

# Explaining how delayed motherhood affects fertility dynamics in Europe<sup>1</sup>

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## Abstract

This paper analyzes the effect of delaying motherhood on fertility dynamics for women living in several European countries characterized by different institutional environments. We show that the effect of delaying the first child on the transition to the second birth (tempo effect) differs both across countries and by a woman's working status. Theoretically, for working women delayed motherhood could *raise* the likelihood of progressing to the second parity due to a career effect since working "late mothers" accumulate more labor market experience, earn higher wages and can afford more children. Hence, the tempo effect for working women depends on whether this positive career effect of delaying motherhood offsets the negative effect due to biological and socio-cultural factors affecting all women. The overall tempo effect on the population, therefore, depends on these two opposite forces. Our empirical analysis shows a positive tempo effect in countries in which the career effect is relatively large, such as Denmark and France, as the opportunity cost of childbearing is relatively low due to the higher provision of external childcare and part-time opportunities. By contrast, in Southern European countries and Ireland, where the opportunity cost of childbearing is relatively high due to the lack of family friendly institutions and cultural influences which may discourage late childbearing, the tempo effect is negative.

*Keywords:* age, childbirth, duration, ECHP, fertility, postponement

*JEL:* C41; J13

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## 1. Introduction

Two well known empirical facts regarding fertility in developed countries are the decline in Total Fertility Rates (TFRs), which are now below the so-called “replacement level” of 2.1 children per woman, and the increase in a woman's age at first birth. The negative correlation observed between a woman's age at first birth and total fertility suggests that delaying motherhood may be an important determinant of the fertility decline (postponement effect). Understanding, therefore, these “tempo-quantum interactions” or *tempo effects* (Kohler et al., 2002) is important for policies aiming to address population aging and its negative economic consequences. Indeed, in the presence of a causal effect of age at first birth on subsequent fertility, policy makers may change fertility dynamics by affecting this age (Lutz and Skirbekk, 2005).

This paper contributes to the debate on delayed motherhood and fertility dynamics in three ways. *First*, we seek to provide micro-level evidence on the effect of age at first birth on the transition to the second parity. Estimating a multivariate discrete-time duration model, which accounts for correlated unobserved heterogeneity across parities, we are able to address the endogeneity of age at first birth. Endogeneity may arise because some unobserved variables, such as preferences towards having children or fecundability, may simultaneously affect both *fertility tempo* and *fertility quantum* and generate a spurious correlation between the two.<sup>2</sup> *Second*, unlike previous work mainly featuring individual country studies, we investigate the consequences of delayed motherhood on fertility in several European countries using highly standardized data from the European Community Household Panel (ECHP). This enables us to analyze the

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<sup>2</sup> The focus on the first two parities is motivated by the fact that despite the declining trend in TFRs, survey data usually show that the modal desired number of children per woman is still two, and that many women fail even this relatively low fertility target (Bongaarts, 2001).

pace of *tempo effects* separately in each country and to relate potential differences in these effects to countries' specific institutional characteristics. *Third*, we consider the interplay between female labor force participation and fertility decisions.<sup>3</sup> In particular, we provide an explanation as to why the effect of delaying the first birth on the transition to the second parity is likely to differ between career and non-career oriented women. In this way, we aim to extend the arguments posited by the existing literature on the “career-planning motive” for delaying the first birth, by assessing its implications for the transitions to higher parities. Distinguishing between career and non-career oriented women also helps us to reconcile the contrasting evidence on *tempo effects* coming from previous studies that do not make such a distinction.<sup>4</sup>

Our paper suggests that the overall *tempo effects* in the population are the result of two opposite forces produced by delayed motherhood. On the one hand, biological and socio-cultural factors acting on both working and non-working women could *lower* a woman's likelihood of progressing to the second parity (*postponement effect*). On the other hand, the career-planning motive to delay the first birth *for working women* could *raise* their likelihood of progressing to the second parity. This is suggested to be due to a career effect since working “late mothers” can accumulate more labor market experience, earn higher wages and can afford more children. Although career-planning pushes women to delay the transition to the first birth due to a higher opportunity cost of childbearing, given that the age-profile of labor income is positive and steeper at younger ages, it might also lead to a faster transition to the second birth due to a dominant income

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<sup>3</sup>As it is well known, female life-cycle labor force participation and fertility decisions are closely related (see, for instance, Moffit, 1984; Hotz and Miller, 1988; Francesconi, 2002).

