ISSN 1471-0498

DEPARTMENT OF ECONOMICS

DISCUSSION PAPER SERIES

ESTIMATING FERTILITY RESPONSES TO EXPECTATIONS: EVIDENCE FROM THE 1958 BRITISH COHORT

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Number 80

October 2001

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Estimating Fertility Responses to Expectations: Evidence from the 1958 British Cohort*

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16th October 2001

Abstract

The aim of this work is to explore the relationship between unemployment and fertility. The hypothesis we investigate is that unemployment affects fertility decisions by influencing individual's expectations of future job opportunities and wage levels. A spell of unemployment may induce women to bring forward or delay the birth of their first child, depending on the relative strength of the income and substitution effects. Our results show that expectations of future wage levels and future job opportunities are relevant in explaining fertility patterns. In particular, higher expected wage levels encourage women to work more and delay childbirth. By contrast, more favourable expected job opportunities raise the hazard of a birth and, everything else equal, induce women to bring forward the event. In the latter case, a dominating income effect seems to be at work.

Key words: Fertility, Unemployment, Duration Analysis
JEL Classification: J13, J60, C41

*This research forms part of my D.Phil. dissertation and I would like to acknowledge the contribution of my supervisors Margaret Stevens and Steve Nickell for their help and advice. I would also like to thank Adriaan Kalwij and Francesca Bettio for helpful discussion. An earlier version of this paper was presented at the European Society of Population Economics Conference 2001. All mistakes are my full responsibility.

1 Introduction

Among the EU group of 15 countries shown in Table 1, Spain, Italy, Greece and Portugal were ranked among the five most fertile nations in 1977, while two decades later they clearly were in the least fertile tail of the distribution. By contrast, after a period of declining fertility between 1965 an 1975, Total Fertility Rates in many Northern European countries picked up again in the 1980s and have remained roughly stable since. The reversal of the traditional North-South opposition, whereby Southern rather than Northern European countries are now exhibiting the lowest levels of fertility, and the rapidity of the demographic transition experienced by Italy or Spain is puzzling demographers, sociologists and economists and is still calling for an explanation.

Table 1
Total Fertility Rates and Female Activity Rates in EU-15

	Total Fertility Rates		**Female Activity Rates**	
	1977	**1997**	**1977**	**1997**
Belgium	1.71	1.55	44.5	56.5
Denmark	1.66	1.75	64.7	75.1
Germany	1.40	1.36	51.2	61.8
Greece	2.27	1.30	33.3	47.5
Spain	2.65	1.15	33.0	47.1
France	1.86	1.71	53.0	59.8
Ireland	3.27	1.92	34.1	50.4
Italy	1.98	1.22	37.6	44.1
Luxembourg	1.45	1.71	39.3	60.9
Netherlands	1.58	1.57	31.9	62.2
Austria	1.65	1.36	54.3	65.1
Portugal	2.45	1.46	47.8	61.9
Finland	1.69	1.75	68.2	71.3
Sweden	1.65	1.52	70.0	74.5
United Kingdom	1.69	1.71	56.3	67.5

Source: *Statistics in Focus*, Eurostat; *Labour Force Statistics*, OECD

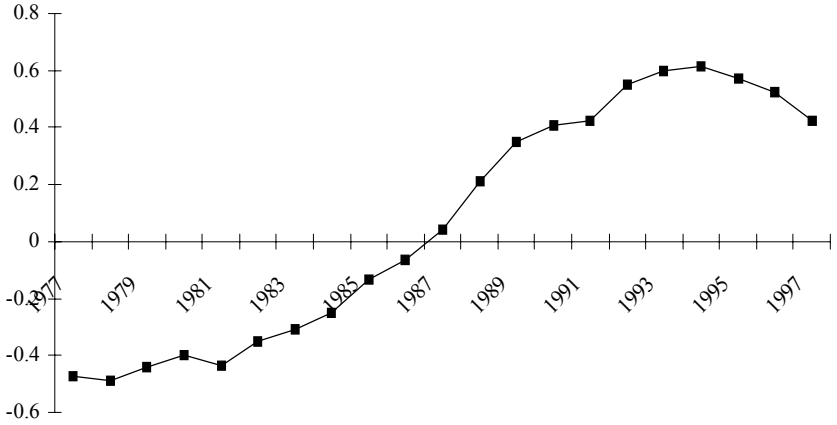
Demographers and sociologists tend to analyse the phenomenon in the light of the so-called "accelerated convergence hypothesis", which posits that those countries which entered the *second demographic transition*[1] later will experience

[1] The theory of the *second demographic transition* stresses the importance of social and economic factors as the main forces behind the fertility decline occurred in Western economies since the 1960s (Lestaeghe, 1983; and van de Kaa, 1987).

a faster and sharper transition during their catching-up period.[2] Recent contributions tend to reject the idea of convergence and focus instead on a combination of sociological and economic explanations, pointing out that an *exceptional* increase in participation has not been matched by changes in attitudes towards women's role in society. According to these studies, the lack of support women receive from institutions and from their own family members has favoured a particularly severe drop in fertility levels.[3]

The problem with the latter hypothesis is that female activity rates did not increase by any *exceptional* degree in Southern European countries and, excluding Portugal, women's participation remains the lowest among industrialised nations (see Table 1 for a comparison among the EU-15 countries). But, even if we were to accept the "accelerated convergence hypothesis" it would still not be clear why convergence did not occur with respect to activity rates. Economic models of fertility behaviour predict that increases in schooling levels and wage rates for women lead to increases in their labour supply and reductions in fertility. In fact, the existence of an inverse relationship between fertility and participation was theoretically established by Becker (1960), Becker and Lewis (1973) and Willis (1973), and empirically documented for the US by Butz and Ward (1979) and on a cross-country basis by Mincer (1985). But, as early as the mid-1980s, the sign of this cross-country correlation became much more volatile until it assumed positive values throughout the 1990s (see Graph 1).

Graph 1
Cross-country correlation between Total Fertility Rates and Female Activity Rates in EU-15



Source: *Statistics in Focus*, Eurostat; *Labour Force Statistics*, OECD

[2] See, for example, Chesnais (1992).
[3] See Delgado Perez and Livi Bacci (1992) and Golini (1994).

Much of the volatility of the relationship between fertility and participation across countries can be obviously attributed to the behaviour of Southern European birth rates and it is therefore clear that not only can we not explain the decline in fertility by looking at participation figures but, on the contrary, any element which contributes to explain the severity of the demographic transition occurred in Southern Europe will also help to clarify the forces behind the breakdown of the inverse relationship between fertility and female labour supply.

2 Previous studies

Since existing economic models and demographic theories fail to provide a convincing explanation for the reversal of the North-South fertility patterns, researchers started looking for aspects of the labour market which may have exacerbated the trade-off between fertility and participation. Two main hypotheses have recently been the object of economic investigation. In Italy, Del Boca (2001) argues that some institutional rigidities of Italian labour markets, namely the scarcity of part-time job opportunities coupled with an inadequate system of child care provision, simultaneously increase the costs of having children and discourage labour market participation of women. In Spain, Ahn and Mira (2001a, 2001b) suggest that high and persistent unemployment rates as well as the growing incidence of temporary contracts are responsible for the reversal of the sign of the cross-country correlation between fertility and participation and the postponement of marriage and childbearing among Spanish young couples.

The direction of research portrayed by Del Boca (2001) suggests that policies intended to favour the combination of women's career and their family responsibilities could go a long way in stimulating fertility and participation rates in Italy. The first element of her explanation requires the researcher to represent the costs of childbearing and childrearing taking into account the actual costs and the availability of child care facilities, an analysis which dates back to earlier work by Ermisch (1989) and Blau (1991). One of the difficulties with this approach is to find an empirical measure of these costs, as very often women combine formal and informal care services. This is especially important in Southern European countries, where the availability of informal care services is one of the features of the "extended family". Colombino (2000) and Chiuri (2000) have recently contributed to this area of research both theoretically and empirically but it is clear that much remains to be done before we can estimate the size of the effect these costs have on female labour supply and fertility behaviour.

The second aspect of the hypothesis put forward by Del Boca (2001) is that the scarce availability of temporary or part-time employment forces women to choose between full-time employment and non participation. But, even if it is possible to find evidence that women working part-time have higher fertility

rates than women working full-time, it is not clear that the absence of part-time opportunities will cause lower fertility rates, at least not in the theoretical framework proposed in Del Boca (2001). If women who have a higher preference for part-time jobs are subject to rationing and have to choose between full-time jobs and dropping out of the labour force, the effect on fertility rates is ambiguous. Those women who choose to work full-time will probably achieve lower fertility than originally desired but, for the same reason, those who choose not to work can potentially reach higher fertility levels than initially planned. The ambiguity is resolved by assuming that even women who do not work tend to reduce their family size anticipating that 'because entry positions are so hard to find, many children live at home until they find their first stable employment'.[4]

This is a very interesting consideration, because it implies the existence of a mechanism by which women form expectations about future labour market conditions and project these expectations onto their own offspring. Bettio and Villa (1998) consider the same mechanism but they relate it to the experience of unemployment, which not only reduces current income but also affects the level of income families consider necessary for the well-being of their children.[5] Because of its similarity with Easterlin's concept of relative income, the experience of unemployment is thought to create a magnified income effect.[6] Interestingly, both Del Boca (2001) and Bettio and Villa (1998) are implicitly suggesting that when job rationing is present and perceived to be a persistent feature of the labour market, individuals form their expectations about the future taking this information into account.

Ahn and Mira (2001b) empirically test the hypothesis that the emergence of high and persistent rates of unemployment in Europe might have contributed to the acceleration of the fertility decline and might have been responsible for the reversal in the sign of the correlation between Total Fertility Rates and Female Participation Rates across OECD countries. Using the Hodrick-Prescott filter, they compute the cyclical component of unemployment rates and fertility rates for the OECD countries and find that in 15 out of 21 countries fertility is highly procyclical. Their work constitutes the first piece of evidence of the existence of a relationship between unemployment and fertility. But, since macroeconomic analysis of fertility behaviour greatly limits the possibility of insightful interpretation, they turn to micro data in order to formulate and test a more articulate hypothesis of the role on unemployment on fertility decisions.

Using a very large sample of Spanish families drawn from the Spanish Socio-demographic Survey, Ahn and Mira (2001a) estimate the effect of men's labour market status and past experience of unemployment on the probability of marriage and on different birth parities. In defining men's labour market status,

[4] See Del Boca (1999), p. 3.

[5] In fact we can consider it a more general approach, as they are considering employment rationing and do not distinguish between full-time or part-time job opportunities.

[6] To those not familiar with the Italian labour market it might seem rather excessive to imagine that parents project their own labour market experience onto their children and take this effect into account when planning their family size. However, this is not an unrealistic scenario when the public system does not provide any support to the young unemployed and the family network must act as a substitute.

they distinguish full-time/permanent employment from part-time/temporary contracts and unemployment status. They find that men who are currently experiencing an unemployment spell and those who are engaged in part-time or temporary work are likely to delay family formation. The similarity between the estimated behaviour of unemployed men and men engaged in part-time/temporary work is important as it leads them to suggest that the effect they are estimating is not simply an income effect but may reflect the 'enormous uncertainty regarding future careers and income'.[7] Moreover, they explicitly stress the importance of expectations when changes in labour market conditions are perceived to have a permanent nature. To reconcile their hypothesis with the evidence that in Spain unemployment declined during the second half of the 1980s while fertility rates continued to fall, Ahn and Mira (2001a) argue that the fact that unemployment rates remained very high changed people's expectations about future job market prospects with negative consequences for fertility decisions.

More recently, Fraser (2001) provides the first attempt to model the effect of uncertainty, as measured by the second moment of the income distribution, on fertility decisions. Drawing upon the theory of optimal choice under uncertainty with two-argument utility functions[8], he is able to show that - under plausible assumptions - a mean-preserving increase in income uncertainty decreases the demand for children, if children are a normal good. The motivation of his theoretical model is based on the empirical finding that in the UK and the US the standard deviation of the transitory component of income is negatively and statistically significantly correlated with contemporaneous birth rates.

Our analysis is closely related to the literature reviewed above and, in what follows, we will suggest and empirically test the hypothesis that current fertility decisions are affected not only by current economic conditions, but also by expectations of future labour market outcomes. In particular we are interested in analysing how past labour market experience affects expectations of future earnings and job opportunities and how these expectations influence the probability of a first birth. Expectations of future wages are obtained using a human capital equation while expectations of future job opportunities are proxied by the probability of being employed conditional on participation. All the expectations are estimated using only information available to individuals at each point in time. Finally, using an appropriately specified hazard model, we estimate the role that these time-varying expectations play on the timing of the first birth. In contrast to Ahn and Mira (2001a), we emphasize mainly unemployment experience and take into account women's expectations of future wages and employment opportunities. It is clear that in our framework a change in the individual's experience of unemployment may induce the woman to bring forward or delay the birth of her first child, depending on the relative strength of the income and substitution effects involved.

The next section presents the theoretical framework which supports our em-

[7] See Ahn and Mira (1999a), p. 5.
[8] See Dardanoni (1988).

pirical question, while section 4 describes our empirical specification of individuals' expectations on future wages and job opportunities. The characteristics of our dataset and the variables used are described in section 5. Our sample is derived from the *National Child Development Study*, a longitudinal survey which collects working and family histories of a specific cohort of individuals born in Great Britain in 1958. Although this implies that our analysis is confined to British women, the richness of the information collected in this survey offers an extremely valuable opportunity to test our hypothesis. Section 6 presents the results of our estimation, first discussing how past labour market experience affects expectations of future earnings and future employment opportunities and then how these expectations affect the probability of the first birth. Section 6 concludes offering our interpretation of the findings and indicating areas in which further research is needed.

3 The theoretical model

Life-cycle models are now rather common in the economic literature on fertility. They have gradually grown richer in order to incorporate the effects of fertility decisions on the mother's human capital investment or on the probability of divorce, while in other cases they have focused on the stochastic nature of the reproduction process.[9] Relatively few specifications, though, take into account the possibility that parents may face uncertainty about future income and wage levels or even employment opportunities. Those who have tried to model these features have preferred a finite-horizon dynamic programming approach, representing parents' choices in a sequential decision setting and solving the household's maximization problem via backward induction methods. However, the resulting equations are rather complex functions of future variables, the models are generally difficult to estimate and their empirical predictions are still rather unsatisfactory.[10]

The approach we adopt in this work is to extend one of the existing life-cycle models of family behaviour in order to allow for the uncertainty women face when thinking about the future.[11] We derive the first order conditions, but do not attempt to go further in order to avoid too many restrictions on the theoretical framework. Therefore, the empirical specification presented in section 4 is only a reduced form and this is because at this stage we are mainly interested in testing the hypothesis that women's expectations about future wage levels and future probability of having a job may affect their current fertility decisions rather than estimating a structural model.

