, from activities which are more compatible with 'passive' child care and breast feeding, such as familial agricultural labor, to those which are less compatible, means that the opportunity cost of spending maternal time in work in terms of child welfare loss is higher. At the same time, such labor market activity often has higher renumeration, making child care more costly. These changes make the trade-offs between child and maternal welfare much steeper.

This far, we have considered the effects of education on maternal

and child welfare via employment and income. However, as we have seen, education affects fertility, which in turn affects maternal and child welfare. Women with more education marry later, and so have their first births later. They have fewer children in total. Offsetting this, they breastfeed for shorter periods, and space their (early) children more closely, which might (although not necessarily) lead to negative welfare effects[14]. We now examine such inter-relationships between fertility patterns and child welfare, as indicated by nutritional and survivorship indices.

3.3 Fertility, Nutrition and Survival

As with inter-relationships between fertility and education, a great amount of variability is observed when looking at large data sets - variability that is at least partly due to cultural differences. This may be thought more relevant to inter-relationships between education and fertility, or education and nutrition, because in those cases education can be expected to act directly at the cultural level. However, just because here many of the relationships are biological or biodemographic does not mean they are not conditioned by cultural and economic variation (MacCormack (1982). On breastfeeding see Butz (1978), Saucier (1972), Page and Lestaeghe (1981)).

---

[14]The data below show a strongly negative effect of short spacing and breast feeding, but this need not have much impact on the children of the most-educated mothers from richer households (Mosley (1985)).

To summarise the fertility/nutrition inter-relationships conveniently a classification system is required. First, we distinguish between the effects of fertility patterns on child health and nutrition, from those on maternal health and nutrition. This second distinction is subject to the qualification that maternal and child welfare are not independent. Via the generational effect, malnutrition and poor growth in childhood for girls leads to their children in turn being smaller at birth (Mata (1978), Omran and Standley (1981) pg 25). Via the contemporaneous effect, poor maternal nutrition during pregnancy is associated with low birth weight (Mata (1978), Lechtig et al (1975) and see below). Third, we distinguish the various aspects of 'fertility' - i.e. family size, birth order, maternal age and inter-birth interval - each of which has a discernible effect on both child and maternal status. Having identified the various fertility/nurtition relationships, we consider possible underlying processes. In understanding how women's status interacts with these processes, we make a fourth distinction between physiologically-based mechanisms, (working through lactation and maternal depletion), and economic and social mechanisms.

3.3.1 The effects of nutrition on fecundity and fertility

There are two effects of nutrition on fertility though neither is pronounced. The first is on fecundability[15]. It has been argued that severe malnutrition and/or large energy demands can lead to lower fertility through amenorrhoea, there being some evidence that reproductive function is dependent on fat/body weight ratios (Frisch (1975), Mosley (1978)). However, examination of comparative data has shown that in normal populations, this effect seems to hold only for the onset of the reproductive period, in the delay of menarche for poorly nourished girls. For women in mid-reproductive life, the reproductive function seems to be protected by processes of adaptation where the health of the mother suffers, but in which frequent pregnancy and lactation can continue (Menken, Trussell and Watkins (1981), Bongaarts and Potter (1983)).

The second effect of nutrition on fertiltiy is that child malnutrition increases child mortality, which may induce higher fertility, either via a 'replacement' effect, or through the early involuntary cessation of breastfeeding (see below). However, both the historical evidence (as noted above) and contemporary evidence suggest that the 'replacement' effect is weak (Cleland and Wilson (1987) pg 14, Preston (1978b)), so that the relationship is largely physiological (Cantrelle and Leridon (1971) and below).

---

[15]Fecundability is the ability to conceive, and should be distinguished from fertility, which is reproductive outcome. Thus fecundability is one of the determinants of fertility.

3.3.2 The Effects of age and parity on welfare

In considering the effects of fertility on maternal and child nutrition, we shall first deal with the effects of maternal age, birth order and total family size, and then separately with birth intervals. It is also necessary to bear in mind that here much of the evidence is on mortality rather than nutritional status. However, it is well known that malnutrition is a major underlying cause of infant and child mortality (Ashworth (1982), Preston (1980), Mosley and Chen (1984), Scrimshaw, Taylor and Gordon (1968)).

Studies of relationships between family size, birth order and maternal age on the one hand, and indicators of child well-being on the other, give mixed results. Differences between cases will undoubtedly partly be due to cultural and economic variation. Another factor is the co-linearity of the demographic variables, older women tending to have higher parity births and larger families.

Studies from Western Europe, Singapore, India and a number of African countries show a definite increase in mean or median birth weight with parity, while the incidence of prematurity seems to be related to parity in a number of ways cross-culturally (Omran and Standley (1981) pp 24-5). Later on in life, however, family size and parity seem to affect child status more unambiguously. In a number of WHO studies in 1976 it was found that "in almost all the [maternal] age groups and in

most of the cultural groups examined, children of mothers who had a large number of pregnancies for their age had lower mean heights, weights and haemoglobin levels than those of mothers with fewer pregnancies for the same age" (Omran and Standley (1981) pp 25), and similar results have been observed in India (Gopalan and Naidu (1972)) and Colombia (Wray and Aguirre (1969)).

The main infuences of maternal age on child survival factors are pregnancy-related, i.e. prematurity and birth weight. Studies suggest that there is a relatively "safe age band" in the 20s and early 30s, on either side of which prematurity and low birth weight (LBW) (as well as pregnancy loss) increase, but more especially for younger mothers (Omran and Standley (1981) pg 33, Selvin et al (1972), Chakraborty et al (1975)).

The other factor that qualifies these relationships is the birth interval; higher parity and family size for given maternal age imply closer spacing, and it may be this aspect of demographic structure which is most important. Thus, in a recent study of WFS data from 39 countries, it was found that, apart from first births and births to teenage mothers, there are no strong effects of parity or maternal age on infant and child mortality outcomes independent of birth spacing (Hobcraft et al (1985))[16].

The variation in evidence suggests that relationships between family size, parity and maternal age and child well-being are not direct, but rather involve further relationships between family

[16]Although see Pebley and Stupp (1987) pg 58

structure, maternal status and the economic position of family members. A graphic example is given in Wray and Aguirre's classical study in Colombia. Child nutritional status improves with smaller family size and lower parity, but the position in even small families is still very poor when compared with standards in the developed world, reflecting the economic insecurity of the entire community under investigation (Wray and Aguirre (1969) Tables XII and XIII).

Given that the high prevalence of premature and LBW births to older women of higher parity probably represents accumulated strain on a woman's reproductive system (Jelliffe (1966)), we might expect a similar pattern in maternal mortality and morbidity. At least 500,000 women die each year from pregnancy-related causes and many more incur permanent disability (Royston and Ferguson (1985)). Studies from the developing world show that these deaths are concentrated among the primiparous and the grand multiparous[17], a pattern which is obviously related also to age. Maternal age is in fact generally considered to be the relevant factor (Omran and Standley (1981) pp 29-30, Chen et al (1974) Tables 6-8, pp 337-8).