<sup>4</sup>For instance, Heckman et al. (1985) show the existence of a catch-up effect in Sweden, while Kohler et al. (2002) find a strong postponement effect in Southern European countries.

effect on fertility later in their life (*catch-up effect*).

The empirical analysis shows that these two opposite forces, which act differentially on women according to their working status, co-exist and have different magnitudes depending on the country's institutional features. It is their relative magnitude that determines the sign and magnitude of *tempo effects* in the whole population. In particular, the positive effect of delaying the first birth on the transition to the second birth for working women seems to be larger in countries with high childcare provision and part-time opportunities, in which both the opportunity cost of childbearing and the costs of external child-care are relatively low, such as in Denmark and France. This leads to an overall *catch-up effect* observed in the population as the income effect on working women produced by delaying childbirth is larger than the opportunity cost of childbearing. This means the career effect is positive, and exceeds the negative biological and socio-cultural effects operating on all women.<sup>5</sup> In contrast, the latter (negative) effect of delaying the first birth on the transition to the second birth seems to prevail in Southern European countries and Ireland, where social norms may discourage late childbearing, leading to an overall *postponement effect*. This occurs because the career effect for working women is not big enough to compensate the large negative effects operating on all women.

The structure of the paper is as follows. The next section introduces a simple analytical framework which suggests the existence of differential *tempo effects* according to the women's working status and countries' institutions. Section 3 introduces the ECHP

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<sup>5</sup>The centrality of labor market and child care institutions in shaping both the direct and indirect costs of childbearing and the correlation between maternal work and fertility has recently been stressed by Ahn and Mira (2002), among others. Bettio and Villa (1998) state that with the extremely low levels of fertility currently prevailing in Europe "the burden of making motherhood more compatible with working life falls mainly on the timing of births" (p. 166).

data and reports some sample descriptive statistics, while Section 4 describes the multivariate discrete-time duration model used in the empirical analysis. In Section 5, we report and discuss our main findings concerning the effect of the age at first birth on the timing of the second childbirth. The last section concludes.

## **2. An analytical framework for *tempo effects***

In this section, we set a simple analytical framework which helps us to motivate our empirical strategy and to interpret the results. We distinguish the overall effect of delayed motherhood (*tempo effects*) into three causal pathways. The first two (the *biological effect* and the *socio-cultural effect*) operate on all women irrespective of labor force participation, while the third one (the *career effect*) operates only on working women. These pathways are likely to produce either a postponement effect, i.e. a negative effect on the hazard of progressing to the following parities, or a catch-up effect, i.e. a positive effect on higher parity progression. In the following, we discuss each of these channels and the extent to which they might differ across countries.

The *biological effect*. A reason why women who delay the birth of their first child might be slower in achieving the following parities, and even have a lower total fertility, is that their fecundability declines with age. Several studies have shown that women who delay childbearing after the age of 30 are at greater risk of remaining childless due to declining fecundability (see Billari et al. 2007a, for a review). This causal pathway from age at first birth to fertility produces a postponement effect. The effect of aging on the biological decline of fecundability could be mitigated by means of assisted reproductive technologies (ART), which are not equally available in all countries (see Langdrige and

Blyth, 2001). For this reason, the biological effect may have a different impact across countries and be more severe in those with stricter ART regulation.

The *socio-cultural effect*. As stressed by Billari et al. (2007b), limits to the delay of childbearing are not only of a biological but also of a cultural or social nature.<sup>6</sup> In several countries, people perceive a normative “age deadline” for childbearing. In both Italy and France, for instance, this age is reported to be around 40. Women who had their first child relatively late may refrain from having additional children when they approach their 40s because of the perception of being too old to become mothers again. This causal pathway from age at first birth to fertility would produce a postponement effect: those mothers who had their first child late are less likely to progress to the second parity. As with the biological effect, this socio-cultural effect is likely to be country-specific given the different social and cultural environments in European countries. We expect social or cultural norms against *very late* fertility to be stronger in Southern European countries in which mothers are traditionally given a primary role in childrearing and where female labor force participation and external childcare are still relatively low (the male breadwinner model).