Assume that the first decision occurs at time 1 and that the time horizon terminates at T. At each interval of time, parents derive utility from a com-

[9] See Hotz et al. (1997) for an extensive review.

[10] See Heckman and Willis (1975), Wolpin (1984), Rosenzweig and Schultz (1985), Newman (1988), Montgomery (1988), Hotz and Miller (1993), Ahn (1995), Kalwij (1999) and Francesconi (2000).

[11] The original model is in Walker (1995).

posite market good, x_t, and child services, c_t, which are assumed to be directly proportional to the number of births observed up to time t, n_t. The household's utility function is intertemporally strongly separable and also contemporaneously separable in its arguments, so that parents maximise:

$$\underset{x_{t+s},b_{t+s}}{Max} \; E_t\left[\sum_{s=0}^{T-t}\beta^s\left(u\left(x_{t+s}\right)+\nu\left(n_{t+s}\right)\right)\right], \tag{1}$$

where $u\left(\right)$ and $\nu\left(\right)$ are strictly increasing and concave functions of x_{t+s} and n_{t+s} respectively, and β is the parents' rate of time preference. Uncertainty about future events is considered by taking expectations over future realizations of utility. Children are a time intensive good and, therefore, the mother's time constraint can be written as:

$$f\left(\underline{b}_{t+s}\right)+h_{t+s}=1, \tag{2}$$

where $\underline{b}_{t+s}$ is a $T\times 1$ vector whose first $t+s$ elements can assume value 0 or 1 depending on whether or not a birth occurs in the corresponding period and all the other elements are zero.[12] Equation (2) above says that women can spend their time either working in the labour market, h_{t+s}, or looking after children, $f\left(\underline{b}_{t+s}\right)$. Here we do not consider leisure, partly because we focus on fertility choices but also because drawing a strict dichotomy between leisure and time spent with children is perhaps not possible. The function $f\left(\underline{b}_{t+s}\right)$ takes into account the fact that children of different ages demand different proportions of the mother's time. These different levels of demand, ϕ^j - where j denotes the age of the child - are assumed to be exogenous:

$$f\left(\underline{b}_{t+s}\right)=\sum_{j=0}^{M}\phi^j b_{t+s-j}. \tag{3}$$

M represents the maximum age at which children require parental care and in the discussion that follows we assume that M is strictly greater than $T-t$, the interval of time relevant for the fertility decisions.

Equation (3) represents the mother's time expenditure on children.[13] In order to represent the direct cost of children we assume that the inputs to the production of child quality are care, c^j_{t+s}, and direct expenditures on children, m^j_{t+s}, and also that parental care and non-parental care are perfect substitutes:

$$g\left(\underline{b}_{t+s}\right)=\sum_{j=0}^{M}m^j_{t+s}b_{t+s-j}+h_{t+s}\sum_{j=0}^{M}c^j_{t+s}b_{t+s-j}.$$

[12] Assuming that the b's are discrete choice variables is not a necessary feature of the model and none of its implications will depend on it. In fact it is usual to assume some kind of restriction on the number of births and here we are excluding the possibility of multiple births or of more than one birth in each interval of time, which will roughly be one year.

[13] Note that since the parameters ϕ^j are completely exogenous the woman's participation rate is completely determined by her fertility decisions.

The direct implication of the latter assumption is that when the woman is working the household spends more on non-parental care as opposed to the case where the woman is not working. This is a way of representing the cost of rearing children in terms of the mother's forgone opportunities in the labour market.

The period-by-period budget constraint is given by:

$$A_{t+s+1} = A_{t+s}\,(1+r) + w_{t+s}h_{t+s} - g\left(\underline{b}_{t+s}\right) - x_{t+s}, \tag{4}$$

where we normalise with respect to the price of market goods. A_{t+s} represents the discounted sum of the flow of income deriving from initial assets and the father's earnings while r is the constant interest rate.[14]

As in Walker (1995), we assume that wages are given by the market's return to human capital, k_{t+s}:

$$w_{t+s} = k_{t+s}\omega_{t+s}, \tag{5}$$

where ω_{t+s} represents an exogenous productivity shock that affects the demand for labour. The equation for human capital is given by:

$$k_{t+s} = \exp\left(\mu_0 + \mu_1 \sum_{l=1}^{t+s-1} h_l + \mu_2 S_{t+s} + \mu_3 A\right), \tag{6}$$

here the summation over the h_l's represents experience in the labour market and the returns to education and to ability - which is supposed not to change over time - are captured by the coefficients μ_2 and μ_3 respectively.

Taking logs of (5), using (6), gives us the familiar earnings function:

$$\ln w_{t+s} = \mu_0 + \mu_1 \sum_{l=1}^{t+s-1} h_l + \mu_2 S_{t+s} + \mu_3 A + \varepsilon_{t+s}, \tag{7}$$

where,

$$\varepsilon_{t+s} = \ln \omega_{t+s}. \tag{8}$$

The set of conditions from (2) to (8) together with the expression in (1) completely define the household intertemporal maximization problem. Using (4) to substitute x_{t+s} in (1) and writing explicitly some of the representative terms of the summation we can write:

[14] Here we are implicitly assuming not only that the father's earnings are completely exogenous, but that they grow at a constant rate $(1+r)$:

$$Y_{t+s} = (1+r)Y_{t+s-1}. \tag{5a}$$

The latter assumption is not restrictive in any respect, but it simplifies our following discussion. Another assumption implicit in (4) is that capital markets are perfect, so that parents can borrow and lend at the market interest rate.

$$\underset{A_{t+s},b_{t+s}}{Max}\ E_t\left[...+\beta^{s-1}uA_{t+s-1}(1+r)+w_{t+s-1}h_{t+s-1}-\right.$$
$$-\sum_{j=0}^{M}m_{t+s-1}^{j}b_{t+s-1-j}-h_{t+s-1}\sum_{j=0}^{M}c_{t+s-1}^{j}b_{t+s-1-j}-A_{t+s})+$$
$$+\beta^{s-1}\nu\left(\sum_{l=1}^{t+s-1}b_l\right)+\beta^{s}u(A_{t+s}(1+r)+w_{t+s}h_{t+s}-$$
$$-\sum_{j=0}^{M}m_{t+s}^{j}b_{t+s-j}-h_{t+s}\sum_{j=0}^{M}c_{t+s}^{j}b_{t+s-j}-A_{t+s+1})+$$
$$\left.+\beta^{s}\nu\left(\sum_{l=1}^{t+s}b_l\right)+...\right]. \tag{9}$$

The first order conditions for this problem are given by:

$$\beta^{s}(1+r)E_t\left[u'_{t+s}\right]=\beta^{s-1}(1+r)E_t\left[u'_{t+s-1}\right], \tag{10}$$

for $s=1,2,...,T-t$, where u'_{t+s} represents the derivative of $u\left(\right)$ with respect to x_{t+s}, and:

$$E_t\left[\sum_{j=0}^{T-(t+s)}\beta^{s+j}\left\{\nu'_{t+s+j}+u'_{t+s+j}\left[w_{t+s+j}\frac{\partial h_{t+s+j}}{\partial b_{t+s}}+\right.\right.\right.$$
$$\left.\left.\left.+\frac{\partial w_{t+s+j}}{\partial b_{t+s}}h_{t+s+j}-\frac{\partial g_{t+s+j}}{\partial b_{t+s}}\right]\right\}\right]=0, \tag{11}$$

for all $s\geq 0$, where ν'_{t+s+j} represents the derivative of $\nu\left(\right)$ with respect to n_{t+s}.[15] Indicating explicitly the partial derivatives, we can see that (9) becomes:

$$E_t\left[\sum_{j=0}^{T-(t+s)}\beta^{s+j}\nu'_{t+s+j}\right] \quad = \quad E_t\left[\sum_{j=0}^{T-(t+s)}\beta^{s+j}u'_{t+s+j}\times\right.$$

[15] It is important to note that here we are considering b_{t+s} as a continuous variable whereas before we assumed that it could only take values of 0 or 1. In this context we can legitimately derive (9) with respect to b_{t+s} bearing in mind that the value we will obtain for b_{t+s} is only an approximation for its true value.

$$\times \left\{ w_{t+s+j} \left(\phi^j + h_{t+s+j}\mu_1 \sum_{l=0}^{j-1} \phi^l \right) + m^j_{t+s+j} \right.$$
$$\left. -\phi^j \sum_{l=0}^{M} c^l_{t+s+j} b_{t+s+j-l} + h_{t+s+j} c^j_{t+s+j} \right\} \Bigg] \quad (12)$$

and, since (12) holds for all $s \geq 0$, we can rewrite it for $s = 0$:

$$E_t \left[\sum_{j=0}^{T-t} \beta^j \nu'_{t+j} \right] = E_t \left[\sum_{j=0}^{T-t} \beta^j u'_{t+j} \times \right.$$
$$\times \left\{ m^j_{t+j} + h_{t+j} c^j_{t+j} - \phi^j \sum_{l=0}^{M} c^l_{t+j} b_{t+j-l} + \right.$$
$$\left. \left. + \phi^j w_{t+j} + w_{t+j} h_{t+j} \mu_1 \sum_{l=0}^{j-1} \phi^l \right\} \right]. \quad (13)$$

Equation (13) tells us that the demand for child services depends on the current and expected future price of children. Commenting on the right-hand side of the expression above, we can say that the first and the second term represent direct expenditures on the marginal child (as market goods and non-parental care respectively), the third term represents the reduction in non-parental care expenditure on the other children which derives from having one more child, the fourth term captures the mother's forgone earnings and the last summation can be interpreted as the value of the mother's forgone human capital accumulation due to child raising.[16] Deriving a precise expression for the conditional demand for children would require an *ad hoc* specification of the functional forms of $u()$ and $\nu()$. Usually, these problems cannot be always solved analytically and here we limit our interpretation to suggest that (13) provides some support for the hypothesis that fertility choices depend on the expected future values of the woman's wage and her expected future job opportunities even though, strictly speaking, the model above does not consider any constraint on the labour supply of the individual.[17]

4 The empirical model

In the first stage of our analysis, we estimate the individuals' expectations about future wages and future probabilities of being employed conditional on partici-

[16] The third term is the only negative term in (13) and its negative sign derives from the fact that as a woman has one more child, she spends less time in the labour market and will need to purchase less child-care as clearly indicated in (**??**). Informally, this term captures the existence of positive economies of scale in the rearing of children. However, if we think that economies of scales are an important element of the analysis, then it would be more appropriate to explicitly model this feature in the production function.

[17] In fact the labour supply of the woman is completely determined by her fertility decisions, as we saw in equation 2. See also footnote 12.

pation, using the subjects' labour market experience, education level and ability, together with an indicator of the demand for labour. We allow these expectations to change through time, as individuals accumulate more information and experience. In the second stage, we use these estimated expectations, evaluated at different points in time, as time-varying covariates of the duration model and study their effect on the timing and the probability of observing a birth event.

The theoretical specification of the model has already suggested what variables might affect future wages. Taking the human capital equation in (7) we can write its empirical specification as:

$$\ln w_{i,t+s} = \mu_{10} + \mu_{11} \frac{\sum_{l=1}^{t+s-1} h_{i,l}}{t+s-1} + \mu_{12} S_{i,t+s} + \mu_{13} A_i + \ln \omega_{t+s} + u_{1i}, \quad (14)$$

where the subscript i refers to the i_{th} individual and $t+s$ represents a point in the future, s periods ahead of the current period t. The only difference with respect to equation (7) is that the second term on the RHS of (14) represents experience in the labour market calculated as the number of months spent in full-time employment, part-time employment, unemployment and out of the labour force over the total period under observation.[18] The third term represents the individual's level of schooling, while the fourth is a measure of individual-specific ability, which is assumed to remain fixed with time. The fifth term captures exogenous shocks, which affect the marginal productivity of labour. The shocks ω_{t+s} are assumed to be log-normally distributed, so that their logarithm is normally distributed around a zero mean. We assume no serial correlation between shocks at different periods in time. The last term in (14) captures unobservable individual characteristics and measurement errors as in a standard regression model.[19]

Unfortunately, if we tried to estimate (14) through OLS we would obtain biased and inconsistent estimates of the parameters. The wage at $t+s$ is observed only for women employed at time $t+s$ and this is the source of a well known selection bias, especially relevant in the empirical work on female labour supply. The solution to this problem is to correct our estimates using the two-step Heckman procedure.[20]

A convenient way to address the problem of selection bias is to specify a more general framework in which the wage equation is linked to a participation equation through the distribution of the time-invariant error terms.

To simplify our notation, we rewrite (14) as:

$$y_{1i,t+s} = \boldsymbol{\mu}_1' \mathbf{w}_{1i,t+s} + \ln \omega_{t+s} + u_{1i}, \quad (15)$$

where we have defined:

[18] We also distinguish between months spent in full-time education and months spent in other out of the labour force states.

[19] We are assuming that the distribution of $u_1$is time invariant, although we are aware that this would not strictly apply to measurement errors.Unobserved individual characteristics are more likely to remain fixed through time.

[20] See Heckman (1979).

$$y_{1i,t+s} = \ln w_{i,t+s}. \tag{16}$$

Now consider the participation equation:

$$y^*_{2i,t+s} = \boldsymbol{\mu}_2' \mathbf{w}_{2i,t+s} + \theta \ln \omega_{t+s} + u_{2i}, \tag{17}$$

where we do not directly observe $y^*_{2i,t+s}$, but only a discrete variable with values 0 or 1 depending on whether the subject is employed or not at time $t+s$. The vector of explanatory variables in (17), $\mathbf{w}_{2i,t+s}$, contains all the variables which we can observe and which are likely to influence the woman's decision to participate in the labour market. It includes metropolitan counties dummies to proxy for local labour market conditions and for identification purposes, a dummy variable with value 1 when the woman is living with the partner, and her wage, appropriately instrumented by the variables which appear also in $\mathbf{w}_{1i,t+s}$ and which we have already mentioned.