3.3.3 The effects of birth spacing on welfare

We now turn to the effects of child spacing. Here most studies

---

[17]Primiparous refers to women having their first live birth. Grand multiparous in this context means women with 6 or more live births.

take infant and child mortality as the dependent variable, rather than nutrition. However, certain patterns of mortality, for example a high second year death rate, almost certainly reflect such nutritional factors as the ending of breastfeeding and consequent weanling diarrhoeal diseases (Gordon, Wyon and Ascoly (1967), Gordon (1971)), as well as the already mentioned close relationship between malnutrition, morbidity and mortality. Many studies suggest that short birth intervals are associated with relatively high rates of infant and child mortality, and with a high prevalence of malnutrition (see Winikoff (1983), Gray (1981), Hobcraft et al (1983) and de Sweemer (1984) for recent surveys). However, there are many problems of interpretation in these associations, and methodologies vary (Winikoff (1983) pp 231-232, Cleland and Sathar (1984) pp 401-402, amd Millman (1985)). Many of the early studies in this field suffer from methodological problems of spurious association by failing to control for other factors such as socio-economic status and maternal age. These studies are reviewed in Winikoff (1983), who concludes that they "provide evidence that infant mortality rates are generally negatively related to birth interval. But the relative lack of comparability of the data and the different patterns of effects suggest that knowledge in this area is far from secure. It appears that the most striking effects of birth interval occur in the post-neonatal [1 - 11 months] period and with the very shortest birth intervals. One caution here is that methodological difficulties are most likely to affect the reliability of data for precisely those very shortest intervals" (Winikoff (1983) pp 236-237).

More recent studies using the large data sets available from the WFS and more sophisticated methodologies have made it possible to distinguish the relative importance of the different effects. Data on 12 Latin American countries and on 39 countries covered by the WFS, carefully controlled for background factors like maternal age, and socio-economic variables such as education show significant association between increased infant and child mortality and shorter preceding and subsequent birth intervals. Hobcraft et al (1985) find that if two children were born in the two years preceding the birth of the child under consideration, or if one was born, but died by the start of the survival period, mortality in the first year trebles. Similarly, Palloni and Millman (1986) pp 221, 226 find that the preceding interval affects child survival in the first month of life. These effects are often considered to work through a 'maternal depletion syndrome', whereby frequent, narrowly spaced pregnancies and lactation deplete maternal resources, leading to increased prematurity, and low bith weight (LBW) infants who have an increased mortality risk (Jelliffe (1966), Pebley and Stupp (1987)).

Both Palloni and Millman and Hobcraft et al also find association between increased post-neonatal and child mortality, and shorter subsequent birth or conception intervals. Interestingly, they both also find that there is no evidence that this is due to an early voluntary cessation of breastfeeding (Palloni and Millman (1986) pp 225-226, Hobcraft et al (1985) pp 372-373). This is

important because breast feeding is a highly significant independent effect on child survival, and indeed the more deprived a family, the mre significant it is (Palloni and Millman (1986) pg 228).

The subsequent interval effect may then instead occur because early infant death leads to an involuntary cessation of breast feeding and consequent early conception (Hobcraft et al (1985) pg 374, and see also Cleland and Sathar (1984)). Further, the resumption of menstruation and ovulation is possible without the complete cessation of breastfeeding, the process depending more of the frequecy, duration and intensity of suckling (Cantrelle and Leridon (1971), Santow and Singh (1984), Van Ginneken (1978) Tyson and Perez (1978) and Dobbing (1985)).

However, the possiblity then arises that short birth intervals and high mortality are spuriously related through precisely this mechanism. Families that experience high mortality for independent reasons have early deaths, interrupted breastfeeding, resumption of ovulation and thus short intervals. Hobcraft et al (1986) find that this is unlikely; the overall mortality status of a family makes almost no difference to the relative risks of mortality arising from spacing effects (pp 375-376). They conclude: "...regardless of the risk status of the family we find that a short birth interval is clearly associated with considerable excess mortality risk for the index child (around 50 to 60 percent on average). We think this fairly conclusive that short birth intervals bring about a real excess mortality beyond the level appropriate for the family. But familial levels of

mortality are probably the main source of the differences in excess infant mortality of the index child by survival status of earlier children" (Hobcraft et al pg 375).

The remaining problem of interpretation is the possibility that the factors determining the risk status of the family (e.g. income)are in fact endogenous, affected by the demographic structure of the family. In particular, this might arise if a pattern of closely spaced births were related to low income. There is much evidence that while children in Latin America, Africa and Asia perform many valuable labor services (see above pg 26), large family size is associated with lower money income per capita (Visaria (1980), Lipton (1983), although caution must be exercised in the interpretation of such income data, both in what it leaves out and the deflators used (Deaton and Muellbauer (1980), Sen (1983)). On the other hand, there is little evidence relating child spacing and resources, although one study in the Philippines shows constraints on the mother increase with the number of children aged under six years (Ho (1979)).

As noted above, some of the effects of birth spacing on child mortality are considered to work through a deleterious influence on maternal health, the 'maternal depletion syndrome' (Jelliffe (1966)). There is certainly evidence that pregnancy and lactation place additional strain on maternal health and nutrition, especially iron stores (LLewelly-Jones (1965), Prema (1980), Royston (1982), Aebi and Whitehead (1980)). However, evidence that these pressures are converted into a worsening of women's nutritional status during pregnancy and lactation is very

mixed (Bernard et al (1978), Omran and Standley (1981)). It has been hypothesised that instead they are passed on as "reducetions in the resources given to the fetus (resulting in premature and LBW infants)" (Population Council (1984)). As discussed above, high parity and family size do play such a role, while other evidence also suggests strongly that the confluence of nutritional shortage and metabolic stress in work patterns powerfully influences birthweights (Dunn (1979), Bantje (1980), Petros-Barvazian and Behar (1978)).

We have seen how patterns of reproductive behaviour can have profound influence on maternal and child welfare. Within the framework outlined here, such influence may be seen to alter welfare through extension or contraction of the set of utility possiblities, as morbidity, birth status and survivorship probabilities affect capabilities.

4. Policy and Research

This paper has attempted to categorise relationships between fertility, maternal education and maternal and child nutrition and mortality. Our analysis has focused upon the capabilities of the mother, as a member of a domestic group, as a potential or actual participant in labor, and as a recipient and user of information. The central importance of both culture and resources in affecting the constraints on choice has been stressed.

We now discuss the role of public policy in influencing maternal and child welfare: whether such policy is desirable, to what extent it it possible and which policy measures are preferable. Many policy questions cannot be answered on current knowledge and so we also consider what kind of research might be needed in order to identify more effective policy.

4.1 Policy Options

When it comes to surveying the 'policy menu' of relevant measures which have been and are being applied in the countries of Africa, Asia and Latin America, we can think of policy on two levels (Jelliffe and Jelliffe (1983) p 85). At one level we have the immediate or direct policy instruments of supplemental feeding, primary health care and family planning programmes, and educational policy, in that order. At another level, any one policy measure has to be seen against the policy 'background' of wider social and economic policies which may also bear on welfare, at a deeper level. Policy background will include policies on employment, and hence macroeconomic planning including structural adjustment packages, the organsitaion of incentives and inputs through extension schemes and agricultural policy in favouring or discouraging shifts to cash-cropping. Another set of policy measures which can be seen at different times as either immediate or background are those relating to the family, including laws and enforcement of laws on marriage,

divorce, the levirate, and domestic violence. The legal status of children and the treatment of spousal and other familial relations in the media.