The *career effect*. Dynamic models of fertility have shown that there are two main motives for delaying fertility: “consumption smoothing” and “career planning” (see, for instance, Cigno and Ermisch, 1989; Blackburn et al., 1993; Walker, 1995; Gustafsson, 2001). The consumption smoothing argument posits that, in the presence of capital market imperfections, women have children when their incomes are high enough to bear the costs of childrearing and to smooth consumption inter-temporally. The career

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<sup>6</sup> Culture has recently been shown to be important in shaping women’s fertility and labor force participation decisions (see for instance, Fernandez and Fogli, 2006, 2009).

planning motive posits that working women give birth when it penalizes their careers less, which means when they have accumulated substantial work experience. Hence, we should observe a negative effect of women's working status on the hazard of the first birth. The effect of delaying motherhood due to the career planning motive on fertility quantum is, however, theoretically ambiguous (Cigno and Ermisch, 1989). On the one hand, given that the age-profile of wages is positive and steeper at younger ages, delaying motherhood may produce an increase in women's wages and lifetime earnings and raise the demand for children *of working women* (Ahn and Mira, 2002; Apps and Rees, 2004; Martínez and Iza, 2004).<sup>7</sup> On the other hand, higher women's wages have not only a positive income effect but also a negative substitution effect on the demand for children. However, the latter is likely to be lower the higher the possibility of reconciling family and work. Therefore, the effect of delaying motherhood on higher parity progression is likely to vary both in sign and magnitude across countries depending on the price of children.

In particular, the opportunity cost of childbearing and the price of children are relatively low in countries where both low-cost external childcare and part-time opportunities are widely available. Therefore, the income effect may prevail over the substitution effect and the career effect is likely to be positive and large in magnitude. In these countries, mothers in full-time employment can use external childcare without reducing their working hours, or they can temporarily switch to part-time employment around childbirth without penalizing their careers. In contrast, in countries with little

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<sup>7</sup> Evidence that late motherhood is positively associated with mothers' wages can be found in Amuedo-Dorantes and Kimmel (2005) and Miller (2008), while Davies and Pierre (2005) use ECHP data to show that mothers under 24 are more likely to suffer from a family wage gap than older mothers. Del Bono et al. (2008) show that an unexpected career interruption has a sizeable negative effect on women's fertility. This effect could be explained by a reduction in expected life-time earnings due to the destruction of working mothers' firm-specific human capital.

public childcare and few part-time employment opportunities, the price of childbearing for working women is high, and an increase in lifetime resources due to delayed motherhood is unlikely to have strong positive effects on their fertility. In these countries, working is incompatible with having many children (Del Boca and Sauer, 2008). Table 1 shows high coverage of childcare and availability of part-time employment opportunities in countries such as Denmark and France; whilst Southern European countries (Italy, Greece, Portugal and Spain) are characterized by both little access to childcare and a low share of part-time employment. Hence, we expect a higher positive career effect in the former group of countries.

The discussion above suggests some guidelines for our empirical analysis. First, the average effect of delaying the first birth on progression to the second parity is likely to differ according to a woman's employment status. Hence, unlike previous literature, we will include interaction effects between women's age at first birth and proxies of labor force attachment. Second, the sign and the overall magnitude of *tempo effects* are likely to depend on the specific institutional and cultural features of each country. Thus, separate analyses for each country have to be preferred to a pooled country analysis.

### **3. Data**

The analysis is based on individual data from the European Community Household Panel (1994-2001). The ECHP is a survey based on a standardized questionnaire that involves annual interviewing of a representative panel of households and individuals in each country, covering a wide range of topics including demographics, employment characteristics, education, etc. In the first wave, a sample of some 60,500 nationally

representative households from 12 Member States - approximately 130,000 adults aged 16 and over - were interviewed. The features that make the ECHP relevant for this study are the standardized methodology and procedures yielding comparable information across countries and the longitudinal design in which information on the same set of households and persons is gathered.

In this study we focus on 10 countries (Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Portugal, Spain and the United Kingdom), which have participated since the beginning of the survey, excluding Luxembourg because of its small sample size and the Netherlands due to missing relevant information. The sample consists of all women between 28 and 37 years old at the first observed wave (1994). We construct the age of the mother at each birth using the age of the children in the household. We define the duration until first birth as the time elapsed since age 17 until the age at the birth of the first child. Women who never give birth are considered right-censored observations. For those who give birth to the first child, we can construct the duration to the second childbirth. The sample selection on women's age is made mainly for two reasons. First, we want women to be close to the end of their fecund time-span at the last observed wave (Heckman et al., 1985). Second, we want to select women who are not too old to avoid the risk that they will appear childless because their children have already left the parental home. Table A1 in the Appendix provides summary statistics of the sample.