As standard, we assume that u_1 and u_2 are distributed according to a bivariate normal:

$$u_1 \mid u_2 \sim N_2 \left[\frac{\sigma_1}{\sigma_2} \rho u_2, \sigma_1^2 \left(1 - \rho^2\right) \right], \tag{18}$$

where σ_1 and σ_2 represent the standard errors of u_1 and u_2 respectively and ρ is the correlation coefficient.

In order to represent expectations at time t of wages at time $t+s$ we need to consider the information set available to each individual i at time t. Taking expectations at time t of (15) and (17) results in the following expressions:

$$E_t \left[y_{1i,t+s} \right] = \boldsymbol{\mu}_1' \mathbf{m}_{1i,t} + u_{1i}, \tag{19}$$

$$E_t \left[y^*_{2i,t+s} \right] = \boldsymbol{\mu}_2' \mathbf{m}_{2i,t} + u_{2i}, \tag{20}$$

where we are assuming that individuals hold rational expectations with respect to the productivity shocks ω_{t+s}:

$$E_t \left[\ln \omega_{i,t+s} \right] = 0, \tag{21}$$

that the level of schooling the individual expects to have at time $t+s$ does not differ from the level she has already achieved at time t:

$$E_t \left[S_{i,t+s} \right] = S_{i,t} \tag{22}$$

and the change in notation is necessary as we assume that individuals project into the future their past experience in the labour market using all the available information at time t:

$$E_t \left[\frac{\sum_{l=1}^{t+s-1} h_{i,l}}{t+s-1} \right] = \frac{\sum_{l=1}^{t} h_{i,l}}{t}. \tag{23}$$

This implies that our expression for expected future values of the wage at $t+s$ when the individual uses only information available at time t is:

$$E_t\left[\ln w_{i,t+s}\right] = \mu_0 + \mu_1 \frac{\sum_{l=1}^{t} h_{i,l}}{t} + \mu_2 S_{i,t} + \mu_3 A_i + u_{1i} \tag{24}$$

Using the model specified by the equations (18), (19) and (20), we can apply the standard two-step Heckman procedure and obtain unbiased estimates of $\boldsymbol{\mu}_1'$, which will be used to compute the expected future wages for both working and non-working women.[21]

Using a procedure similar to the one just described, we calculated the expected future conditional probability of being employed at time $t+s$ given participation at time $t+s$ and information available at time t. The only additional point to stress here is that we restrict our sample to those women who are still in the labour force at time $t+s$. That is, we estimate the probability of being employed at time $t+s$ with respect to the characteristics of those individuals who are actively participating in the labour market at the same date. This is in order to represent the future job opportunities a woman could expect had she continued to participate in the labour market. In order to obtain estimates of these 'forecasted' values, we can use a simple Binomial Probit model.

We assume that the conditional probability of being employed at time $t+s$ is a function of demand as well as supply side factors and a normally distributed error term, which accounts for unobservables. Before considering the expectations at time t, we can write:

$$z^*_{i,t+s} = \boldsymbol{\delta}'\mathbf{v}_{i,t+s} + \epsilon_{i,t+s}, \tag{25}$$

where the dependent variable in (25) is not observed in our data and what we actually see is a discrete variable, $z_{i,t+s}$, which assumes values 0 or 1 depending on whether the subject is employed or not at time $t+s$. The vector of explanatory variables in (25) contains variables related to the labour force experience of the individual and metropolitan counties dummies, while it does not include any information on the cohabiting status of the subject as the latter is mainly thought to influence the participation decision and here we consider the participation decision as given.

Using the same assumptions as before and evaluating the expectations at time t of (25), we can write:

$$E_t\left[z^*_{i,t+s}\right] = z^{*t}_{i,t+s} = \boldsymbol{\delta}'\mathbf{v}_{i,t} + \xi_i, \tag{26}$$

and, since what we actually observe is the employment status of the individual at time $t+s$, our probability model will be:

$$z^t_{i,t+s} \begin{cases} = 1 \quad if \quad \xi_i > -\boldsymbol{\delta}'\mathbf{v}_{i,t} \\ = 0 \quad if \quad \xi_i \leq -\boldsymbol{\delta}'\mathbf{v}_{i,t} \end{cases} . \tag{27}$$

Under the assumption that the error term is normally distributed, we can specify the appropriate probabilities, write the likelihood function and compute

[21] The estimated parameters will still be inefficient because of the presence of heteroscedasticity but the standard errors can be easily calculated to derive the appropriate significance levels.

the estimated expected future probabilities of being employed conditional on participation for each woman.[22] We then repeat the same procedure for each interval of time between t and $t+s-1$ and calculate our time-varying expectations.

Having represented the expectations of the woman's future wage and her expected employment opportunities, we turn to the specification of expected partner's earnings. By assumption, partner's earnings are considered a source of household income when the woman is cohabiting with her partner. The problem we face is twofold: women cohabiting with their partners at time $t+s$ might not have had a partner at time t, while those who do not have a partner at time $t+s$ might have been cohabiting at time t.

Therefore, we first regress the partner's wage at time $t+s$ on a vector of observable (and time-varying) characteristics of the woman:

$$E\left[\ln w^{p}_{i,t+s} \mid c_{i,t+s}=1\right] = \boldsymbol{\pi}'\mathbf{q}_{i,t+s} + \varphi_i, \tag{28}$$

where $\ln w^{p}_{i,t+s}$ is the natural logarithm of the partner's weekly earnings, $c_{i,t+s}$ is a variable with value 1 if the woman is cohabiting with her partner at time $t+s$ and 0 otherwise, $\mathbf{q}_{i,t+s}$ contains a woman's observable characteristics including regional dummies, qualification, ability, her father's social class and her father's years of schooling; φ_i is a time-invariant error term normally and independently distributed across individuals. Taking expectations at time t of (28) gives:

$$E_t\left[\ln w^{p}_{i,t+s} \mid c_{i,t+s}=1\right] = \boldsymbol{\pi}'\mathbf{q}_{i,t} + \varphi_i. \tag{29}$$

Equation (29) represents expectations at time t of partner's earnings at time $t+s$ conditional on the woman living with a partner at time $t+s$. We use the estimated coefficients obtained from (29) to calculate an expected value of partner's earnings for all women, independently of their cohabiting status at time $t+s$.

Then, by means of a Binomial Probit, we compute for each woman the probability of cohabiting with a partner at time $t+s$, conditional on her cohabiting status and a vector of observable characteristics observed at time $t, t+1, ..., t+s-1$. The latent variable indicating the value of cohabitation is not observed, but it can be represented by:

$$c^{*}_{i,t+s} = \boldsymbol{\theta}'\mathbf{n}_{i,t+s} + \psi_i, \tag{30}$$

which, after taking expectations at time t, becomes:

$$E_t\left[c^{*}_{i,t+s}\right] = c^{*t}_{i,t+s} = \boldsymbol{\theta}'\mathbf{n}_{i,t} + \psi_i, \tag{31}$$

where $\mathbf{n}_{i,t}$ is a vector of observable attributes of the woman, including her region of residence, qualification, ability, father's social class and cohabiting status and the error term ψ_i is assumed to be normally distributed and independent across time and observations.

[22] Note that in (27) the dependent variable has a subscript t in order to indicate that we are considering the infomation set of the individual at time t.

We do not observe $c^*_{i,t+s}$, but its realization at time $t+s$, so we can write our probability model as:

$$c^t_{i,t+s} \begin{cases} = 1 & if \quad \psi_i > -\boldsymbol{\theta}' \mathbf{n}_{i,t} \\ = 0 & if \quad \psi_i \leq -\boldsymbol{\theta}' \mathbf{n}_{i,t} \end{cases} . \tag{32}$$

Under the further assumption that ψ_i and φ_i are not correlated we can then write the expected partner's earnings as:

$$E_t \left[\ln w^p_{i,t+s} \right] = E_t \left[\ln w^p_{i,t+s} \mid c_{i,t+s} = 1 \right] \times E_t \left[\Pr \left(c_{i,t+s} = 1 \right) \right], \tag{33}$$

where:

$$E_t \left[\Pr \left(c_{i,t+s} = 1 \right) \right] = c^t_{i,t+s}. \tag{34}$$

In order to estimate the effect of these time-varying expectations on the probability of having a birth, we first adopt a semi-parametric approach and estimate a Cox Proportional Hazard regression model.[23] The hazard rate for the i_{th} individual is represented by:

$$h(t \mid \mathbf{x}_{i,t-1}) = h_0 \left(t \right) \times \exp \left(\mathbf{b}' \mathbf{x}_{i,t-1} \right) \tag{35}$$

where t represents the duration before the event of a birth, $h_0(t)$ is the baseline hazard, and $\mathbf{x}_{i,t-1}$ is a vector of covariates including the expectations of future wages, future employment opportunities, future partner's earnings and other control variables including the labour force status of the woman and a categorical variable expressing her preferences for family size. All the covariates in (35) are lagged one year in order to consider the effect of expectations on the decision to have a child when the decision is made rather than when the outcome is observed.[24]

The Cox Proportional Hazard Model does not impose restrictions on the form of the baseline hazard, but it does not use the information efficiently, especially when time-varying covariates are included. Nonparametric and semi-parametric methods make comparisons between subjects at times when failures occur and, as a consequence, if no failures occur during a certain interval of time the information provided by the covariates is virtually discarded. In order to allow for a more efficient use of the information provided by the time varying covariates, parametric duration models are often estimated. We have therefore specified also a parametric model, choosing a Weibull distribution for the baseline hazard, so that:

$$h_o \left(t \right) = p t^{p-1} \exp \left(a \right), \tag{36}$$

where a and p are parameters which will be estimated together with $\mathbf{b}$.

Since we observe the working and family histories of a cohort of British women until they reach 33 years, we limit our analysis to the estimation of

[23] See Cox (1962).

[24] Considering the control variables one year before the event is roughly equivalent to considering the hazard of conception rather than the hazard of an actual birth.

the effect of expectations of future economic variables on the probability of observing the birth of the first child. Considering the transition between the first and the second birth or even higher parities[25] would require information on the complete fertile history of this sample of individuals and the treatment of unobserved heterogeneity correlated across different spells.[26] An adequate account of these issues is not feasible in our circumstances, and is left for future work.[27]

5 Data and sources

Our sample is derived from the *National Child Development Study* (hereafter NCDS), a continuing longitudinal study which takes as its subjects all those who were born in the week between 3rd and 9th March 1958 in Great Britain.[28] The NCDS was originally launched as a Perinatal Mortality Survey that, together with the *National Survey of Health and Development* (started in 1946) and the *British Cohort Study* (started in 1970), was part of a larger project aimed at examining the social and obstetric factors associated with stillbirth and death in early infancy. Each of these Perinatal Mortality Surveys developed into a longitudinal study and today they represent an extremely valuable opportunity to investigate the social and economic patterns that have influenced the lives of three overlapping generations of people in Britain.

Since 1958 there have been five major follow-up studies in order to trace all the 17,000 members of the NCDS and monitor their physical, educational and social development. These follows-up were carried out by the National Children Bureau in 1965 (NCDS1: when the cohort was aged 7), in 1969 (NCDS2: when the cohort was aged 11), in 1974 (NCDS3: when the cohort was aged 16) and in 1981 (NCDS4: when the cohort was aged 23) and by the Social Statistics Research Unit, City University, in 1991 (NCDS5: when the cohort was aged 33).

The fifth follow-up, the NCDS5, introduces various innovative features. Before 1991, most of the work on the NCDS mainly linked early characteristics of the individuals - for example, literacy or numeracy scores - to adult achievements. This sweep of the survey photographs the cohort members at 1991 and collects their memories of the past, allowing the researcher to identify particular circumstances at the age of 33 and trace the antecedents of these outcomes throughout the records of their experience.[29]

[25] See Newman and McCulloch (1984).

[26] See Heckman and Walker (1990).

[27] The most recent wave of the *National Child Development Study*, which will collect information on the same individuals at 41, took place in 1999-2000. Data are expected to be released in August 2001.

[28] See Shepherd (1995) for a complete description of the Survey.

[29] See Ferri (1993).

Table 2

National Child Development Study

All children born in Great Britain between 3rd and 9th March 1958 (including immigrants 1958-1974)

PMS 1958	**NCDS1 1965**	**NCDS2 1969**	**NCDS3 1974**	**EXAMS 1978**	**NCDS4 1981**	**NCDS5 1991**
Birth	7 years	11 years	16 years	20 years	23 years	33 years
17,733[a]	16,833	16,835	16,915	16,906	16,457	16,500
Parents	Parents	Parents	Parents			
	School	School	School	School		
	Tests	Tests	Tests			
Medical	Medical	Medical	Medical			
		Subject	Subject		Subject	Subject
			Census		Census	
						Spouse / Partner
						Children
17,414[b]	15,468	15,503	14,761	14,370	12,537	11,400

a: target sample; b: achieved sample

Approximately 11,000 individuals completed the retrospective questionnaire 'Your Life Since 1974' (see Table 3) and 5,717 of these were women. They constitute our reference sample and some of the variables like the interval of time before the birth of the first child, the presence of a partner and the woman's experience in the labour market are derived from this source. Other variables, like the woman's hourly wage, her husband's weekly earnings, her participation, employment and cohabiting status at 1991 together with information about the highest qualification obtained at the age of 33, were derived from the Cohort Member Interview. Qualification levels obtained by the age of 23, time of completion of full-time education, regional and metropolitan counties variables were derived from the fourth sweep of the survey (NCDS4, when the cohort members were 23). Additional information about educational achievements prior to 1981, mathematical and reading test scores recorded at the age of 11, her father's social class and schooling and her family size preferences collected at the age of 16 date back to the third and second NCDS waves.

Table 3

NCDS5: Fifth Follow-up

Response Figures

Survey instrument	(a) Target	(b) Traced	(c) Obtained	(c)/(b) %
Cohort Member Interview	15,666	13,444	11,407	85%
Cohort Member 'Your Life Since 1974'	15,666	13,444	11,177	83%
Cohort Member 'What do you think?'	15,666	13,444	10,898	81%
Partner 'Your Life Since 1974'		9,138	7,126	82%
Mother Interview		2,556	2,524	99%
Mother 'Your Child'		5,067	5,012	99%
Child Interview (Tests)		3,575	3,467	97%

Our time horizon extends over a period of approximately 18 years.[30] For the period between 1974 and 1991 we have information related to the respondent's experience in the labour market as a full-time or part-time worker, the period she spent in unemployment or in government training schemes, and the period she spent out of the labour force. We can also collect information on the presence of a partner and the length of time before a birth occurred. This information was recorded monthly and we aggregated it on a year-to-year basis, considering, for example, the cumulative number of months spent in full-time employment up to the age of 25 as a percentage of the total period observed (i.e., nine years and three months, from January 1974 to the 25th birthday in March 1983).