Each policy measure may in turn be seen as consisting of a number of component parts or aspects, some or all of which may best be treated separately. Thus educational policy comprises far more than simply a target for enrollment rates. There is the issue of content, and also of the types of education to be pursued, including adult education and literacy. In addition to educational policy strictly defined, a closely related set of policies concern itellectual production, especially the distribution of published material including newspapers. All of this is relevant for understanding what educational policy in any one case actually is. Similarly, maternal and child primary health (MCH) programmes may be run in tandem with other components such as immunisation or sanitation programmes, while the integration of health service delivery and family planning services has become widespread since the 1978 Alma Ata Conference on primary health care (Fauqee and Johnson (198), Mosley (1985)). The progressive integration of programmes in health, nutrition and family planning has partly been a response to the failure (and political costliness) of past attempts to run population programmes separately (Warwick (1982)), although to the extent that such integration merely represents administrative reorganisation, some observers feel that no fundamental change has been brought about (Mosley (1985)). Such issues require us to examine the relative merits of policies and policy combinations, to which we now turn.

4.2 The Ranking of Policy

The first step in evaluating the relative successes of different policies is to identify what their aims were, both stated, and if they differ, actual. The confusion and expediency in this area may be illustrated by the history of policy on family planning[18]. Programmes of distribution of knowledge about and supplies of contracetpion in the 1960s and early 1970s were conducted under the umbrella of population control and an increase in the freedom of individuals to exercise choice over their reproduction (Warwick (1982) pp 31-33). Indeed, although population policy was often supposed to involve other elements, especially after the post-Bucharest consensus that 'development is the best contraceptive', it was in fact often identical to family planning policy.

However, over the decade of the 1970s a number of factors forced a change in the packaging of population policy and showed the true nature of the implementation of family planning programmes under conditions which threatened their success. Popular resistance, fuelled by political, often nationalist, rhetoric, brought quick retraction of the notion that population policy aimed to control and restrain population growth, and family planning came to be linked rhetorically at first, and then

---

[18]For more complete accounts of this history and the politics of population and birth control policies see Warwick (1982) and Young (1983).

administratively, to primary health and general welfare provision. In Africa, the focus was shifted from overall limitation of family size to child spacing, argued to be a more traditional practice.

Ironically, the delinking of family planning provision from an overt population control rhetoric in many countries co-incided with the use of force and highly pressurising incentives in family planning programmes, notably in India during the Emergency (Warwick (1982) pp 195-200).

More recent forms of family planning provision have become identified with packages of policy measures to enhance the status and position of women and children, especially in Africa and Asia where birth rates are relatively high (e.g. UNICEF (1984)). At the same time, there is still an obvious concern with the extent to which education and policy other than family planning may be effective in reducing the birth rate (e.g. Boulier (1985), Wheeler (1985), Faruqee (1982)). The problem here is one of inconsistency. Either the aim of policy is to raise the status of women, or it is to reduce fertility and although the two are interrelated, choice of final aim can make a difference in treatment of measures. In the first case, even if education is not a cost effective route to reduced fertility, it should not be abandoned as a key element as long as it can raise status. In the latter, education may under these conditions be jettisoned, but it should also be made clear that reduced fertility through family planning alone will not necessarily bring about better status for women, and may indeed further restrict rather than

increase their freedom (Young (1983)). This is not an argument about the conditions of that provision, and its implementation, which we discuss below.

Ironically, women may be protected from the latter kind of policy. We noted above that contraceptive use spread into lower educational groups only at lower overall levels of fertility and higher levels of education and general development. Thus to the extent that governments and agencies seek a quick and cheap solution to population problems in family planning programmes at the expense of social policy for women they are likely to be frustrated by the structural relationship between education and contraceptive acceptance rates.

Research in this area is often (ideally) aimed at policy that improves the capabilities of women and children selected according to some set of value objectives. However, policy designers are not omnipotent, especially with respect to other policy makers (Sen (1972) pp 486-487). In particular, it is important to note the multiplicity of routes of effect of a given policy change. An example is policy designed to enhance the welfare, power and productivity of women. The ability of women to work outside the home or hearth, in or outside of a formal labor market, undoubtedly improves their economic postion and power, if they retain control of the rewards of that labor. But equally, for women whose nutritional status is already marginal, working harder to produce more can be counter-productive. This is especially so where commitments to labor time use are lumpy.

Women working as primary household food suppliers, faced with the task of the main harvest, may be too busy to grow and harvest supplementary protein foods when they are most in short supply, and too poor to buy them (e.g. Bantje (1980)) This is not a problem of information, since mothers may often know perfectly well that they and their children go poorly nourished, but is rather one of a limit on the most common resource of labor time. The issue then is why other resources are not available to increase productivity, and why other people's (i.e. men's) labor is not used.

Thus there is perhaps a danger in the 'targetting' of women for social policy as an undifferentiated category in isolation from the groups, communities and markets they participate in.

Evidence on the relative success of different kinds of policy in reducing fertility suggests that family planning is more cost effective (Bulatao (1984) p 100) than programmes to lower mortality or increase education, but there is also evidence that family planning programmes are most effective when overall mortality is relatively low and levels of education are relatively high (Boulier (1985) p 102, Wheeler (1985) p 160). When the aim is increasing income per capita, the postion is reversed: educational policies dominate family planning measures, despite large cost differentials (Wheeler (1985) p 161). However, evaluation is complicated[19] because family planning has

[19]There are in addition numerous technical prolems in the application of CEA/CBA techniques to family planning programmes (Siragelin et al (1983)).

often been combined in practice with other kinds of health and welfare measures (Boulier (1985) p 100), and it appears that this integration makes them more successful in increasing the acceptance rate and maybe in reducing fertility (Faruqee (1982), Faruqee and Johnson (1982)).

On the side of public health provision to reduce mortality and improve nutrition, there is a strong consensus that the record of policy shows that integration and co-ordination of MCH services, especially with educational and literacy policy is essential and cost-effective (Preston (1978b) pp 118-9), Mosley (1985), Lamptey and Sai (1985)). Lamptey and Sai ((1985) p 127) also argue for integrated policy to take account of generational effects, recognising the importance of the influence of long run nutritional and reproductive histories on dyad welfare.

But there is also another sphere of policy evaluation. Policies differ not only in content or type, but also in implementation. Although there is not the space here to go deeply into this matter, it is clear that the implementation of policies is as important a factor is success or failure as their design (Warwick (1982)). It has been forcefully pointed out that of the five major initiatives laid out in 1978 as the foundations of primary health care policy, only the two technical and administrative ones have actually been widely put into action. The widespread implementation of the community participation and development of traditional healing components has failed.

4.3 Research Needs

Three themes emerge from this review of existing research and policy evaluation: multiple interaction of 'status' factors on welfare, the need for integrating policy, and the large number of steps and divergences in the routes from education to fertility and welfare.

We have seen the multiple interaction of facets of women's autonomy, including their education and employment possibilities, and of fertility, on the well-being of the mother-child dyad. That there is systematic interaction is perhaps best shown in the fact that both the education/fertility and the education/mortality relationships exhibit structural shifts as we move to lower levels of fertility and mortality. The effects of education seem to multiply progressively beyong certain thresholds.