Table 1 shows the share of women above 35 who are childless at the last observed wave (2001). The highest shares are observed for Italy (20.3%), Germany (18.5%) and Spain (18.1%). On average, the share of childless women seems to be slightly higher in Southern European (16.5%) compared to other European countries (15.3%). Table 1 also

shows that countries with a high share of childless women have a low share of women with more than one child. For instance, Italy, which has the highest share of women without children, also has the lowest share of women with more than one child (41%). The last column depicts the mean age at first birth for women above 35 at the last observed wave, who are close to completing their fecund life-span. Greece and Portugal exhibit the lowest mean age (24.1 and 23.9, respectively).

#### **4. The econometric model**

Several studies have found a negative correlation between women's age at first birth and fertility (Morgan and Rindfuss, 1999, Kohler et al. 2002 among others). However, these studies do not address the issue of potential endogeneity of the first birth with progression to higher parities. Endogeneity may arise because some unobserved variables, such as preferences towards children or a woman's fecundability may simultaneously affect both *fertility tempo* and *fertility quantum* and generate a spurious correlation between the two. Without taking into account these unobserved effects it is not possible to distinguish a true causal effect from a simple spurious correlation. To the best of our knowledge, only a few studies have tried to tackle the issue of endogeneity. Heckman et al. (1985) studied *tempo effects* in Sweden using a multivariate transition model and found a catch-up effect. Kohler et al. (2001) addressed the endogeneity issue using a sibling-estimator and found a postponement effect for Denmark. We contribute to these single country studies by seeking to estimate the causal effect of *fertility tempo* in several countries, which strongly differ in terms of both culture and institutions.

The statistical analysis is based on a multivariate discrete-time duration model, in

which both the transition to the first birth and the transition to the second birth, conditional on the age at first birth, are modeled. Following Heckman et al. (1985) we distinguish the true causal effect of the age at first birth on the transition to the second parity from the spurious correlation due to individual unobserved heterogeneity, that is, to unobserved characteristics which simultaneously determine both the age at first birth and the occurrence of a second birth.<sup>8</sup>

The hazard function, which is defined as the probability that a spell is completed at time  $t$  given that it has not been completed before  $t$ , as a function of  $t$ , is the basic building block of the discrete-time duration model. In the present context, we define the duration until the first birth ( $T_1$ ) as the time in years elapsed since age 17 and the duration until the second birth ( $T_2$ ) as the elapsed time in years since the time of the first birth.

The hazard function for an individual  $i$  in state  $j = 1, 2$ , which indicates the two transition states, is defined as

$$\lambda_{ji}(t_{ji} | y_{ji}) = P[T_{ji} = t_{ji} | T_{ji} \geq t_{ji}, y_{ji}] = F(y_{ji}), \quad (1)$$

where  $F(\cdot)$  denotes the logistic cumulative distribution function. For the transition to the first birth, where  $j = 1$ , the index  $y_j$  (abstracting from the subscript  $i$ ) is defined as

$$y_1 = \beta_{01} + \beta_{11}\mathbf{X}_1 + \sum_{k=1}^K \beta_{21}I_k(t_1) + \varepsilon_1, \quad (2)$$

where the vector  $\mathbf{X}_1$  includes both time-invariant and time-variant individual characteristics. The effect of duration dependence is modeled by using the yearly time

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<sup>8</sup> The use of bivariate duration models is common in the analysis of labor market dynamics (see Lancaster, 1990 and van den Berg, 2001 for an overview), but it has also been used extensively in health economics in the analysis of the use of alcohol and tobacco (van Ours, 2004) or drugs (van Ours, 2003).

dummies  $I_k(t_1)$ , where  $t_1$  denotes realizations of the stochastic duration of the spell since age 17 until the first birth, and  $k = (1, \dots, K)$  refers to the year intervals since age 17.