The main disadvantage of using a retrospective questionnaire is the presence of missing values and, more generally, of memory-loss problems. The respondent is asked to recollect her memories over a long period of time and the information she provides tends to become less precise the further back in time she goes. As a consequence, we excluded from our sample individuals who had missing values for the earlier years or those who provided inconsistent information, declaring, for example, they had been unemployed and working full-time in the same month.

Additional inconsistencies were found with respect to the information on full-time education, where we privileged the variables collected in the main interviews to those available through the retrospective questionnaire. For reasons of consistency, we consider the time of completion of full-time education as the time at which the individual declared to have left full-time education in the fourth sweep of the survey, provided that she did not proceed in acquiring an additional qualification in the following two years and, in this case, considering the time of completion of this additional qualification instead.[31] This obviously

[30] The retrospective questionnaire 'Your life since 1974' covers the period between January 1974, when the individual was still aged 15 and the date of the interview in 1991, which was usually held in April or May, when the subject was aged 33.

[31] This was in order to take into account the possibility of gap-years.

reduced the number of observations we could rely upon and the actual number of cases considered after these checks was 3,751, approximately 65% of the original sample.

The sample selection model, whose results are presented in Tables 5a and 5b, gives the expectations, evaluated every year between the age of 16 and the age of 33, of the weekly wage at 1991. Each participation equation, estimated by means of a Binomial Probit, has as its dependent variable a discrete variable taking values 1 or 0 depending on whether the individual was working or not in 1991 and each wage equation is a regression of the natural logarithm of the hourly wage at 1991 on a vector of explanatory variables. In Table 6 we report the results of the estimation of the probability of having a job in 1991 conditional on participation in 1991. The partner's weekly wage is the dependent variable of the set of regressions in Table 7, while cohabiting status in 1991 is what we estimate in Table 8.[32]

While the dependent variable is fixed, the explanatory variables change between one year and the next, "updating" the information set of the subject. This procedure applies, in particular, to the variables representing experience in and out of the labour market, which is disaggregated according to the percentage of the observed period spent in full-time employment, part-time employment, unemployment or government training schemes, full-time education and other out of the labour force states. Another variable that is allowed to change on a year-to-year basis is the highest qualification obtained by the subject, which has been recoded according to National Vocational Qualification (hereafter NVQ) levels.[33] On the contrary, the region or the metropolitan county is not a time-varying variable and is represented by the region or the county of residence of the subject at the age of 23.[34] All the other variables considered are invariant across equations.[35]

6 Results

6.1 Expected future wages

Tables 5a and 5b present the results of the estimation of expected future wage levels. The upper part of the tables reports the estimated coefficients of the regressions of the logarithm of hourly female wage rates in 1991 on variables including labour market experience, educational qualification and proxies for ability at different points in time; the bottom panel reports the results of the

[32] Note that in Table 8 we estimate the probability of living with a partner in 1991 conditional on having a partner at the age of 33. The subjects in our sample are aged 33 in 1991, but the dependent variable refers to the month in which the interview was carried out, which is typically April or May, while all the time-variant explanatory variables refer to March, the month in which the subjects have their 33rd birthday.

[33] Details on this procedure of recoding are available from the author on request.

[34] It was impossible, because of too many missing values in the regional variables collected at the age of 33, to construct a more detailed history of geographic mobility. Additionally, reasons of confidentiality restrict access to this information.

[35] Table 4 provides a more detailed description of the variables and their meaning.

selection equation based on the employment status of the individual in 1991.[36] To improve the identification of the model we consider local labour market conditions - as proxied by metropolitan counties dummies - and partner's earnings - accounted for by a dummy variable with value 1 if the woman is living with her partner in the reference period - as additional factors which influence the woman's participation decision in the selection equation. Given that we will later use the expected future wages obtained through this procedure to estimate the probability of a birth, we did not include in the participation equation any variable related to the number of children as they are direct measures of fertility.

Commenting first on the participation equation, we see that the independent variables have almost always the sign we would expect. In particular, the presence of a partner reduces the probability of being in the labour force, the accumulation of part-time or full-time employment experience reveals a strong attachment to the labour force, while the percentage of the observed period spent in unemployment discourages participation. Notice that part-time employment experience is a very good predictor of the individual's future attachment to the labour force even during the first years. We introduce a variable controlling for the period spent in full-time education in order to distinguish between different non participation states. This is necessary because we report the highest educational qualification the individual has obtained at each point in time and, especially when the individual is very young, we need to further distinguish those who are not in the labour force because they are pursuing higher qualification levels, from those who are not investing in any form of human capital.[37]

The only odd result we observe in the bottom part of Tables 5a and 5b is that women with an intermediate level of education (NVQ level 3) have a lower probability to participate in 1991 with respect to women with no education or very low formal qualification levels. The coefficient of this variable is always negative and almost always significant at the 5 per cent level of significance. It is possible that, since here we do not introduce a direct measure of partner's earnings, the educational level of the woman is capturing this exogenous source of income, as it emerges from Table 7 where having an intermediate level of education is one of the variables most strongly correlated with the partner's weekly earnings in 1991. By contrast, a positive effect of education on women's participation is evident for women with the highest qualifications. The coefficient on high levels of education (NVQ level 4) is clearly positive and often significant at the conventional level.

The wage equation reveals very interesting and robust results. Almost all the variables are significant at the 1 per cent significance level, even during earlier years and they always present the expected signs. At the age of 26 years (which

[36] Although we later refer to these equations as participation equations, it is important to keep in mind that these equations should be defined as employment equations as we consider the employment status of the woman rather than her participation status.

[37] This is consistent with the assumption in 15 that the level of schooling the individual expects to have at time $t+s$ does not differ from the level she has achieved at time t.

corresponds to 123 months from the beginning of observations), for example, individuals with one more year of full-time labour market experience will expect an hourly wage 2.3 per cent higher in 1991 than individuals who stayed out of the labour force, while those who have been unemployed for the last 12 months will expect a hourly wage about 6.3 per cent lower. Individuals with NVQ level 4 will usually expect to have a hourly wage 40 per cent higher than if they had no or very low educational qualifications. A 10 point higher result in both the reading and mathematical test scores should account for between 1.3 and 0.7 percentage points increase in the hourly wage rates in 1991 depending on the age of the individual, as with the accumulation of human capital differences in ability will tend to count less.

More generally, by looking at the magnitude of the estimated coefficients and the way the latter change through time, we notice that labour market experience seems to explain a larger part of differences in wages in 1991 at a later stage, while educational and ability variables play a much more important role in earlier years. The percentage of period spent in unemployment exhibits a coefficient which is much more stable across time then the coefficients on full-time or part-time employment, indicating that the experience of unemployment recurs through time for certain individuals. The overall fit of the regressions is rather satisfactory. Although the Wald statistics decreases the further away we go from 1991, the estimated model is always significant and the coefficient of correlation between the equations is always significantly different from zero at the conventional level.

6.2 Expected future probability of employment conditional on participation

The expected probability of being employed in 1991 conditional on participation at the same date is estimated by means of a Binomial Probit. Here, instead of considering the *unconditional* probability of having a job in the future, we specify a *conditional* (on participation) probability. This leads us to consider only the characteristics of individuals who are still active in the labour market in 1991 and estimate the explanatory power of their time-varying characteristics on the probability of employment. Since some of the most important characteristics we observe are related to labour market experience, it was necessary to exclude women who had dropped out of the labour force before 1991. The predictions obtained are subsequently attributed to all women, irrespective of their participation status at the end of the period of observation.

As shown in Table 6, we do not include among the regressors variables which are supposed to affect a woman's participation decision, like the presence of a partner. Metropolitan counties have been aggregated because of the much smaller sample size we are now considering. As opposed to the 65 different counties analysed in Tables 5a and 5b, we now have only 21 aggregates.[38] We

[38] Counties have been grouped according to their geographical proximity and the geographical classification of Eurostat's Regio database.

also tried to use regional dummies, but they were always jointly insignificant, while aggregates of metropolitan counties are jointly significant at the conventional 5 per cent level between 25 and 33 and always significant at the 10 per cent level between 16 and 24. The fit of the model is rather good for all different ages although the pseudo-R^2 decreases as we go further back in time.

As we could have expected, the individual's unemployment experience is the most significant predictor of future labour market opportunities, while among the other explanatory variables mathematical ability is the only one that exhibits a stable coefficient and that is almost always significant at the 10 per cent significance level. It is interesting to see how, once we account for unemployment experience, the variables related to part-time and full-time employment experience contribute positively but only at times significantly to the conditional probability of having a job in 1991. This is perhaps because we are considering the probability of having a job in 1991, after a significant part of an individual's labour market experience has already gone by. At this stage the differences in employment experience are perhaps rather small, given that all these women are participating in the labour market, and only unemployment can reveal uncertainty about the future.

We also notice that educational qualification contributes negatively to the probability of employment in 1991, but this effect is never significant. This does not mean that educational qualifications do not ever have an impact on the probability of finding a job. Schooling might affect job opportunities at earlier stages in life and we saw in Tables 5a and 5b that the effect of education on participation decisions or wages is much less pronounced as experience accumulates. It might also indicate that those who experience difficulties in finding a job because of their poor education become discouraged and drop out of the labour force altogether. For those who are participating in the labour force in 1991, the experience of unemployment and the area of residence are the most powerful predictors of future employment opportunities.

6.3 Expected future partner's earnings

Table 7 presents results of the estimation of the partner's weekly earnings in 1991 for all women who were living with their partners in 1991[39], while Table 8 reports the results of the Binomial Probit model estimated for the probability of cohabiting with a partner in 1991. As explained in section 5, the interaction between the predicted partner's weekly earnings in 1991 (conditional on cohabitation in 1991) and the predicted probability of cohabiting with a partner in 1991 will give a measure of the expected future partner's earnings. In other studies, male earnings are constrained to be zero for women not cohabiting with a partner, and it is therefore not clear whether the coefficient on male earnings is simply capturing the absence of a partner rather than an income effect.[40] Our procedure enables us to relax this restriction as well as consistently explore the effect of expectations of future economic variables on current fertility decisions.

[39] Irrespective of marital status.

[40] See Heckman and Walker (1990).

As shown in Table 7, we used women's characteristics in order to predict their partners' earnings in 1991. The explanatory variables we consider are almost all time invariant, with the exception of educational qualifications, which are allowed to change as women acquire more formal schooling. In order to fully explore this information we introduce interactions between educational qualifications and regional dummies, which reveal to be almost always jointly significant.[41] Other variables we include are regional dummies, the social class and level of schooling of the woman's father and her level of ability, proxied by the results of the mathematical and reading tests taken at the age of 11.

As we can see, our specification explains around 18 per cent of the overall variation in partner's weekly wage in 1991 and the F-test reveals that the regressions are always significant throughout the observed period. All the coefficients have the expected signs and we can notice that partner's earnings are positively and significantly correlated with the woman's educational qualification and that this is true in particular for women with intermediate education. Father's social class is also an important predictor of the partner's earnings, while the level of the father's schooling - simply indicated by a dichotomous variable with value 1 if the father stayed in full-time education after compulsory schooling - appears much less significantly correlated to the dependent variable, everything else equal.

Turning to the predictions of the cohabiting status in 1991, we immediately notice that the most powerful explanatory variable is given by current cohabiting status. This is very much what we expected, but it is nevertheless interesting to see how the predictive power of this variable fades away the further back we go in time, which gives a very nice empirical representation of how expectations of future cohabiting status might evolve. Not living with a partner at the age of 18 does not significantly affect the probability of cohabitation in the distant future, but not living with a partner at the age of 30 is - possibly also in the subject's mind - a good indication of the probability of cohabitation three years later. The fit of this model follows closely the predictive power of current cohabiting status but, as explained above, this is not necessarily an unsatisfactory result in our context.

Notice also that having an intermediate education is not significant in this case. This variable appears to be a good predictor of the partner's wage but is not strongly correlated to cohabiting status. This confirms our interpretation of the effect of the intermediate education level in the participation equation in Tables 5a and 5b. By contrast, high education is significant in both Tables 7 and 8, while a low level of the father's social class, which comprises skilled non-manual workers, is insignificant in the partner's wage regression and almost always significant for the probability of cohabiting status.

[41] Here we used regional dummies because of the even more limited sample size.

6.4 The probability of a first birth

The "number of months before the birth of the first child" is the dependent variable in our hazard model. We restrict our attention to the first birth because we have information on individuals' family and working histories until the age of 33. As we explained in section 4, we do not observe our sample long enough to estimate a piecewise hazard model, which could account for transitions to different birth parities. Nevertheless, the occurrence of the first birth is an important turning point in a couple's family life and we hope that, even if restricted to this single event, the analysis presented here will shed some light on the relevance of our hypothesis.

In defining the duration before the event, we adopt two different approaches. First, we consider the subjects as being "at risk" of a birth since the first observed month in our sample (January 1974). In the second specification, we consider the "risk of a birth" setting in only after the completion of full-time education. In both cases the dependent process varies monthly, while the variables representing expectations of future wages, employment probabilities and partner's earnings are supposed to vary at intervals of years. When dummy variables for the individual's labour force status are introduced, these are supposed to vary monthly, while preferences for family size expressed at the age of 16 are time-invariant. All the covariates are lagged one year, in order to consider their effect on the time of conception.

In Table 9 we present the Cox Proportional Hazard Model, estimated through a semiparametric method, while in Table 10 we report the corresponding results when the baseline hazard function is parametrically specified (Weibull distribution). In each table we show the hazard rates estimated when the duration before the event is calculated from the first observed period or only after completion of full-time education. In the second specification, we need to introduce biological age as an additional explanatory variable, while in the first case this is not needed as all the individuals are born in the same week.

As we can see in the first column of Table 9, expectations of future economic variables are all statistically significant at the 1 per cent significance level.[42] The value of the hazard ratios indicate also that the effect of these variables is almost always in line with what predicted by the theory. A higher expected value of future hourly wages decreases the conditional probability of a first birth, while a higher value of expected future partner's earnings has a strong positive effect on the conditional probability of the event. Perhaps surprisingly, better expected future job opportunities increase the conditional probability of the event, indicating that women who expect to have a greater likelihood of being employed in the future will feel encouraged to have a child. Here we would have probably expected an effect in the opposite direction, as the opportunity-cost

[42] Although in the discussion of the results we will refer to the t-statistics presented in the tables, we need to keep in mind that these significance values should be trated with caution. The standard errors of our estimated semi-parametric and parametric hazard models should be corrected in order to take into account the two-stage estimation procedure used in deriving our expected future variables.

of a child to a woman with favourable job opportunities is higher than the one faced by a woman with poorer prospects.