There is increasing recognition of the importance of integrating public policy measures in these areas. Both existing research and policy experience have shown that family planning and direct nutritional programmes will be more successful when they are integrated with policy on other factors with which fertility and nutrition are interrelated (including each other).

The complexites of interaction arise from there being a multiplicity of factors acting through a large number of 'steps' to produce welfare outcomes. These relationships have sometimes been categorised according to their 'depth', into underlying and proximate determinants e.g. of fertility (Bongaarts and Potter (1983)) and mortality (Mosley (1985)).

The framework offered here further categorises proximate determinants according to the type of action they have; influencing constraints, trade-offs, decisions or preferences. The resulting implication is that in any one case, there should be no pre-judgement that a given factor will have a certain outcome without considering all the intervening steps. Further, no factor should be pre-judged as more important than another. The only way to satisfy both these conditions is to conduct research into all relevant factors simultaneously. This entails drawing up lists of hypotheses or steps to be investigated, as exhaustively as possible, as indeed has already been suggested by some observers for cetain areas (Ware (1984) p 209, Youssef (1982)).

Some gaps in existing knowledge have long been noted - for example there have been many calls for more research into the role of content of education in detemining changes in both fertility (El-Hamamsy (1977) p 442) and mortality (Ware (1984)). A list of such factors based on this paper is provided as an appendix. What is perhaps most important here is the idea that integrated policy for what are, after all, inter-related problems, requires integrated research. That is, we cannot tell how important the role of, for example, educational content and hence shifts in cultural systems are in affecting fertility or mortality without also investigating the effects of education on those variables via employment for those individuals. In turn, we cannot investigate the role of employment without specifying relevant labor market conditions, availability of maternal

substitutes, wages, and the kind of work involved. Research in this sense is synergistic - investigating many factors altogether tells us more than a number of partial investigations could.

One possibily highly productive route to easier applications of such a research approach would be the use of existing institutional frameworks and data resources, and one of the most suitable institutions is the joint WHO/UNICEF Nutrition Support Program being run in 18 countries (WHO/UNICEF (1986)). The quality and spread of the JNSP varies greatly from country to country, but in the more successful cases, such as Tanzania, much of the basic individual nutritional and agricultural data is systematically collected on a regular basis. This accumulation of long-run data sets could form a core on which to build more complete studies as suggested (WHO/UNICEF (1986) pg 50-55).

Two general areas of research are suggested by the dyadic framework, as applied specifically to the context of African countries. Both of these topics are treated at the level of individual women and child pairs, and so must also be seen ultimately within the context of historical changes and policies at the level of the whole society.

One concerns breastfeeding. Breast feeding has been identified as the sine qua non of factors in the integrative approach to nutrition and family planning Lamptey and Sai (1985), Katz (1977) pp 235-236), related as it is to both post-partum amenorrhoea (p.p.a.) and infant and maternal nutrition. Sufficient clinical research has been done in gaining a fuller understanding of the physiological relationships between the duration, intensity and

frequency of suckling on the one hand and amenorrhoea on the other. Similarly, the relationship between maternal nutrition and milk quality and quantity has been explored. Survey methodology on breast feeding and amenorrhoea measurement has also kept pace. What is more required now is research which relates such data to the cultural, social and economic changes underlying declining breast feeding and reduced p.p.a., especially in Africa and Asia. While it is clear from experience that prolonged breast feeding is neither necessary nor sufficient for low infant mortality rates, and while it may be over-optimistic to expect a reverse in trends, such research will assist knowledge of whether breast feeding decline is or is not an integral part of desired economic or social change.

The other research area suggested here concerns the control over resources within domestic groups. Two possible trends in particular will be essential for future understanding. One is the extent to which shifts in sexual and age divisions of labor, and from subsistence to cash crops in the rural economy have brought about a marginalisation of womens' authority and independent income, and the extent to which this has been avoided through alternative routes to fiscal autonomy, or indeed if the opposite has occured. The other is the extent to which women maintain control over income that they earn in new occupational situations (especially rural proto-industrial or urban situations), and whether this is sufficient to offset the loss of time (if any) that would otherwise be spent with children. Such research would need to include prior consideration of the

temporal structure of working and reproductive histories; i.e. whether women are working before, during or after having infants. This last direction for research offers a clear opportunity for policy. Even while women in developing countries are increasingly drawn away from subsistence, family based agriculture, and into wage - labor markets, their relative marginalisation in technological innovation means that they suffer poorer opportunities and wages[20]. As Beneria and Sen poiint out, redical policy to remote discrimination in formal labor markets would require the removal of hierarchy within firms, whereby the low status of women reinforces their poorly paid, low-skilled jobs (Beneria and Sen (1986)).

Policy must also address how, given women's reproductive roles and domestic gender relations affect both the supply of and the demand for female labor. In formal labor markets, this means confronting the problem that employers often prefer not to employ women if they have to bear the costs of maternity leave, nursing facilities and creches (Anker and Hein (1985)), and further,that they often employ women without meeting their legal obligations (Humphrey (1984) p 243).

Perhaps most important in researching ways to expand and consolidate women's existing roles in rural sel-employment are examinations of intra-household bargaining power, the consistency of roles of mother and worker, and the forms of discrimination

---

[20]e.g. See Wong (1986) p 215 on the erosions of women's position within Singapore manufacturing as capital intensity and skilling is raised.

(Ahmad (1984)). If mothers and children benefit from greater income and autonomy through labor that is 'outside' the home, but suffer either from the conditions of the work itself or from lack of adequate child care alternatives, public policy can play an important role in extending the limits to the process.

Appendix

List of variables to be included in an integrated study of education, fertility and nutrition/mortality. The list draws heavily on Ware (1984) and Mosley (1985).

1 Education reduces fertility

Basic fertility data: age of mother, party/birth order, birth intervals

Basic mortality data: previous infant deaths, age at death

Basic education data: type and level of schooling

1.a Education affects knowledge/attitudes

Sex of children
Education of mothers parents (especially mother's mother)
Information about the content of education received
Information on knowledge of and attitudes towards the use of contraception

1.b Education affects employment affects fertility

Occupation of mother
Crops grown
Information about the work pattern of the mother (daily and seasonal time budget)
Can the mother work with the infant present?
Information about substitutes (availability, quality)
Information about place of work (e.g. factory, plantation) shifts, distance to residence
Labor market: local and regional migration, availability of work, access for women to extension schemes

1.c Education reduces or increases fertility through certain proximate determinants

Definition of marriage(s)
Age at first marriage / union
Divorce
Prevalence of pre-marital sex
Prevalence of abortion
Contraceptive prevalence
Breast feeding (duration, full/partial) and post-partum amenorrhoea

2. Education increases nutrition/reduces mortality

Basic nutrition data: prematurity, birth weight or anthropometric equivalent, current weight/age

Optional: full clinical examination, vitamin deficiencies, hemoglobin for anemia

2.a Education affects knowledge/attitudes

Cooking practices (number of times a day, re-heating food)
Availability and cost of fuel
Feeding practives
Action taken in case of illness, and how the decisions is reached
Knowledge of health care facilities available
Hygiene practices
Sex of child

2.b Education affects employment affects nutrition

(as 1.b + who cares for the child, and quality of that care)

2.c Education affects employment affects income/autonomy affects nutrition

Who controls the income from woman's labor
Who takes the decisions in case of illness, about feeding, about treatment
Personal income and wealth data