Similarly for the transition to the second birth, where  $j = 2$ , the index  $y_j$  is defined as

$$y_2 = \beta_{02} + \beta_{12} \mathbf{X}_2 + \beta_{22} T_1 + \sum_{k=1}^K \beta_{22} I_k(t_2) + \varepsilon_2, \quad (3)$$

where  $t_2$  denotes realizations of the stochastic duration of the spell since the first birth. In both equations (2) and (3),  $\varepsilon$  denotes the unobserved random factors that affect the transitions to the first and to the second birth, respectively. The specification in (3) includes the duration until the first birth, denoted as  $T_1$ , where the coefficient  $\beta_{22}$  on this variable identifies the true *tempo effects*. In particular,  $\beta_{22} > 0$  is consistent with catch-up effects while  $\beta_{22} < 0$  with postponement effects. The effect of duration dependence is modeled by using the yearly time dummies  $I_k(t_2)$ , where  $t_2$  denotes realizations of the stochastic duration of the spell since the year of the first birth until the second birth, and  $k = (1, \dots, K)$  refers to the year intervals since the first birth.

Using the hazard functions in equation (1), the contribution to the likelihood can be defined for each individual. Let  $T_j^0$  denote the observed censored duration for  $j = 1, 2$  so that  $T_j^0 = T_j$  if  $T_j < C_j$  and  $T_j^0 = C_j$  otherwise,  $C_j$  is the censored observed duration.

The contribution of a completed spell is given by the conditional density function

$$f_j(t_j | \cdot) = \lambda_j(t_j | \cdot) \prod_{t_j=1}^{T_j^0-1} (1 - \lambda_j(t_j | \cdot)), \quad (4)$$

while the contribution of a censored spell is given by the conditional survival function

$$S_j(t_j | \cdot) = \prod_{t_j=1}^{T_j^0} (1 - \lambda_j(t_j | \cdot)). \quad (5)$$

The total sample likelihood is given by the product of the individual likelihoods

$$L(\theta, \varepsilon_1, \varepsilon_2) = \prod_{i=1}^N L_1(\theta_1) L_2^{c_i}(\theta_2) dG(\varepsilon_1, \varepsilon_2), \quad (6)$$

where  $L_j(\theta) = [f_j(t_j | \cdot)]^{c_j} [S_j(t_j | \cdot)]^{1-c_j}$ ,  $\theta_1$  and  $\theta_2$  are the parameters to be estimated,  $N$  is the number of individual spells and  $c_j$  are dummies that take the value one for a completed spell ( $T_j < C_j$ ) and zero for a censored spell ( $T_j = C_j$ ). Note that the spells for the second birth contribute to the likelihood when the spell for the first birth is not censored (i.e.  $c_1 = 1$ ).

The unobserved heterogeneity distribution  $G(\varepsilon_1, \varepsilon_2)$  is defined flexibly as a discrete distribution with support points denoted by  $\varepsilon_{jp}$  and the corresponding probability mass given by  $\Pr(\varepsilon_j = \varepsilon_{jp}) = \pi_p$ , where  $p = 1, \dots, P$  denotes the support points. This approach in modeling unobserved heterogeneity is used frequently in labor economics and originates from Heckman and Singer (1984). Each unobserved factor is assumed to be time-invariant and individual specific, and it is allowed to be correlated across transitions. With two mass points for each unobserved component (random effects), there may be four types of individuals that are different in terms of their inclination to reach the first and the second parity because they have, for instance, a different desired fertility

$$\begin{aligned} \Pr(\varepsilon_1 = \varepsilon_{11}, \varepsilon_2 = \varepsilon_{21}) &= \pi_1, & \Pr(\varepsilon_1 = \varepsilon_{11}, \varepsilon_2 = \varepsilon_{22}) &= \pi_2, \\ \Pr(\varepsilon_1 = \varepsilon_{12}, \varepsilon_2 = \varepsilon_{21}) &= \pi_3, & \Pr(\varepsilon_1 = \varepsilon_{12}, \varepsilon_2 = \varepsilon_{22}) &= \pi_4, \end{aligned}$$

where  $0 \leq \pi_p \leq 1$ ,  $\sum_{p=1}^4 \pi_p = 1$  with  $p = 1, \dots, 4$  and  $\pi_p = \exp(\alpha_p) / \sum_{p=1}^4 \exp(\alpha_p)$  with normalization  $\alpha_4 = 0$  to have a multinomial logit specification.<sup>9</sup>

The sample log-likelihood can be written as follows

$$\log L = \sum_{p=1}^4 \pi_p \log L_p, \quad (7)$$

where  $\log L_p$  is defined as in (6) for a specific mass point  $p$ . In the presence of a constant term in the vector of the observed covariates, we normalize the first mass point  $\varepsilon_{j1}$  to zero, so that the estimated coefficient for the second mass point denotes the deviation from the constant term.