In the second column of Table 9, we introduce current labour force status as an additional covariate. This is in order to control for the possibility that expectations of future outcomes could simply be the reflection of current economic conditions. The result is very interesting. None of the variables representing expectations of future economic situation loses its predictive power despite the fact that current labour force dummies are very significant. Even the variable representing expected future job market opportunities, whose specification revealed a strong reliance on the cumulated experience of unemployment, remains significant at the 5 per cent significance level.

It is interesting to notice that being in full-time education reduces the hazard of a birth by almost 80 per cent and that being in unemployment or government training one year before the event of a birth does not increase, in fact, it considerably reduces the conditional probability of the event. The effect of unemployment is even stronger than the effect of full-time employment, which confirms the idea that unemployment experience may have a dramatic impact on a couple's fertility decisions. Being in part-time employment, by contrast, reveals a positive but totally insignificant effect on the hazard of a first birth.

The results do not change when we consider also another form of heterogeneity across individuals: the preference for family size expressed at the age of 16. Here we grouped the responses to the question in order to build a categorical variable which broadly distinguishes women with a low (0-1 children), medium (2-3 children) and strong (4-6 children) preference for children. We indicated separately the response of those who were not sure, even though they seem not to be statistically different from our reference group. It is apparent that the effect of this variable is in line with what we expected.

The last three columns of Table 9 present the same results when the duration of the interval before the first birth is calculated since the end of full-time education. The most noticeable differences here are that the covariate representing the subject's age is significant and above one and that expectations of future wages have a less negative impact on the hazard of a birth. This is because, in the first specification, we consider individuals at risk of a birth since the first month of the observation period and the covariate representing future expected wages is capturing the postponement effect of formal education, which must be only partly accounted for by the dummy for full-time education. The difference between the two specifications is also reflected in Table 10, where we present the results of the parametric model. Here the effect of age is not significant, as its role is completely absorbed by the parameter of the distribution, but the effect on the magnitude of the coefficient on expected future wages is exactly of the same type as we observed in the semiparametric estimates.

As we can see, in Table 10, all the variables representing expectations of future economic conditions are strongly significant and their effect on the dependent variable is consistent with what estimated through the semiparametric model. The estimated baseline hazard increases with time at a decreasing rate, as shown by the fact that the estimated parameter p is less than 2 but signif-

icantly higher than 1. This also coincides with non-parametric representations of the cumulative hazard obtained through the Nelson-Alen estimator.

7 Conclusions

These results seem to give support to our initial hypothesis, namely that fertility decisions are affected not only by current economic conditions but also by expectations about future economic outcomes. Although we make a few stringent assumptions in specifying the mechanisms through which individuals form their expectations about the future, we obtain an estimable empirical model which allows us to predict today's expectations about future wage levels and future job opportunities. The methodology adopted also makes it possible to analyse the effect of changing labour market experience, for example unemployment experience, on these estimated expected values.

By estimating expectations at different years - each time considering only the labour market experience the individual accumulated until the corresponding period - we allow the predicted expected future wage and conditional probability of being employed to change over time. This procedure represents empirically the idea that individuals change or "update" their expectations about the future considering their current information set. Interestingly, this exercise is not limited to obtaining time-varying covariates for our final hazard model but suggests that some of the variables have a different explanatory power over time. For example, we saw that experience in the labour market is more important in predicting future wage levels at later stages of a woman's life, while educational qualifications and ability are more relevant earlier on.

Estimating expectations of future partner's earnings is essential in two respects. From the one hand, considering expectations of future income rather than current income is more consistent with our hypothesis and the specification of the other explanatory variables. From another perspective, the procedure followed above allows us to attribute a certain level of (expected) exogenous income to those women who are not cohabiting with their partner at the time of the main interview and for whom we do not have a record of the partner's earnings.

In all the specifications of our hazard model we find that expectations of future wage levels and future probability of being employed conditional on participation are relevant in explaining fertility outcomes. In particular, higher expected wage levels encourage women to work more and delay childbirth. By contrast, more favourable expected job opportunities raise the hazard of a birth and, everything else equal, induce women to bring forward the event. In the latter case, a dominating income effect seems to be at work.

Since unemployment is one of the variables that most significantly affect the expectations of future wage and future job opportunities, and since previous studies indicate that higher levels of unemployment in Southern Europe might be responsible for the drop in fertility rates observed in the last decades, it would be interesting to calculate the overall effect of unemployment through our estimated coefficients. The experience of unemployment affects negatively both

future wages and the probability of finding a job conditional on participation but, while the first of these estimated expectations decreases fertility, the other increases it. Additionally, as our results show, an individual experiencing an unemployment spell one year before the birth of the first child has a probability 65 to 67 per cent lower to have a birth than a non participating woman.

The calculation of these effects is not a trivial task, as it involves the computation of the impact of time-varying variables on the hazard of a birth. Moreover, in order to test the hypothesis put forward by Ahn and Mira (2001a, 2001b) we would need to consider also the effect of the partner's unemployment experience on the expected partner's earnings. This indicates that, in order to determine the effect of unemployment on fertility with a reasonable degree of confidence we need to engage in a more complex simulation exercise than originally envisaged and this is, at the moment, beyond the scope of this paper.

However, the finding that expected future employment probabilities (conditional on participation) significantly influence the fertility decision even after controlling for the expected level of future wages and exogenous income, seems to suggest that in order to represent the influence of economic variables on the hazard of a birth we need to consider not only the expectations of future variables but also the degree of uncertainty attached to these expectations. Expected conditional probabilities of future employment can be interpreted as one form of uncertainty surrounding future income.

As discussed in section 2, the idea that uncertainty affects fertility decisions is not new to the literature, but very few studies are concerned with uncertainty about future income and prices, while usually uncertainty refers to the specific biological features of fertility. Even when income and prices are treated as stochastic variables, the vast majority of the existing models impose restrictions on the utility functions in order to facilitate empirical estimation but at the same time eliminate the need to consider the second moments of the partner's income or women's wage distributions.[43]

Yet the idea that uncertainty about the future affects current fertility decisions is clearly expressed in Ahn and Mira (2001a), who see temporary/part-time contracts or unemployment as responsible for the 'enormous income uncertainty' experienced by Spanish young couples.[44] Fraser (2001) shows a negative effect of the standard deviation of the temporary component of income on aggregate birth rates, but his model remains essentially static. Bettio and Villa (1998) stress the importance of the uncertainty 'attached to job search'[45] in a context in which women might fear to be discriminated against by future employers if they become pregnant while looking for a job, or they might want to delay the decision of having a child because of the constraints that this will impose on their geographical mobility.

In the light of these suggestions and of what our results indicate, we think

[43] See how the *certainty equivalence* result with respect to income holds in Wolpin (1984). Since all the other structural model are extensions of this earlier model, the same result holds in Eckstein and Wolpin (1989), Hotz and Miller (1993) and Francesconi (2000).

[44] See Ahn and Mira (1999a), p. 5.

[45] See Bettio and Villa (1998) p. 161.

that the theoretical and empirical analysis of different "types" of uncertainty - not only that related to the biological process of conception - might help us to understand more about fertility behaviour. Being able to model and represent the uncertainty related to labour market variables like earnings and employment would also offer a good opportunity to analyse the effect of different labour market institutions and derive policy implications. In our view, this represents a very promising area of research.

References

Ahn, N., (1995): "Measuring the Value of Children by Sex and Age Using a Dynamic Programming Model", *Review of Economic Studies*, Vol. 62, pp. 361-379

Ahn, N. and Mira, P. (2001a): "Job bust, baby bust: the Spanish case", *Journal of Population Economics, Vol. 14(3)*, pp. *491-504*

Ahn, N. and Mira, P. (2001b): "A Note on the Changing relationship Between Fertility and Female Employment Rates in Developed Countries", forthcoming in the *Journal of Population Economics*

Becker, G., (1960): "An Economic Analysis of Fertility", in *Demographic and Economic Change in Developing Countries*, Universities-National Bureau of Economic Research Conference Series 11, pp. 209-231

Becker, G. and Lewis, H., (1973): "On the Interaction between Quantity and Quality of Children", *Journal of Political Economy*, Vol. 81, pp. S279-S288

Bettio, F. and Villa, P., (1998): "A Mediterranean perspective on the breakdown of the relationship between female participation and fertility", *Cambridge Journal of Economics*, Vol. 22, pp. 137- 171

Blau, D., (1991): *The Economics of Child Care*, Russel, Sage: New York

Butz, W. and Ward, M., (1979): "The emergence of countercyclical US fertility", *American Economic Review*, Vol. 69, pp. 318-28

Chesnais, J., (1992): *The Demographic Transition*, Oxford: Clarendon Press

Chiuri, M., (2000): "Quality and Demand of Child Care and Female Labour Supply in Italy", *Labour*, Vol. 14, No. 1, pp. 97-118

Colombino, U., (2000): "The cost of children when children are choice", *Labour*, Vol. 14, No. 1, pp. 79-95

Cox, D., (1962): "Partial likelihood", *Biometrica*, pp. 269-276

Del Boca, D., (2001): "Participation and Fertility Behaviour of Italian Women: the Role of Labour Market Rigidities", forthcoming in he *Journal of Population Economics*

Dardanoni, V. (1988): " Optimal Choice Under Uncertainty: the Case of Two-Argument Utility Functions", *Economic Journal*, Vol. 98, pp. 429-450

Delgado Perez, M. and Livi Bacci, M., (1992): "Fertility in Italy and Spain: the lowest in the world", Family Planning Perspectives, Vol. 24, No.4, pp.162-171

Ermisch, J., (1989): "Purchased Child Care, Optimal Family Size and Mother's Employment: Theory and Econometric Analysis", *Journal of Population Economics*, Vol. 2, pp. 79-102

Ferri, E., (1993): *Life at 33. The Fifth Follow-up of the National Child Development Study*, E. Ferri (ed.), Derby: Saxon Graphics Limited

Francesconi, M., (2000): "A Joint Dynamic Model of Fertility and Work of Married Women", Institute for Social and Economic Research, University of Essex, *mimeo*, forthcoming in the *Journal of Labour Economics*

Fraser, C. (2001): "Income Risk, the Tax-benefit System and the Demand for Children", *Economica*, Vol. 68, pp.105-125

Golini, A., (1994): *Tendenze demografiche e politiche per la popolazione, Terzo rapporto IRP*, Bologna, Il Mulino

Heckman, J., (1979): "Sample Selection Bias as a Specification Error", *Econometrica*, Vol. 47, n.1, pp.153-161

Heckman, J. and Singer, B., (1984): "Social Science Duration Analysis", in: Heckman, J. and Singer, B. (eds.), *Longitudinal Analysis of Labour Market Data*, Cambridge: Cambridge University Press

Heckman, J. and Walker, J., (1990): "The Relationship between Wages and Income and the Timing and Spacing of Births: Evidence from Swedish Longitudinal Data", *Econometrica*, Vol. 58, pp. 1411-1441

Heckman, J. and Willis, R., (1975): "Estimation of a Stochastic Model of Reproduction: an Econometric Approach", in Terleckyj, N., (ed.), *Household Production and Consumption*, Columbia University Press, New York

Hotz, V., Klerman, J. and Willis, R., (1997): "The Economics of Fertility in Developed Countries", in: Rosenzweig, M. and Stark, O. (eds.), *Handbook of Population and Family Economics*, pp. 275-347

Hotz, V. and Miller, R., (1988): "An Empirical Analysis of Life Cycle Fertility and Female Labour Supply", *Econometrica*, Vol. 56, n. 1, pp. 91-118

Hotz, V. and Miller, R., (1993): "Conditional Choice Probabilities and the Estimation of Dynamic Models", *Review of Economic Studies*, Vol. 60, pp. 497-530

Kalbfleisch, J. and Prentice, R., (1980): *The Statistical Analysis of Failure Time Data*, New York: Wiley

Kalwij, A., (1999): *Household Consumption, Female Employment and Fertility Decisions: a Microeconometric Analysis*, Ph.D. dissertation, CentER for Economic Research, Tilburg University

Kalwij, A., (2000): "The effects of female employment status on the presence and the number of children", *Journal of Population Economics*, Vol. 13, pp. 221-239

Lesthaeghe, R., (1983): "A Century of Demographic and Cultural Change in Western Europe", *Population and Development Review*, Vol. 9, No. 3, pp. 411-435

Montgomery, M., (1988): "A Dynamic Model of Contraceptive Choice", *Population Council*, New York (unpublished)

Mincer, J., (1985): "Intercountry comparisons of labour force trends and of related development: an overview", *Journal of Labour Economics*, Vol. 3, No. 1, s1-s30

Newman, J., (1988): "A Stochastic Dynamic Model of Fertility", *Research in Population Economics*, Vol. 6, pp. 41-68

Newman, J. and McCulloch, C., (1984): "A Hazard Rate Approach to the Timing of Births", *Econometrica*, Vol. 52, pp. 939-961

Rosenzweig, M. and Schultz, T., (1985): "The Demand for and Supply of Births: Fertility and its Life-Cycle Consequences", *American Economic Review*, Vol. 75, pp. 55-76

Shepherd, P., (1995): "The National Child Development Study. An Introduction, its Origin and the Methods of Data Collection", NCDS User Support

Group, *Working Paper 1*, City University

Van de Kaa D. (1987): "Europe's Second Demographic Transition", *Population Bulletin*, No. 42

Walker, J., (1995): "The Effect of Public Policy on Recent Swedish Fertility Behaviour", *Journal of Population Economics*, Vol. 8, pp. 223-251

Ward, M. and Butz, W., (1980): "Completed Fertility and its Timing", *Journal of Political Economy*, Vol. 88, pp. 917-941

Willis, J., (1973): "A New Approach to the Economic Theory of Fertility Behaviour", *Journal of Political Economy* , Vol. 81, pp. S14 - S64

Wolpin, K., (1984): "An Estimable Dynamic Stochastic Model of Fertility and Child Mortality", *Journal of Political Economy*, Vol. 92, pp. 852-874