2.d Education affects fertility affects nutrition/mortality

Maternal height
Maternal diet, work load and weight/height during pregnancy
Place of birth
Attendance at birth
Treatment of umbilical cord
Breast feeding (partial/full, duration)
Feeding practices at specific ages

3 Background

Size of house, number and size of rooms
Current household members (updating if prospective)
Immunisation/level of health service provision
Use of traditional healing
Availability of water (nearest source dry/wet season)
Sewage/sanitation
Malaria (endemic?)
Land owned/farmed
Household income and wealth data

Bibliography

Aebi, H. and R. Whitehead (eds.) (1980) Maternal Nutrition During Pregnancy and Lactation, Berne, Hans Huber

Ahmad, Zubeida (1984) "Rural women and their work: dependence and alternatives for Change", International Labour Review, 123,1

Ahmed, Iffikhar (1983) "Technology and rural women in the Third World" International Labour Review, 122, 4

Akadiri, K. (1984) "The 'modern' employment market in selected African Countries" Women at Work, ILO

Anker, Richard (1985) "Problems of interpretation and specification in analysing fertility differentials: illustrated with Kenyan survey data" in Farooq and Simmons (eds.)

Anker, Richard, Mayra Buvinic and Nadia H. Youssef (eds.) (1982) Women's Roles and Population Trends in the Third World, London, Croom Helm.

Anker, Richard and Catherine Hein (eds.) (1986) Sex inequalities in urban employment in the third world, London, Macmillan

Anker, Richard and Catherine Hein (1985) "Why Third World Urban Employers Usually prefer men", International Labour Review, 124, 1.

Arizpe, Lourdes and Josefina Aranda (1986) "Women workers in the strawberry agribusiness in Mexico" in Leacock and Saba (eds.)

Ashurst, Hazel, Sundat Balkaran and J.B. Casterline (1984) "Socio-economic differentials in recent fertility" WFS Compatative Studies, 42

Ashworth, A., (1982) "International differences in infant mortality and the impact of malnutrition: a review" Human Nutrition, Clinical Nutrition, 36C

Bantje, Han (1980) "Seasonal variations in birth weight distribution in Ikwiriri Village, Tanzania" Research Report 43, Bureau of Resource Assessment and Land Use Planning, University of Dar es Salaam

Becker, Gary S. (1965) "A theory of the allocation of time" Economic Journal, 75

Becker, Gary S. (1981) A treatise on the Family Cambridge, Mass., Harvard U.P.

Becker, Gary S. and H. Gregg Lewis (1973) "On the interaction between quantity and quality" Journal of Political Economy Supplement to Vol. 81

Beneria, Lourdes (1979) "Reproduction, production and the sexual division of labour" Cambridge Journal of Economics 3.

Beneria, Lourdes and Gita Sen (1986) "Accumulation, reproduction and women's role in economic development: Boserup revisited" in Leacock and Saba (eds.)

Beenstock, Michael and Patricia Sturdy (1986) "The determinants of infant mortality in regional India" mimeo, City University, London

Bernard, J. et al (1978) "International maternity care monitoring: results of a pre-test" International J. Gynaecology and Obstetrics 17,1

Bevan, David, Paul Collier and Jan Gunning (forthcoming) The Economic Consequences of Temporary Trade Shocks, Oxford OUP

Bigsten, Arne (1984) Education and Income Determination in Kenya, Aldershot, Gower

Birdsall, Nancy (ed.) (1985) "The effects of family planning programmes on fertility in the developing world", World Bank Staff Working Paper 677

Bongaarts, Jon, Odile Frank and Ron Lesthaeghe (1984) "The proximate determinants of fertility in sub-Saharan Africa", Population and Development Review 10, 3

Bongaarts, Jon and Robert Potter (1983) Fertility, Biology and Behaviour: an analysis of the Proximate Determinants, London, Academic Press

Boserup, Ester (1970) Woman's Role in Economic Development, London, Allen and Unwin

Boulier, Bryan (1985) "Family planning programs and contraceptive availability: their effects on contraceptive use and fertility" in Birdsall (ed.)

Brass, William (1975) Methods for estimating fertility and mortality from limited and defective data, Laboratories for Population Statistics, University of North Carolina

Bulatao, Rodolfo (1984) "Reducing fertility in developing countries: a review of determinants and policy levers", World Bank Staff Working Paper 680

Bulatao, Rodolfo and Ronald Less (eds.) (1983) Determinanats of Fertility in Developing Countries, N.Y. Academic Press

Butz, William (1978) "An Economic analysis of breastfeeding" in W.H. Mosley (ed.) (1978)

Cain, Mead (1977) "The economic activities of children in a Bangladesh village", Population and Development Review 3

Caldwell, J.C. (ed.) (1978) The Persistence of High Fertility in the Third World, Canberra, ANU

Caldwell, J.C. (1979) "Education as a factor in mortality decline; an examination of Nigerian data" Population Studies 33, 3

Caldwell J.C. (1980) "Mass education as a determinant of the timing of fertility decline" Population and Development Review 6

Caldwell J.C. (1982) Theory of Fertility Decline, London Academic Press

Cantrelle, Pierre and Henri Leridon (1971) "Breastfeeding, mortality in childhood and fertility in a rural zone of Senegal", Population Studies 25, 3

Caplan, A.P. (1984) "Cognatic descent, Islamic law and women's property on the East African coast", in R. Hirschon (ed.) Women and Property, Women as Property Croom Helm

Casterline, John (1985) "Schooling and Fertility", IUSSP International Population Conference Vol II, Florence

Casterline, John, Susheela Singh, John Cleland and Hazel Ashurst (1984) "The proximate determinants of fertility", WFS Comparative Studies 39

Chakraborty, R et al (1975) "Proportion of low birth weight infants in an Indian Population and its relationship with maternal age and parity", Human Heredity 2

Chen, Lincoln C. et al (1974) "Maternal mortality in rural Bangladesh", Studies in Family Planning 5, 11

Chen, L.C., E. Hug and S. D'Souza (1981) "Sex bias in family allocation of food and health care in rural Bangladesh", Population and Development Review 7

Cleland, John and Zaba A. Sathar (1984) "The effect of birth spacing on childhood mortality in Pakistan", Population Studies 38, 3

Cleland, John and John Hobcraft (eds.) (1985) Reproductive Change in Developing Countries, Oxford, OUP

Cleland, John and Christopher Wilson (1987) "Demand theories of the fertility transition: an iconoclastic view", Population Studies 41, 1

Clemhout, S. and H.Y. Wan (1977) "Symmetric marriage, household decision making and impact on fertility", Cornell University Working Paper 152

Cochrane, Susan Hill (1978) Fertility and Educaiton: What do we really Know?. Baltimore, John Hopkins U.P.

Cochrane, Susan Hill (1983) "Effects of education and urbanisation on fertility", in R. Bulatao and R. Lee (eds.)