Table 4
Variable Labels

Female Wage 91	Natural logarithm of the subject's hourly wage in 1991
Employed 91	Dummy variable (=1 if employed in 1991)
Partner's Wage 91	Natural logarithm of the partner's weekly wage in 1991
Cohabiting 91	Dummy variable (=1 if living with partner in 1991)
Age	Age of the cohort member in years
Out of labour force (ref. category)	Percentage of the observed period spent out of the labour force
Period FT employment	Percentage of the observed period spent in full time employment
Period PT employment	Percentage of the observed period spent in part time employment
Period unemployment	Percentage of the observed period spent in unemployment
Period FT education	Percentage of the observed period spent in full time education
Education very low (ref. category)	No qualification or NVQ level 1 (reference category)
Education low	NVQ level 2
Education intermediate	NVQ level 3
Education high	NVQ level 4 or higher
Reading test	Reading test scores (age=11)
Mathematical test	Mathematical test score (age=11)
Metropolitan Counties 65	Metropolitan Counties (65 aggregates)
Metropolitan Counties 21	Metropolitan Counties aggregated in 21 larger groups
Region	Standard Statistical Region (age=23)
Cohabiting	Dummy variable (=1 if living with partner in the observed month)
Father's social class very low (ref. category)	Father's social class: unskilled, semiskilled, skilled manual (reference category) (age=7)
Father's social class low	Father's social class: skilled non-manual (age=7)
Father's social class intermediate	Father's social class: intermediate (age=7)
Father's social class high	Father's social class: professional (age=7)
Father's education	Dummy variable (=1 if father stayed in full time education after compulsory schooling)
Expected female wage 91	Predicted value of the wage in 1991 (natural logarithm)
Expected employment 91	Predicted value of the employment probability in 1991 (codified as 0-100)
Expected partner's wage 91	Predicted value of the partner's weekly wage in 1991 (natural logarithm) multiplied by the predicted value of the probability of living with a partner in 1991
Out of labour force (ref. category)	Dummy variable (=1 if woman is out of the labour force in the reference month)
In FT education	Dummy variable (=1 if woman is in full time education in the reference month)
Unemployed	Dummy variable (=1 if woman is in unemployment in the reference month)
FT employed	Dummy variable (=1 if woman is in full time employment in the reference month)
PT employed	Dummy variable (=1 if woman is in part time employment in the reference month)
Desired family size: 0-1 children (ref. category)	Dummy variable (=1 if the woman wants 0-1 child, opinion asked at the age 16)
Desired family size: 2-3 children	Dummy variable (=1 if the woman wants 2-3 children, opinion asked at the age 16)
Desired family size: 4-6 children	Dummy variable (=1 if the woman wants 4-6 children, opinion asked at the age 16)
Desired family size: don't know	Dummy variable (=1 if the woman is uncertain opinion asked at the age 16)

Table 5a
Wage Equation
Dependent variable: Female Wage 91
(robust standard errors in parentheses)

Age	33	32	31	30	29	28	27	26	25
Period FT employment	**0.4850*** **	**0.4482*** **	**0.4017*** **	**0.3803*** **	**0.3471*** **	**0.3114*** **	**0.2694*** **	**0.2310*** **	**0.1961*** **
	(0.0531)	(0.0517)	(0.0496)	(0.0457)	(0.0441)	(0.0438)	(0.0439)	(0.0412)	(0.0391)
Period PT employment	**0.4116*** **	**0.3843*** **	**0.3404*** **	**0.3395*** **	**0.3181*** **	**0.2966*** **	**0.2660*** **	**0.2391*** **	**0.2171*** **
	(0.0783)	(0.0790)	(0.0794)	(0.0753)	(0.0757)	(0.0788)	(0.0842)	(0.0807)	(0.0769)
Period unemployment	**-0.7447*** **	**-0.6727*** **	**-0.6458*** **	**-0.6152*** **	**-0.5738*** **	**-0.5406*** **	**-0.5098*** **	**-0.5709*** **	**-0.6270*** **
	(0.2194)	(0.2045)	(0.1889)	(0.1807)	(0.1772)	(0.1727)	(0.1734)	(0.1725)	(0.1765)
Period FT education	**0.5833*** **	**0.5355*** **	**0.4961*** **	**0.4597*** **	**0.4217*** **	**0.4006*** **	**0.3696*** **	**0.3292*** **	**0.2866*** **
	(0.1194)	(0.1123)	(0.1051)	(0.0998)	(0.0933)	(0.0885)	(0.0829)	(0.0776)	(0.0735)
Education low	**0.0571*** **	**0.0587*** **	**0.0593*** **	**0.0617*** **	**0.0641*** **	**0.06516*** **	**0.0690*** **	**0.0722*** **	**0.0781*** **
	(0.0211)	(0.0213)	(0.0214)	(0.0217)	(0.0219)	(0.0219)	(0.0219)	(0.0222)	(0.0224)
Education intermediate	**0.1220*** **	**0.1313*** **	**0.1404*** **	**0.1398*** **	**0.1331*** **	**0.1439*** **	**0.1542*** **	**0.1661*** **	**0.1724*** **
	(0.0325)	(0.0329)	(0.0333)	(0.0338)	(0.0342)	(0.0343)	(0.0347)	(0.0347)	(0.0348)
Education high	**0.3868*** **	**0.3918*** **	**0.3927*** **	**0.3973*** **	**0.4011*** **	**0.3993*** **	**0.3987*** **	**0.4059*** **	**0.4132*** **
	(0.0317)	(0.0318)	(0.0323)	(0.0332)	(0.0335)	(0.0342)	(0.0354)	(0.0358)	(0.0361)
Reading test	**0.0045** **	**0.0047** **	**0.0048** **	**0.0050** **	**0.0053** **	**0.0055** **	**0.0055** **	**0.0057*** **	**0.0057** **
	(0.0021)	(0.0021)	(0.0020)	(0.0021)	(0.0021)	(0.0021)	(0.0021)	(0.0021)	(0.0022)
Mathematical test	**0.0028** **	**0.0028** **	**0.0028** **	**0.0031** **	**0.0032** **	**0.0033*** **	**0.0036*** **	**0.0037*** **	**0.0040*** **
	(0.0012)	(0.0013)	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.0012)	(0.0013)
Selection equation; Dependent variable: Employed 91									
Metropolitan Counties 65	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***
Cohabiting	**-0.5515*** **	**-0.5173*** **	**-0.5878*** **	**-0.4832*** **	**-0.4218*** **	**-0.3734*** **	**-0.4004*** **	**-0.3058*** **	**-0.1816** **
	(0.0878)	(0.0876)	(0.0872)	(0.0807)	(0.0795)	(0.0836)	(0.0904)	(0.0874)	(0.0737)
Period FT employment	**2.3103*** **	**1.8707*** **	**1.5181*** **	**1.2696*** **	**1.0172*** **	**0.8167*** **	**0.6334*** **	**0.5252*** **	**0.4426*** **
	(0.1323)	(0.1249)	(0.1208)	(0.1175)	(0.1158)	(0.1142)	(0.1131)	(0.1114)	(0.1103)
Period PT employment	**4.9014*** **	**4.1264*** **	**3.7027*** **	**3.3785*** **	**3.0330*** **	**2.6266*** **	**2.2560*** **	**1.9504*** **	**1.7857*** **
	(0.3629)	(0.3405)	(0.3425)	(0.3506)	(0.3577)	(0.3479)	(0.3407)	(0.3341)	(0.3458)
Period unemployment	**-2.1557*** **	**-2.0393*** **	**-1.8523*** **	**-1.9475*** **	**-1.9003*** **	**-1.8075*** **	**-1.7035*** **	**-1.6466*** **	**-1.6055*** **
	(0.6411)	(0.5992)	(0.6053)	(0.5826)	(0.5685)	(0.5452)	(0.5447)	(0.5519)	(0.5704)
Period FT education	**1.4445*** **	**1.0939*** **	**0.7296***	**0.5739**	**0.3549**	**0.1616**	**0.02953**	**0.0129**	**0.0589**
	(0.4369)	(0.4077)	(0.3810)	(0.3556)	(0.3312)	(0.3102)	(0.2907)	(0.2690)	(0.2451)
Education low	**-0.0663**	**-0.0594**	**-0.0625**	**-0.0366**	**-0.0192**	**-0.0058**	**0.0087**	**0.0191**	**0.0375**
	(0.0855)	(0.0826)	(0.0813)	(0.0796)	(0.0786)	(0.0775)	(0.0771)	(0.0763)	(0.0754)
Education intermediate	**-0.2668** **	**-0.2863** **	**-0.2675** **	**-0.2492** **	**-0.2523** **	**-0.2208** **	**-0.2040***	**-0.1876***	**-0.1831***
	(0.1159)	(0.1135)	(0.1128)	(0.1110)	(0.1104)	(0.1088)	(0.1081)	(0.1071)	(0.1063)
Education high	**0.1541**	**0.1359**	**0.1579**	**0.1686**	**0.2065***	**0.2466** **	**0.2579** **	**0.2496** **	**0.2397** **
	(0.1264)	(0.1245)	(0.1226)	(0.1214)	(0.1207)	(0.1198)	(0.1205)	(0.1198)	(0.1198)
Reading test	**0.0027**	**0.0036**	**0.0045**	**0.0046**	**0.0054**	**0.0061**	**0.0070**	**0.0077**	**0.0082**
	(0.0078)	(0.0076)	(0.0076)	(0.0075)	(0.0074)	(0.0074)	(0.0074)	(0.0073)	(0.0072)
Mathematical test	**0.0002**	**0.0015**	**0.0024**	**0.0030**	**0.0037**	**0.0040**	**0.0046**	**0.0045**	**0.0047**
	(0.0045)	(0.0044)	(0.0044)	(0.0043)	(0.0042)	(0.0042)	(0.0042)	(0.0042)	(0.0041)
Correlation (Rho)	0.5192	0.5166	0.4834	0.5378	0.5341	0.5225	0.5012	0.5327	0.5798
Wald test (Rho=0)	0.0000	0.0000	0.0001	0.0000	0.0001	0.0013	0.0159	0.0073	0.0004
Wald chi2	812.52	784.36	751.06	735.88	707.69	671.68	623.18	620.57	635.04
Prob>chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Number of obs.	2352	2352	2352	2352	2352	2352	2352	2352	2352

***Significant at 1% significance level; **Significant at 5% significance level; *Significant at 10% significance level
(a) Jointly significant

Table 5b
Wage Equation
Dependent variable: Female Wage 91
(robust standard errors in parentheses)

Age	24	23	22	21	20	19	18	17	16
Period FT employment	**0.1647*** **	**0.1347*** **	**0.1140*** **	**0.0981** **	**0.0850** **	**0.0824***	**0.0866***	**0.0677**	-
	(0.0386)	(0.0387)	(0.0387)	(0.0394)	(0.0410)	(0.0433)	(0.0453)	(0.0488)	
Period PT employment	**0.2011** **	**0.1988** **	**0.2017** **	**0.2004** **	**0.1761***	**0.1700**	**0.1844**	**0.0123**	-
	(0.0780)	(0.0802)	(0.0843)	(0.0900)	(0.0983)	(0.1107)	(0.1332)	(0.2139)	
Period unemployment	**-0.6095*** **	**-0.6243*** **	**-0.6345*** **	**-0.6931*** **	**-0.6499*** **	**-0.6964*** **	**-0.5351***	**0.3134**	-
	(0.1810)	(0.1934)	(0.1917)	(0.1961)	(0.2068)	(0.2079)	(0.3081)	(0.3796)	
Period FT education	**0.2511*** **	**0.2644*** **	**0.3689*** **	**0.4641*** **	**0.4447*** **	**0.3984*** **	**0.3877*** **	**0.3946*** **	-
	(0.0678)	(0.0615)	(0.0548)	(0.0507)	(0.0506)	(0.0511)	(0.0492)	(0.0506)	
Education low	**0.0820*** **	**0.0870*** **	**0.0680*** **	**0.0597*** **	**0.0493** **	**0.0362***	**0.0212**	**0.0308**	**0.0942*** **
	(0.0226)	(0.0229)	(0.0226)	(0.0221)	(0.0219)	(0.0218)	(0.0216)	(0.0215)	(0.0234)
Education intermediate	**0.1811*** **	**0.1915*** **	**0.1355*** **	**0.1002*** **	**0.0792** **	**0.0734** **	**0.1104*** **	**0.1539*** **	**0.2370*** **
	(0.0350)	(0.0357)	(0.0354)	(0.0344)	(0.0342)	(0.0346)	(0.0346)	(0.0381)	(0.0456)
Education high	**0.4217*** **	**0.4046*** **	**0.3595*** **	**0.3458*** **	**0.3369*** **	**0.3158*** **	**0.3585*** **	**0.3818*** **	-
	(0.0365)	(0.0358)	(0.0335)	(0.0337)	(0.0337)	(0.0344)	(0.0410)	(0.0428)	
Reading test	**0.0060*** **	**0.0059*** **	**0.0066*** **	**0.0063*** **	**0.0067*** **	**0.0071*** **	**0.0070*** **	**0.0070*** **	**0.0117*** **
	(0.0021)	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0023)	(0.0023)	(0.0024)
Mathematical test	**0.0041*** **	**0.0041*** **	**0.0043*** **	**0.0045*** **	**0.0048*** **	**0.0054*** **	**0.0058*** **	**0.0059*** **	**0.0072*** **
	(0.0013)	(0.0013)	(0.0013)	(0.0013)	(0.0013)	(0.0013)	(0.0013)	(0.0014)	(0.0014)
Selection equation; Dependent variable: Employed 91									
Metropolitan Counties 65	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***
Cohabiting	**-0.1066**	**-0.0117**	**0.0633**	**0.1063***	**0.1388** **	**0.0864**	**0.1326**	**0.0222**	**0.2600**
	(0.0666)	(0.0572)	(0.0533)	(0.0564)	(0.0603)	(0.0734)	(0.1008)	(0.1709)	(0.3863)
Period FT employment	**0.3687*** **	**0.2934*** **	**0.2525** **	**0.2357** **	**0.2317***	**0.1925**	**0.1881**	**0.0710**	-
	(0.1100)	(0.1106)	(0.1124)	(0.1166)	(0.1240)	(0.1327)	(0.1420)	(0.1655)	
Period PT employment	**1.7006*** **	**1.6485*** **	**1.6325*** **	**1.5027*** **	**1.3343*** **	**0.1093** **	**0.7390**	**0.2357**	-
	(0.3661)	(0.3965)	(0.4249)	(0.4216)	(0.4103)	(0.4287)	(0.4819)	(0.6406)	
Period unemployment	**-1.5000** **	**-1.2355** **	**-1.1363***	**-1.0244***	**-1.0791** **	**-1.0065***	**-1.2418***	**-1.5746***	-
	(0.5822)	(0.5992)	(0.6093)	(0.5916)	(0.5429)	(0.5476)	(0.6497)	(0.9374)	
Period FT education	**0.0395**	**0.0974**	**0.2660**	**0.3855** **	**0.3189** **	**0.1818**	**0.1491**	**0.0485**	-
	(0.2220)	(0.1972)	(0.1688)	(0.1598)	(0.1594)	(0.1583)	(0.1530)	(0.1649)	
Education low	**0.0463**	**0.0681**	**0.0494**	**0.0476**	**0.0496**	**0.0371**	**0.0275**	**0.0336**	**0.0523**
	(0.0748)	(0.0740)	(0.0722)	(0.0714)	(0.0702)	(0.0697)	(0.0678)	(0.0656)	(0.0694)
Education intermediate	**-0.1597**	**-0.1092**	**-0.1627**	**-0.2383** **	**-0.2233** **	**-0.1903***	**-0.1618**	**-0.1767***	**-0.2139***
	(0.1063)	(0.1056)	(0.1026)	(0.1009)	(0.1002)	(0.1006)	(0.0994)	(0.1045)	(0.1196)
Education high	**0.2698** **	**0.2592**	**0.1753***	**0.1788**	**0.1719**	**0.1819**	**0.4025*** **	**0.2154**	-
	(0.1201)	(0.1170)	(0.1059)	(0.1092)	(0.1098)	(0.1120)	(0.1425)	(0.1672)	
Reading test	**0.0086**	**0.0085**	**0.0098**	**0.0103**	**0.0111**	**0.0111**	**0.0100**	**0.0096**	**0.0101**
	(0.0072)	(0.0072)	(0.0072)	(0.0072)	(0.0072)	(0.0072)	(0.0071)	(0.0072)	(0.0070)
Mathematical test	**0.0045**	**0.0045**	**0.0051**	**0.0059**	**0.0065**	**0.0072***	**0.0078**	**0.0079***	**0.0081***
	(0.0042)	(0.0041)	(0.0041)	(0.0041)	(0.0042)	(0.0041)	(0.0042)	(0.0041)	(0.0041)
Correlation (Rho)	0.5989	0.6290	0.6396	0.6365	0.6193	0.6088	0.6166	0.6167	0.6632
Wald test (Rho=0)	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wald chi2	637.91	624.62	609.31	591.78	601.20	571.16	537.82	530.50	341.14
Prob>chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Number of obs.	2352	2352	2352	2352	2352	2352	2352	2352	2352

***Significant at 1% significance level; **Significant at 5% significance level; *Significant at 10% significance level
(a) Jointly significant

Table 6

Binomial Probit Model for Probability of Employment in 1991 Conditional on Participation at 1991

Dependent variable: Employed 91, all women participating in the labour market in 1991

(robust standard errors in parentheses)

Age	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**25**
Metropolitan Counties 21	(a)***	(a)***	(a)***	(a)***	(a)**	(a)**	(a)**	(a)**	(a)**
Period FT employment	**0.4770***	**0.3829**	**0.3715**	**0.3715**	**0.3721**	**0.3821**	**0.4119***	**0.4722****	**0.4759****
	(0.2467)	(0.2448)	(0.2435)	(0.2435)	(0.2390)	(0.2341)	(0.2272)	(0.2195)	(0.2162)
Period PT employment	**1.0492****	**0.7970****	**0.7307**	**0.6687**	**0.5615**	**0.4514**	**0.4363**	**0.5068**	**0.4831**
	(0.4280)	(0.3987)	(0.3963)	(0.4082)	(0.3996)	(0.3869)	(0.3942)	(0.4097)	(0.4203)
Period unemployment	**-5.2612*****	**-4.5158*****	**-4.3500*****	**-4.4110*****	**-4.3019*****	**-4.1975*****	**-4.0464*****	**-4.1206*****	**-3.9458*****
	(0.8317)	(0.7733)	(0.7585)	(0.7574)	(0.7314)	(0.7868)	(0.8237)	(0.8597)	(0.8699)
Period FT education	**1.0434**	**0.9232**	**0.8751**	**0.8988**	**0.8864**	**0.8563**	**0.8888**	**0.9281**	**0.9572***
	(0.9807)	(0.9345)	(0.8722)	(0.8263)	(0.7714)	(0.7133)	(0.6545)	(0.6001)	(0.5488)
Education low	**-0.0104**	**-0.0026**	**-0.0142**	**-0.0115**	**-0.0066**	**0.0023**	**0.0086**	**-0.0027**	**0.0024**
	(0.1763)	(0.1724)	(0.1714)	(0.1723)	(0.1711)	(0.1707)	(0.1702)	(0.1706)	(0.1696)
Education intermediate	**-0.2744**	**-0.2791**	**-0.2977**	**-0.3174**	**-0.3247**	**-0.3303**	**-0.3269**	**-0.3369**	**-0.3387**
	(0.2365)	(0.2359)	(0.2375)	(0.2377)	(0.2398)	(0.2394)	(0.2379)	(0.2371)	(0.2352)
Education high	**-0.2135**	**-0.2138**	**-0.2402**	**-0.2767**	**-0.2849**	**-0.2829**	**-0.3136**	**-0.3274**	**-0.3467**
	(0.2440)	(0.2445)	(0.2431)	(0.2451)	(0.2442)	(0.2439)	(0.2452)	(0.2462)	(0.2457)
Reading test	**-0.0019**	**-0.0013**	**-0.0009**	**-0.0011**	**-0.0018**	**-0.0023**	**-0.0017**	**-0.0011**	**-0.00002**
	(0.0174)	(0.0173)	(0.0174)	(0.0174)	(0.0175)	(0.0174)	(0.0172)	(0.0172)	(0.0172)
Mathematical test	**0.0155**	**0.0160**	**0.0164***	**0.0164***	**0.0169***	**0.0170***	**0.0170***	**0.0165***	**0.0158**
	(0.0099)	(0.0098)	(0.0098)	(0.0099)	(0.0099)	(0.0099)	(0.0098)	(0.0098)	(0.0097)
Wald chi2	107.57	98.12	94.87	94.79	93.24	90.02	85.86	83.95	80.48
Prob>chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.1921	0.1701	0.1670	0.1677	0.1652	0.1612	0.1570	0.1578	0.1528
Number of obs.	1904	1904	1904	1904	1904	1904	1904	1904	1904

Age	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	**16**
Metropolitan Counties 21	(a)*	(a)*	(a)*	(a)*	(a)*	(a)*	(a)*	(a)**	(a)*
Period FT employment	**0.4646****	**0.4066****	**0.3522***	**0.3666***	**0.3439**	**0.3824**	**0.4543***	**0.2479**	**-**
	(0.2066)	(0.2044)	(0.2126)	(0.2152)	(0.2258)	(0.2401)	(0.2613)	(0.3294)	
Period PT employment	**0.5782**	**0.8094***	**1.1969****	**2.3587****	**4.0974****	**2.7330***	**1.5785***	**0.2442**	**-**
	(0.4265)	(0.4863)	(0.5436)	(0.9959)	(1.9548)	(1.4626)	(0.8783)	(0.9406)	
Period unemployment	**-3.8362*****	**-3.2703*****	**-2.6833*****	**-2.0623****	**-1.8632****	**-1.9079****	**-2.7337*****	**-3.2309*****	**-**
	(0.8808)	(0.8890)	(0.9362)	(0.9050)	(0.7864)	(0.8309)	(0.9387)	(1.5504)	
Period FT education	**0.7692**	**0.6793**	**0.5489**	**0.6106***	**0.5664***	**0.5831***	**0.5505***	**0.3696**	**-**
	(0.4831)	(0.4219)	(0.3673)	(0.3226)	(0.3111)	(0.3025)	(0.3080)	(0.3240)	
Education low	**-0.0181**	**0.0152**	**0.0486**	**0.0509**	**0.0624**	**0.0552**	**0.0635**	**-0.0060**	**0.0487**
	(0.1631)	(0.1575)	(0.1548)	(0.1539)	(0.1523)	(0.1519)	(0.1513)	(0.1459)	(0.1571)
Education intermediate	**-0.1967**	**-0.1365**	**-0.2181**	**-0.2556**	**-0.2507**	**-0.2749**	**-0.2569**	**-0.3186**	**-0.4230**
	(0.2505)	(0.2476)	(0.2157)	(0.2021)	(0.1977)	(0.1994)	(0.2060)	(0.2084)	(0.2650)
Education high	**-0.2121**	**-0.1792**	**-0.0787**	**-0.1151**	**-0.1309**	**-0.1570**	**0.1036**	**0.1826**	**-**
	(0.2522)	(0.2431)	(0.2396)	(0.2359)	(0.2333)	(0.2303)	(0.3232)	(0.4463)	
Reading test	**-0.0029**	**-0.0040**	**-0.0031**	**-0.0032**	**-0.0026**	**-0.0031**	**-0.0057**	**-0.0034**	**-0.0009**
	(0.0176)	(0.0177)	(0.0175)	(0.0176)	(0.0177)	(0.0176)	(0.0172)	(0.0168)	(0.0167)
Mathematical test	**0.0160***	**0.0170***	**0.0176***	**0.0183***	**0.0183***	**0.0192****	**0.0203****	**0.0218****	**0.2396****
	(0.0096)	(0.0095)	(0.0095)	(0.0098)	(0.0096)	(0.0095)	(0.0097)	(0.0096)	(0.0098)
Wald chi2	77.96	71.34	68.19	73.27	84.45	72.01	68.28	61.16	43.23
Prob>chi2	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0001	0.0004	0.0094
Pseudo R2	0.1408	0.1243	0.1166	0.1178	0.1212	0.1172	0.1175	0.1088	0.0991
Number of obs.	1904	1904	1904	1904	1904	1904	1904	1904	1904

***Significant at 1% significance level; **Significant at 5% significance level; *Significant at 10% significance level

Table 7
Partner's Wage Equation Based on the Woman's Characteristics
Dependent variable: Partner's Wage 91
(robust standard errors in parentheses)

Age	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**25**
Region	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***
Region*Education	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***
Education low	**0.0672**	**0.0802**	**0.0802**	**0.0805**	**0.0798**	**0.7910**	**0.0856**	**0.0855**	**0.0865**
	(0.0879)	(0.0862)	(0.0862)	(0.0867)	(0.0866)	(0.0866)	(0.0855)	(0.0856)	(0.0856)
Education intermediate	**0.3882*****	**0.3879*****	**0.3887*****	**0.3883*****	**0.3873*****	**0.3847*****	**0.3875*****	**0.3872*****	**0.3896*****
	(0.1441)	(0.1429)	(0.1432)	(0.1428)	(0.1430)	(0.1259)	(0.1261)	(0.1261)	(0.1258)
Education high	**0.2845*****	**0.2908****	**0.2903****	**0.2798****	**0.2782****	**0.2695****	**0.2701****	**0.2697****	**0.2722****
	(0.1049)	(0.1123)	(0.1125)	(0.1118)	(0.1118)	(0.1171)	(0.1238)	(0.1238)	(0.1240)
Father's social class low	**0.1784*****	**0.1791*****	**0.1766*****	**0.1750*****	**0.1741*****	**0.1737*****	**0.1729*****	**0.1725*****	**0.1741*****
	(0.0364)	(0.0365)	(0.0366)	(0.0367)	(0.0367)	(0.0367)	(0.0366)	(0.0366)	(0.0368)
Father's social class intermediate	**0.0689***	**0.0678***	**0.0655***	**0.0652***	**0.0670***	**0.0654***	**0.0665***	**0.0667***	**0.0642***
	(0.0369)	(0.0370)	(0.0372)	(0.0372)	(0.0372)	(0.0370)	(0.0370)	(0.0371)	(0.0373)
Father's social class high	**0.1547*****	**0.1544*****	**0.1531*****	**0.1522*****	**0.1524*****	**0.1526*****	**0.1524*****	**0.1522*****	**0.1536*****
	(0.0543)	(0.0543)	(0.0542)	(0.0541)	(0.0542)	(0.0544)	(0.0542)	(0.0542)	(0.0542)
Father's education	**0.0605***	**0.0608***	**0.0615****	**0.0612***	**0.0602***	**0.0596***	**0.0585***	**0.0584***	**0.0579***
	(0.0311)	(0.0313)	(0.0312)	(0.0312)	(0.0311)	(0.0310)	(0.0312)	(0.0312)	(0.0312)
Reading test	**0.0041**	**0.0042**	**0.0039**	**0.0040**	**0.0039**	**0.0039**	**0.0039**	**0.0038**	**0.0037**
	(0.0028)	(0.0028)	(0.0028)	(0.0028)	(0.0028)	(0.0028)	(0.0028)	(0.0003)	(0.0028)
Mathematical test	**0.0003**	**0.0003**	**0.0004**	**0.0004**	**0.0005**	**0.0006**	**0.0005**	**0.0005**	**0.0004**
	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)
F test	8.06	8.04	8.11	8.18	8.04	8.02	8.18	8.21	8.07
Significance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R2	0.1911	0.1886	0.1896	0.1895	0.1882	0.1900	0.1889	0.1894	0.1880
Number of obs.	1396	1396	1396	1396	1396	1396	1396	1396	1396