Cochrane, Susan Hill and K.C. Zachariah (1983) "Infant and child mortality as a determinant of fertility: the policy implications", World Bank Staff Working Paper 556

Collier, Paul, Samir Radwan and Samuel Wangwe (1986) Labour and Poverty in Rural Tanzania, Oxford, Clarendon

Cutright, Phillips (1983) "The ingredients of recent fertility decline in developing countries", International Family Planning Perspectives 9

DaVanzo, Julie and Jean-Pierre Habicht (1986) "Infant mortality decline in Malaysia 1946-1975: the roles of changes in variables and changes in the structure of relationships", Demongraphy 23, 2

Deaton, Angus and John Muellbauer (1980) Economics and Consumer Behaviour, Cambridge, CUP

de Sweemer, Cecile (1984) "The influence of child spacing on child survival", Population Studies 38, 1

DeTray, Dennis (1976) "Population growth and educational policies: an economic perspective", in R.G. Ridker (ed.)

Dobbing, J. (ed.) (1985) Maternal Nutrition and Lactactional Infertility, Raven Press

Dunn, P.M. (1979) "Low birthweight: incidence, aitiology and prevention", in R.H. Philpott (ed.) Maternity Services in the Developing World: Proceedings of the seventh studygroup of the Royal College of Obstetricians and Gynaecologists 1979, London

Dyson, Tim and Mick Moore (1983) "On kinship structure, female autonomy and demographic behaviour in India", Population and Deveopment Review 9, 1

Dyson, Tim and Mike Murphy (1985) "The onset of fertility transition", Population and Development Review 11, 3

El-Hamamsy, Laila (1977) "Demongraphic correlates of changes in women's role and status", IUSSP Internationl Population Conference, Mexico, 1977

Elson, Diane and Ruth Pearson (1981) "The subordination of women and the internationalisation of factory production" in K.Young et al (eds.) Of Marriage and the Market, RKP

Engel, R.W. and M. Caedo (1982) "Nutrition and family planning" [Abstract] in Nutrition and Population Growth: the Delicate Balance, West Germany

Epstein, T. Scarlett (1982) "A social anthropological approach to women's roles and status in developing countries; the domestic cycle", in Anker et al (eds.)

Farooq, Ghazi M. (1985) "Household fertility decision making in Nigeria" in Farooq and Simmons (eds.)

Farooq, Ghazi M. and George B. Simmons (es.) (1985) Fertility in Developing Countries: an Economic Perpective on Research and Policy Issues, London, Macmillan

Faruqee, Rashid (1982) "Integrating family planning with health services: does it help?" World Bank Staff Paper 515

Faruqee, Rashid and Ethna Johnson (1984) "Health, nutrition and family planning in India" World Bank Staff Working Paper 507

Field, John (1983) "The importance of context: nutrition planning and development reconsidered", in D.S. McLaren (ed.)

Frisch, Rose (1975) "Demongraphic implications of the biological determinants of female fecundity" Social Biology 26, 4

Goldman, Noreen, Shea O. Rutstein and Susheela Singh (1985) "Assessment of the quality of data in 41 WFS surveys: a comparative approach", WFS Comparative Studies 44

Goldstein, Sidney (1972) "The influence of labour force participation and education on fertility in Thailand", Population Studies 26, 3

Goode, William (1963) World Revolution and Family Patterns N.Y. Free Press

Goody, J. (1976) Production and Reproduction, Cambridge, CUP

Gopalan, C. and A.N. Naidu (1972) "Nutrition and fertility", Lancet 2

Gordon, J.E. (1971) "Diarrhoeal disease of early childhood - worldwide scope of the problem", Annuals of the New York Academy of Science 176

Gordon, J.E., J.D. Wyon and W. Ascoly (1967) "Second year death rate in LDCs", American J. Medical Science 254

Graaf, H.J. (1979) "Literacy, education and fertility, past and present: a critical review", Population and Development Review 5, 1

Gray, R.H. (1981) "Birth intervals, post-partum sexual abstinence and child health", in Page and Lestaeghe (eds.)

Hein, Catherine (1984) "Jobs for the girls: export manufacturing in Mauritius", International Labour Review, 123, 2

Helman, Cecil (1984) Culture, Health and Illness, Bristol, Wright/PSG

Henry, Louis (1961) "Some data on natural fertility", Eugenics Quarterly 8, 2

Hill, Allan (ed.) (1983) Population, Health and Nutrition in the Sahel, London, KPI

Ho, Teresa J. (1979) "The time costs of child rearing in the rural Philippines", Population and Development Review 5, 4

Hobcraft, J., J.W. McDonald and S.O. Rutstein (1983) "Child-spacing effects on infant and early child mortality", Population Index, 49, 4

Hobcraft, J., J.W. McDonald and S.O. Rutstein (1985) "Demographic determinants of infant and eary child mortality: a comparative analysis" Population Studies 39

Humphrey, John (1984) "The growth of female employment in Brazilian Manufacturing industry in the 1970s", Journal of Development Studies, 20, 4

Husain, A.F.A. (1958) Employment of Middle Class Muslim Women in Dacca, Dacca

ILO, (1984) Women at Work

Jakobsen, O. (1978) "Economic and geographical factors influencing child malnutrition: a study from the Southern Highlands, Tanzania" Research Paper 52, Bureau of Resource Assessment and Land Use Planning, University of Dar es Salaam

Jayachandram, J. and G.K. Jarvis (1986) "Socio-economic, medical care and nutrition as determinants of infant mortality in LDCs" Social Biology 33, 3/4

Jelliffe, D.B. (1966) "The assessment of the nutritional status of the community" WGO Monograph Series 53

Jelliffe, D.B. and E.F.P. Jelliffe (1983) "Infant nutrition policy: a dyadic view" in D. S. McLaren (ed.)

Jonsson, Urban (1983), "A conceptual approach to the understanding and explanation of hunger and malnutrition in society" Paper presented to TFNC/UNICEF workshop, Iringa, Tanzania

Katz, Solomon (1977) "Towards a new concept of nutrition" in L.S. Greene (ed.) Malnutrition, Behaviour and Social Organsiation N.Y. Academic Press

Khan, A.A. and B.M. Gupta (1979) "A study of malnourished children in Children's Hospital, Lusaka" Tropical Paediatrics and Environmental Health Care 25, 2/3

Knodel, John and Etienne van do Walle (1979) "Lessons from the past: Policy implications of historical fertility studies" Population and Development Review

Kreager, Phillip (1980) Traditional Adoption Practices in Africa, Asia, Europe and Latin America, London, IUSSP

Kreager, Phillip (1986) "Demongraphic regimes as cultural systems", in D. Coleman and R.Schofield (eds.) The State of Population Theory, Oxford Blackwell

Kynch, Jocelyn and Amartya Sen (1983) "Indian women; well-being and survival", Cambridge Journal of Economics 7

Lampty, Peter and Fred T. Sai (1985) "Integratd health/nutrition/population programmes" in M. Biswas and P. Pinstrup-Anderson (eds.) Nutrition and Development, Oxford, OUP

Leaconck, Elaine and Helen I. Seba (eds.) (1986) Women's work: development and the division of labour by gender, Bergin and Gawey, Massachussets

Lechtig, A. et al (1975) "Effect of food supplementation during pregnancy on birthweight", Pediatrics 56

Leete, Richard (1987) "The post-demographic Transition in East and South East Asia: similarities and contrasts with Europe", Population Studies 41, 2

Leridon, H. (1977) Human Fertility: the Basic Components, Chicago, University Chicago Press

Lim, Linda Y./C. (1983) "Capitalism, imperialism and patriarchy: the dilemma of Third World woman workers in industrial factories" in Nash and Kelly (eds.)