Age	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	**16**
Region	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***	(a)**
Region*Education	(a)***	(a)***	(a)***	(a)***	(a)***	(a)***	(b)	(b)	(a)***
Education low	**0.0859**	**0.0862**	**0.0853**	**0.1129**	**0.1209**	**0.1223**	**0.1202**	**0.1150**	**0.1227**
	(0.0856)	(0.0856)	(0.0856)	(0.0867)	(0.0861)	(0.0861)	(0.0849)	(0.0852)	(0.0878)
Education intermediate	**0.3882*****	**0.3888*****	**0.3138*****	**0.3314*****	**0.3132*****	**0.3168*****	**0.3505*****	**0.268****	**0.1929**
	(0.1256)	(0.1255)	(0.1139)	(0.1119)	(0.1170)	(0.1169)	(0.1202)	(0.1135)	(0.1194)
Education high	**0.2705****	**0.2710****	**0.2966****	**0.0696**	**0.0671**	**0.0706**	**0.0750**	**0.0730**	**-**
	(0.1241)	(0.1241)	(0.1459)	(0.0999)	(0.0997)	(0.1001)	(0.0998)	(0.1102)	
Father's social class low	**0.1753*****	**0.1764*****	**0.1759*****	**0.1804*****	**0.1794*****	**0.1835*****	**0.1907*****	**0.1878*****	**0.1921*****
	(0.0366)	(0.0366)	(0.0369)	(0.0371)	(0.0371)	(0.0367)	(0.0369)	(0.0374)	(0.0370)
Father's social class intermediate	**0.0623***	**0.0618***	**0.0602**	**0.0619***	**0.0616***	**0.0621***	**0.0724***	**0.0774****	**0.0813****
	(0.0373)	(0.0374)	(0.0372)	(0.0373)	(0.0372)	(0.0373)	(0.0373)	(0.0373)	(0.0369)
Father's social class high	**0.1543*****	**0.1533*****	**0.1663*****	**0.1467*****	**0.1488*****	**0.1498*****	**0.1571*****	**0.1641*****	**0.1668*****
	(0.0539)	(0.0539)	(0.0543)	(0.0537)	(0.0539)	(0.0539)	(0.0542)	(0.0546)	(0.0548)
Father's education	**0.0583***	**0.0592***	**0.0632****	**0.0661****	**0.0664****	**0.0666****	**0.0651****	**0.0678****	**0.0583***
	(0.0312)	(0.0312)	(0.0308)	(0.0305)	(0.0604)	(0.0306)	(0.0311)	(0.0313)	(0.0317)
Reading test	**0.0039**	**0.0037**	**0.0039**	**0.0038**	**0.0041**	**0.0040**	**0.0041**	**0.0048**	**0.0052***
	(0.0028)	(0.0028)	(0.0028)	(0.0028)	(0.0028)	(0.0028)	(0.0028)	(0.0029)	(0.0028)
Mathematical test	**0.0004**	**0.0005**	**0.0005**	**0.0007**	**0.0007**	**0.0005**	**0.0002**	**0.0007**	**0.0003**
	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0016)	(0.0017)
F test	7.82	7.75	7.65	7.33	7.38	7.66	n.a.	n.a.	9.64
Significance	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	n.a.	n.a.	0.0000
R2	0.1879	0.1875	0.1848	0.1852	0.1863	0.1875	0.1771	0.1699	0.1679
Number of obs.	1396	1396	1396	1396	1396	1396	1396	1396	1396

***Significant at 1% significance level; **Significant at 5% significance level; *Significant at 10% significance level
(a) Jointly significant, (b) Jointly not significant

Table 8
Binomial Probit Model for Probability of Living with a Partner in 1991
Dependent variable: Cohabiting 91
(robust standard errors in parentheses)

Age	**33**	**32**	**31**	**30**	**29**	**28**	**27**	**26**	**25**
Region	(a)**	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)
Cohabiting	**3.5497*** **	**2.7531*** **	**2.2503*** **	**1.7836*** **	**1.4626*** **	**1.1576*** **	**1.0039*** **	**0.8433*** **	**0.6417*** **
	(0.1423)	(0.1061)	(0.0922)	(0.0858)	(0.0827)	(0.0802)	(0.0781)	(0.0770)	(0.0749)
Father's social class low	**0.4097** **	**0.2687**	**0.1797**	**0.1848**	**0.2534** *	**0.1887**	**0.2058**	**0.2392** *	**0.2465** **
	(0.2065)	(0.1782)	(0.1608)	(0.1437)	(0.1399)	(0.1320)	(0.1290)	(0.1260)	(0.1243)
Father's social class intermediate	**0.6358*** **	**0.3972** **	**0.2784** **	**0.1171**	**0.1355**	**0.1541**	**0.1423**	**0.1199**	**0.0952**
	(0.2127)	(0.1569)	(0.1287)	(0.1202)	(0.1175)	(0.1119)	(0.1105)	(0.1086)	(0.1065)
Father's social class high	**0.2928** *	**0.2767**	**0.2865**	**0.1452**	**0.0637**	**0.0363**	**0.0177**	**0.2420**	**0.0453**
	(0.1732)	(0.1816)	(0.1828)	(0.1865)	(0.1794)	(0.1729)	(0.1691)	(0.1667)	(0.1668)
Education low	**0.0423**	**0.2501** **	**0.2952*** **	**0.2037** **	**0.1911** *	**0.1832** *	**0.1770** *	**0.1676** *	**0.1577** *
	(0.1534)	(0.1245)	(0.1136)	(0.1034)	(0.1010)	(0.0974)	(0.0952)	(0.0950)	(0.0939)
Education intermediate	**0.3037**	**0.2839**	**0.1576**	**0.0443**	**0.0736**	**0.0718**	**0.0643**	**0.0434**	**0.0641**
	(0.2430)	(0.1876)	(0.1641)	(0.1432)	(0.1381)	(0.1365)	(0.1338)	(0.1299)	(0.1283)
Education high	**0.1305**	**0.4583*** **	**0.3902*** **	**0.3198** **	**0.3329** **	**0.2983** **	**0.2597** **	**0.3004** **	**0.2715** **
	(0.1987)	(0.1615)	(0.1418)	(0.1336)	(0.1323)	(0.1297)	(0.1272)	(0.1262)	(0.1255)
Reading test	**-0.0157**	**-0.0093**	**-0.0095**	**-0.0081**	**-0.0085**	**-0.0097**	**-0.0114**	**-0.0104**	**-0.0111**
	(0.0160)	(0.0120)	(0.0106)	(0.0098)	(0.0095)	(0.0094)	(0.0092)	(0.0091)	(0.0089)
Mathematical test	**0.0039**	**0.0047**	**0.0089**	**0.0098**	**0.0060**	**0.0057**	**0.0067**	**0.0066**	**0.0072**
	(0.0090)	(0.0074)	(0.0066)	(0.0059)	(0.0057)	(0.0054)	(0.0053)	(0.0053)	(0.0052)
Wald chi2	705.80	685.71	612.07	445.72	325.96	222.14	183.65	141.59	91.00
Prob>chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.7078	0.5201	0.4034	0.2732	0.1978	0.1318	0.1071	0.0803	0.0532
Number of obs.	2286	2286	2286	2286	2286	2286	2286	2286	2286

Age	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	**16**
Region	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)
Cohabiting	**0.5303*** **	**0.4148*** **	**0.3009*** **	**0.1989*** **	**0.1512** *	**0.2058** **	**0.0628**	**0.6285** *	**0.1346**
	(0.0722)	(0.0704)	(0.0699)	(0.0723)	(0.0796)	(0.1034)	(0.1409)	(0.3309)	(0.5439)
Father's social class low	**0.2599** **	**0.2519** **	**0.2135** *	**0.2115** *	**0.2075** *	**0.2088** *	**0.2058** *	**0.2111** *	**0.1904**
	(0.1246)	(0.1226)	(0.1231)	(0.1225)	(0.1222)	(0.1214)	(0.1214)	(0.1212)	(0.1217)
Father's social class intermediate	**0.0707**	**0.0696**	**0.0652**	**0.0659**	**0.0485**	**0.0476**	**0.0443**	**0.0436**	**0.0341**
	(0.1050)	(0.1045)	(0.1039)	(0.1023)	(0.1024)	(0.1026)	(0.1021)	(0.1022)	(0.1018)
Father's social class high	**0.0662**	**0.0746**	**0.0297**	**0.0275**	**0.0163**	**0.0135**	**0.0097**	**0.0080**	**-0.0299**
	(0.1648)	(0.1641)	(0.1630)	(0.1616)	(0.1619)	(0.1617)	(0.1630)	(0.1624)	(0.1634)
Education low	**0.1643** *	**0.1560** *	**0.1589** *	**0.1646** *	**0.1578** *	**0.1542** *	**0.0906**	**0.1256**	**0.1593** *
	(0.0935)	(0.0927)	(0.0900)	(0.0882)	(0.0867)	(0.0861)	(0.0831)	(0.0800)	(0.0865)
Education intermediate	**0.0888**	**0.0826**	**0.1047**	**0.1937**	**0.2131** *	**0.2055** *	**0.1613**	**0.2217** *	**0.3715** **
	(0.1290)	(0.1259)	(0.1215)	(0.1207)	(0.1196)	(0.1196)	(0.1245)	(0.1321)	(0.1558)
Education high	**0.2918** **	**0.2503** **	**0.2796** **	**0.2900** **	**0.2989** **	**0.3060** **	**0.3308** *	**0.7148*** **	**-**
	(0.1251)	(0.1244)	(0.1256)	(0.1352)	(0.1373)	(0.1393)	(0.1757)	(0.2697)	
Reading test	**-0.0123**	**-0.1219**	**-0.0123**	**-0.0136**	**-0.0141**	**-0.0141**	**-0.0137**	**-0.0145** *	**-0.0151** *
	(0.0089)	(0.0088)	(0.0088)	(0.0088)	(0.0088)	(0.0088)	(0.0087)	(0.0088)	(0.0089)
Mathematical test	**0.0073**	**0.0075**	**0.0079**	**0.0073**	**0.0070**	**0.0073**	**0.0078**	**0.0073**	**0.0050**
	(0.0052)	(0.0052)	(0.0051)	(0.0052)	(0.0052)	(0.0052)	(0.0052)	(0.0052)	(0.0052)
Wald chi2	72.31	51.41	35.51	24.88	22.58	23.20	19.65	26.73	20.84
Prob>chi2	0.0000	0.0000	0.0081	0.1281	0.2071	0.1829	0.3527	0.0843	0.2337
Pseudo R2	0.0420	0.0308	0.0222	0.0158	0.0139	0.0141	0.0114	0.0173	0.0124
Number of obs.	2286	2286	2286	2286	2286	2286	2286	2286	2286

***Significant at 1% significance level; **Significant at 5% significance level; *Significant at 10% significance level
(a) Jointly significant, (b) Jointly not significant

Table 9
First Child
Cox Proportional Hazard Model

An event is defined by the birth of the first child, all covariates are lagged one year

(test-statistics in parentheses)

	Hazard Ratios					
Subject is at risk since:	**January 1974**			**Completed full time education**		
	I	**II**	**III**	**IV**	**V**	**VI**
Demographic						
Age	-	-	-	**1.0965***** (2.89)	**1.0781**** (2.34)	**1.0847***** (2.61)
Expectations						
Expected female wage 91	**0.1162***** (11.22)	**0.1503***** (9.77)	**0.1443***** (9.91)	**0.1753***** (6.35)	**0.2006***** (5.89)	**0.1876***** (6.31)
Expected employment 91	**1.0306***** (3.36)	**1.0261**** (2.53)	**1.0277***** (2.60)	**1.0267***** (2.85)	**1.0243**** (2.31)	**1.0262**** (2.42)
Expected partner's wage 91	**2.2844***** (9.08)	**2.2723***** (8.98)	**2.2961***** (9.05)	**2.2592***** (9.01)	**2.2684***** (8.92)	**2.2968***** (9.00)
Labour Force Status						
In FT education		**0.2119***** (4.82)	**0.2086***** (4.88)		-	-
Unemployed		**0.3309***** (2.62)	**0.3250***** (2.68)		**0.3312***** (2.63)	**0.3257***** (2.69)
FT employed		**0.7825**** (2.02)	**0.7608**** (2.31)		**0.7221***** (2.74)	**0.7045***** (2.99)
PT employed		**1.0744** (0.41)	**1.0271** (0.15)		**1.0121** (0.07)	**0.9733** (0.16)
Desired family size						
Desired family size: 2-3 children			**1.7981***** (2.81)			**1.7651***** (2.71)
Desired family size: 4-6 children			**1.9576***** (3.01)			**1.9705***** (3.04)
Desired family size: don't know			**1.5057** (1.59)			**1.4939** (1.56)
Wald Chi-Squared	148.71	174.35	184.81	94.74	106.35	120.71
Prob>Chi-Squared	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Number of Observations	1220	1220	1220	1202	1202	1202
Number of Failures	932	932	932	914	914	914

***Significant at 1% significance level; **Significant at 5% significance level; *Significant at 10% significance level

Table 10
First Child
Parametric Hazard Modell (Weibull)
An event is defined by the birth of the first child, all covariates are lagged one year
(test-statistics in parentheses)

	Hazard Ratios					
Subject is at risk since:	**January 1974**			**Completed full time education**		
	I	**II**	**III**	**IV**	**V**	**VI**
Demographic						
AGE	-	-	-	**0.9839**	**0.9736**	**0.9764**
				(0.80)	(1.32)	(1.18)
Expectations						
Expected female wage 91	**0.1191*****	**0.1525*****	**0.1463*****	**0.3227*****	**0.3605*****	**0.3439*****
	(11.19)	(9.65)	(9.80)	(4.98)	(4.51)	(4.70)
Expected employment 91	**1.0307*****	**1.0265****	**1.0281*****	**1.0251****	**1.0242****	**1.0259****
	(3.35)	(2.57)	(2.63)	(2.57)	(2.21)	(2.29)
Expected partner's wage 91	**2.2255*****	**2.2216*****	**2.2481*****	**2.1805*****	**2.1951*****	**2.2188*****
	(9.37)	(9.22)	(9.28)	(9.12)	(9.05)	(9.08)
Labour Force Status						
In FT education		**0.2994*****	**0.2961*****		-	-
		(4.47)	(4.53)			
Unemployed		**0.3391****	**0.3325*****		**0.3389*****	**0.3332*****
		(2.56)	(2.62)		(2.60)	(2.65)
FT employed		**0.7717****	**0.7495****		**0.6749*****	**0.6602*****
		(2.14)	(2.45)		(3.33)	(3.55)
PT employed		**1.0638**	**1.0167**		**0.9635**	**0.9269**
		(0.35)	(0.09)		(0.21)	(0.44)
Desired family size						
Desired family size: 2-3 children			**1.8043*****			**1.7521*****
			(2.81)			(2.70)
Desired family size: 4-6 children			**1.9725*****			**1.9404*****
			(3.04)			(2.98)
Desired family size: don't know			**1.5043**			**1.4869**
			(1.58)			(1.54)
Parameter p	**1.7995*****	**1.6919*****	**1.7029*****	**1.6521*****	**1.6993*****	**1.6925*****
	(19.81)	(14.11)	(14.38)	(7.66)	(8.22)	(8.16)
Wald Chi-Squared	151.83	177.58	187.9	93.28	109.10	116.56
Prob>Chi-Squared	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Number of Observations	1220	1220	1220	1202	1202	1202
Number of Failures	932	932	932	914	914	914

***Significant at 1% significance level; **Significant at 5% significance level; *Significant at 10% significance level