Lipton, Michael (1983) "Demography and Poverty", World Bank Staff Working Paper 623

Llewellyn-Jones, D. (1965) "Severe anaemia in pregnancy (Malaysia)" Australian and New Zealand J. Obstetrics and Gynaecology 5, 4

Maletnlema, T.N. et al (1974) "Nutrition studies in pregnancy" East African Medical Journal 51, 7

MacCormack, Carol (1982) "Biological, cultural and social adaptation in human fertility and birth: a synthesis" in C.P. MacCormack (ed.) Ethnography of Fertility and Birth, London, Academic Press

MacFarlane, Alan (1978) "Modes of reproduction" in G. Hawthorn (ed.) Population and Development, London, Frank Cass

Mamdani, Mahmood (1972) The Myth of Population control: family, caste and class in an Indian Village, New York, MRP

Manser, M. and M. Brown (1980) "Marriage and household decision making: a bargaining analysis" International Economic Review 21

Mata, L. (1978) "Maternal factors and fetal growth" in Committee on Maternal Nutrition Maternal Nutrition and the Course of Pregnancy, Washington, National Academy of Science

McLaren, D.S. (ed.) (1983) Nutrition in the Community, Chichester, Wiley

Menken, Jane, T.J. Trussell, and Susan Watkins (1981) "The nutrition-fertility link: an evaluation of the evidence", Journal of Interdisciplinary History 9

Millman, Sata (1985) "Breastfeeding and infant mortality: untangling the complex web of causality", The Sociological Quarterly 26

Mosley, William H. (1985) "Will primary health care reduce infant and child mortality?", in J. Vallin and A.D. Lopez (eds.), Health Policy, Social Policy and Mortality Prospects Liege, IUSSP

Mosley, William H. (ed.) (1978) Nutrition and Human Reproduction, New York, Plenum.

Mosley, William H. and Lincoln C. Chen (eds.) (1984) Child Survival: strategies for research, Population and Development Review Supplement to Vol. 10

Mott, Frank L. (1982) "Infant mortality in Kenya: evidence from the Kenya Fertility Survey", WFS Scientific Reports 32

Mueller, Eva (1976) "The economic value of children in peasant agriculture" in R.G. Ridker (ed.), Population and Development

Murray, Colin (1980) Families Divided

Nash, June and Maria P. Fernandez-Kelly (eds.) (1983), Women, Men and the International Division of Labour, Albany N.Y., Suny Press

Nag, Moni, Ben White and Robert C. Peet (1978) "An anthropological approach to the study of the economic value of children in Java and Nepal", Current Anthropology 19

Newman, J. and C. McCulloch (1984) "A hazard rate approach to the timing of births", Econometrica 52

Notestein Frank (1945) "Population: the long view", in T.W. Schultz (ed.) Food For the World, Chicago

Omran, A.R. and C.C. Standley (eds.) (1981) Family Formation Patterns and Health: further studies, Geneva, WHO

Oshima, Harry (1983) "The industrial and demographic transitions in East Asia", Population and Development Review 9, 4

Page, Hilary and Ron Lesthaeghe (eds.) (1981) Child Spacing in Tropical Africa: Tradition and Change London, Academic Press

Palloni, Alberto and Sara Millman (1986) "Effects of inter-birth intervals and breastfeeding on infant and early childhood mortality", Population Studies 40

Pearson, Ruth (1986a) "The "greening" of women's labour: women workers in multinational companies in the First and Third World", in S. Allen (ed.) The Changing Experience of Employment, London, Macmillan

Pearson, Ruth (1986b) "Latin American Women and the New International Division of Labour: a reassessment", Bulletin of Latin American Research

Pebley, Anne R. and Paul W. Stupp (1987) "Reproductive patterns and child mortality in Guatamala", Demography 24, 1

Petros-Barvazian, A. and M. Behar (1978) "Problem identification: low birth weight - a major global problem" in G. Sterky and L Mellander (eds.) Birth Weight Distribution Geneva, WHO

Piepeier, K.B. and T.S. Adkins (1973) "The status of women and Fertility", Journal of Biosocial Science 5, 4

Polgar, Stephen (1972) "Population history and population policies from an anthropological perspective", Current Anthropology 13, 2

Population Reports (1984) "Healthier mothers and children through family planning", Series J 27 John Hopkins University, Baltimore

Prema, K (1980) "Effect of lactation on maternal nutrition and fertility", Proc. Nutrition Society of India 26

Preston, Samuel H. (1978a) "Mortality, morbidity and development" in Population and Development in the Middle East, Beirut, ECWA

Preston, Samuel H. (1980) "Causes and consequences of mortality declines in less developed countries during the twentieth century" in A. Easterlin (ed.) Population and Economic Change in Developing Countries, Chicago, University of Chicago Press

Preston, Samuel H. (ed.) (1978b) The Effects of Infant and Child Mortality on Fertility, New York, Academic Press

Preston, Samuel H. (ed.) (1982) Biological and Social Aspects of Mortality and the Length of Life, Liege, IUSSP

Puffer, R.R. and C.V. Serrano (1975) "Birthweight, maternal age and birth order; three important determinants in infant mortality", PAHO Scientific Publication 294, Washington

Razin, A; (1980) "Number, spacing and quality of children: a micro-economic viewpoint" in J. Simon and J. DaVanzo (eds.) Research in Population Economics 2

Ridker, R.G. (ed.) (1976) Population and Development: the search for selective interventions, Baltimore, John Hopkins University Press

Rindfuss, Ronald et al (1984) "Child spacing in Asia: similarities and differences", WFS Comparative Studies 29

Rodriguez, German and John Cleland (1981) "Socio-economic determinants of marital fertility in twenty countries: a multivariate analysis", WFS Conference 1980: Record of Proceedings Vol II, Voorburg, Netherlands

Royston, Erica (1982) "The prevalence of nutritional anaemia in women in developing countries: a critical review of available information", World Health Statistics Quarterly 35, 2

Royston, Erica and Jan Ferguson (1985) "The coverage of maternity care: a critical review of available information", World Health Statistics Quarterly 38, 3

Rosenzweig, Mark and R.E. Evenson (1977) "Fertility, schooling and the economic contribution of children in rural India: an econometric analysis", Econometrica 45, 5

Safa, Helen I. (1983) "Women, production and reproduction in Industrial Capitalism: a comparison of Brazilian and US Factory Workers" in Nash and Kelly (eds.)

Safilios-Rothschild, M. (1982) "Female power, autonomy and demographic change in the third world" in Anker et al (eds.)

Santow, Gigi and Susheela Singh (1984) "Infecundity, fecundability and the post-partum non-susceptible period" IUSSP/WFS Seminar on proximate determinants and fertlity trends and levels, London, May 1984

Saucier, J.F. (1972) "Correlates of the long post-partum taboo: a cross-cultural study" Current Anthropology 13, 2

Schultz, T.P. (1976) "Inter-relationships between mortality and fertility" in Ridker (ed.)

Scrimshaw, N.S., C.F. Taylor and J.E. Gordon (1968) Interaction of nutrition and infection Monograph Series No. 28, Geneva, WHO

Selvin, S. et al (1972) "The relationship between parental age and birth order with the percentage of low birth weight infants" Human Biology 44

Sen, Amartya K. (1972) "Control areas and accounting prices" Economic Journal 82

Sen, Amartya K. (1983) "Economics and the family" Asian Development Review 1, 2

Sen, Amartya K. (1985a) Commodities and Capabilities Amsterdam, North Holland

Sen, Amartya K. (1985b) Women, technology and sexual divisions" Trade and Development (UNCTAD) 6

Shama, Ursula (1980) Women, Work and Property in North West India, Tavistock, London

Simmons, George B. (1985) "Research work on the determinants of fertility" in Farooq and Simmons (eds.)

Singh, Susheela and John Casterline (1985) "The socioeconomic determinanats of fertility" in J.Cleland and J. Hobcraft (eds.)

Sirageldin, Ismail et al (eds.) Evaluating Population Policies London, Croom Helm

Smith, Richard M. (1981) "Fertility, economy and household formation in England over three centuries" Population and Develoment Review 7

Standing, G. (1976) Unemployment and Female Labour London, Macmillan/ILO

Taha, Salah (1977) Society, food and nutrition in the Gezira Khartoum, KUP

Tan, Jee Peng and Michael R. Haines (1984) Schooling and the demand for children: historical perspectives Washington, World Bank

Timur, Serim (1977) "Demographic correlates of women's education" IUSSP International Conference, Mexico 1977, Vol. III

Tyson, J.E. and A. Perez (1978) "The maintenance of infedundity in post-partum women" in W.H. Mosley (ed.)

United Nations (1975) Poverty, Unemployment and development policy: a case study of Kerala, New York

UNICEF (1984) The state of the world's children 1984, London, OUP

Van der Mark, Abraham (1983) in Nash and Kelly (eds.)

Van Ginneken, J.K. (1978) "The impact of prolonged breastfeeding on birth intervals and on post-partum amenorrhoea" in W.H. Mosley (ed.)

Visaria, Pravin (1980) "Poverty and living standards in Asia" Population and Development Review 6, 2

Ware, Helen (1984) "Effects of maternal education, women's roles, and child care on child mortality" in Mosley and Chen (eds.)

Warwick, Donald (1982) Bitter Pills, Cambridge, CUP

Weisner, T.S. and K. Gallinos (1977) "My brother's keeper: child and sibling caretaking" Current Anthropology 18,2

Wheeler, David (1985) "Female education, family planning, income and population: a long-run econometric model" in Birdsall (ed.)

White, Ben (1975) "Economic importance of children in a Javanese village" in M. Nag (ed.) Population and Social Organisation Hague

Whitehead, Anne (1981) "I'm hungry, Mum" The politics of domestic budgeting" in Young, Walkowitz and McCullagh (eds.) Of Marriage and the Market, London, CSE Books

Whitehead, Anne (1984) "Beyond the household? Gender and kinship-based resource allocation in a Ghanaian domestic economy" Paper at Conference on Conceptualising the Household, Harvard University, 1984

WHO and UNICEF (1978) Alma Ata 1978: Primary Health Care Geneva WHO

WHO and UNICEF (1986) Joint WHO/UNICEF Nutrition Support Programme Annual Report

Willis, Robert J. (1973) "A new approach to the theory of fertility" Journal of Political Economy Supplement to Vol 81

Winikoff, Beverly (1983) "The effects of birth spacing on child and maternal health" Studies in Family Planning 14, 10

Wong, Aline K. (1986) "Planned development, social stratification and the sexual division of labour in Singapore" in Leacock and Saba (eds.)

Wray, J.D. and A. Aguirre (1969) "Protein-calories malnutrition in Candelaria, Colombia. I. Prevalence; social and demographic causal factors" J. Tropical Pediatrics 15

Young, Kate (1983) "Not the church, not the state...." in K. Young (ed.) Serving Two Masters London, RKP

Youssef, Nadia H. (1982) "The inter-relationship between the division of labour in the household, women's roles and their impact of fertility" in Anker, Buvinic and Youssef (eds.)

Zachariah, K.C. and N. Patel (1984) "Determinants of fertility decline in India: an analysis" World Bank Staff Working Papers 649

PPR Working Paper Series

	Title	Author	Date	Contact
WPS109	Improving Power System Efficiency in the Developing Countries Through Performance Contracting	Philip Yates		
WPS110	Impact of Lower Oil Prices on Renewable Energy Technologies	E. Terrado M. Mendis K. Fitzgerald		
WPS111	Recent World Bank Activities in Energy	Industry and Energy Department		
WPS112	A Visual Overview of the World Oil Markets	Kay McKeough Jose Escay Sompheap Sem		
WPS113	Public Sector Pay and Employment Reform	Barbara Nunberg	October 1988	J. Cheeseman 61703
WPS114	Africa Region Population Projections 1988-89 edition	My T. Vu Eduard Bos Rodolfo A. Bulatao	October 1988	S. Ainsworth 31091
WPS115	Asia Region Population Projections 1988-89 edition	My T. Vu Eduard Bos Rodolfo A. Bulatao	October 1988	S. Ainsworth 31091
WPS116	Latin America and the Caribbean Region Population Projections 1988-89 edition	My T. Vu Eduard Bos Rodolfo A. Bulatao	October 1988	S. Ainsworth 31091
WPS117	Europe, Middle East, and North Africa (EMN) Region Population Projections 1988-89 edition	My T. Vu Eduard Bos Rodolfo A. Bulatao	October 1988	S. Ainsworth 31091
WPS118	Contract-Plans and Public Enterprise Performance	John Nellis	October 1988	R. Malcolm 61707
WPS119	Recent Developments in Commodity Modeling: A World Bank Focus	Walter C. Labys	October 1988	A. Daruwala 33716

PPR Working Paper Series

	Title	Author	Date	Contact
WPS120	Public Policy and Private Investment in Turkey	Ajay Chhibber Sweder van Wijnbergen	October 1988	A. Bhalla 60359
WPS121	Commercial Bank Provisioning Against Claims on Developing Countries	Graham Bird	October 1988	I. Holloman-Willia 33729
WPS122	Import Demand in Developing Countries	Riccardo Faini Lant Pritchett Fernando Clavijo	November 1988	K. Cabana 61539
WPS123	Export Supply, Capacity and Relative Prices	Riccardo Faini	November 1988	K. Cabana 61539
WPS124	International Macroeconomic Adjustment, 1987-1992: A World Model Approach	Robert E. King Helena Tang	November 1988	K. Adams 33738
WPS125	The Effects of Financial Liberalization on Thailand, Indonesia and the Philippines	Christophe Chamley Qaizar Hussain	October 1988	A. Bhalla 60359
WPS126	Educating Managers for Business and Goverment: A Review of International Experience	Samuel Paul John C. Ickis Jacob Levitsky	November 1988	E. Madrona 61711
WPS127	Linking Development, Trade, and Debt Strategies in Highly Indebted Countries	Ishac Diwan	November 1988	I. Diwan 33910
WPS128	Public Finances in Adjustment Programs	Ajay Chhibber J. Khalilzadeh-Shirazi	December 1988	A. Bhalla 60359
WPS129	Women in Development: Defining the Issues	Paul Collier	December 1988	J. Kious 33745
WPS130	Maternal Education and the Vicious			