Identification of multivariate discrete-time duration models is discussed by Cameron and Heckman (1998). They show that identification is enhanced if the index varies with duration without the need of exclusion restrictions. This condition is satisfied in the presence of time variant regressors in  $\mathbf{X}_1$  and  $\mathbf{X}_2$ .<sup>10</sup> It is important to note that the data do not provide observations on drawing from the mixing distribution of unobserved characteristics  $G$  in (6). The information on  $G$  comes from the observed interaction between duration and the observed individual characteristics. By allowing for the unobserved factors to be correlated across the two transitions, we control for potential selectivity which might confound the effect of the age at first birth on the transition to the second.

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<sup>9</sup> We have also considered three mass points in the empirical analysis, but either they did not improve the estimation results, or they could not be identified.

<sup>10</sup> Even with a constant index, their Theorem 4 shows that the model is identified if attention is restricted to finite mixture distributions of the type defined above.

## 5. Results

We estimate the model for the transitions to the first and the second childbirth under two different assumptions. The first, which is the benchmark case, uses the “piecemeal approach” (Heckman et al., 1985) and assumes that the transitions to the first and the second parity are independent. The second allows for dependence across transitions by way of correlated unobserved heterogeneity, as discussed in the previous section.

The index for the transition to the first birth includes both time-variant and time-invariant regressors. The time-variant variables are a dummy for being engaged in full-time education, marital status (married and divorced) and a quadratic for years since first job. The time invariant variables include the highest educational level achieved and a dummy equal to one for women who have been employed at least once and zero for those who have never worked in paid-employment in their life. The highest educational level achieved is classified in three levels according to the International Standard Classification of Education (ISCED): "higher" for recognized higher education, "medium" for second stage of secondary education and "low" for lower than upper secondary education. For those women who have not yet completed education, this variable captures the effect of the expected level of education. We prefer the time-invariant information on having been employed to time-variant current employment status mainly for two reasons. First, the information on individual labor market status is only observed for 1994-2001, so it is not available for the whole period from age 17 to the time of first birth for all women. Hence, estimating a specification including the current labor force status would require focusing only on the period 1994-2001 and on the women aged 17 in 1994 who experienced two childbirths in the same period, which would restrict considerably the sample size and

would impose an arbitrary sample selection according to the spacing of the first two births.<sup>11</sup> For the same reason, we do not include partners' characteristics.<sup>12</sup> Second, the variable on having been employed can be considered as predetermined with respect to the timing of fertility, and especially the timing of the second birth, compared to the current labor force status, which is clearly endogenous. Indeed, in developed countries, where age at motherhood is relatively high, being employed at least once in the life-time is less likely to be hindered by motherhood. Finally, the years since first job proxy for *potential* experience for employed women.

The transition to the second birth includes the same controls as those for the first childbirth, except for the student status dummy. The student indicator, which is time variant, is only included in the transition to the first birth, as student status is generally not compatible with childrearing and is aimed to capture a purely mechanical postponement effect. In addition, the transition to second birth includes the age at which a woman first gave birth, which captures the *tempo effect*, and a dummy variable for the first child being male to account for potential gender bias towards either sons or daughters. Finally, we include year dummies in both equations to capture time-varying policies or macro-economic factors which might affect fertility decisions, and duration dependence dummies.

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<sup>11</sup> The drawback of using the time-invariant information on having been employed is that in some countries a very high percentage of women "has worked". We investigate the sensitivity of our results in Section 5.3 by estimating another specification in which we interact age at the first birth with a more restrictive indicator of being "career oriented" (see Table 1).

<sup>12</sup> In line with the previous empirical literature on *tempo effects*, we do not account for the potential endogeneity of educational variables. This means, for instance, that the coefficient on educational variables could also proxy for an individual's preference towards childbearing. By including the higher education achieved in both the first and the second birth equations we aim to capture the effect of age at first birth on the timing of the second birth over and above the association between age at first birth and the level of completed education.

## 5.1 Transition to the first birth

Table 2 shows the estimation results from the benchmark case based on the assumption of independent transitions.<sup>13</sup> Starting with the transition to the first birth, characteristics which are generally associated with a delay of the first childbirth are: being a student; having completed higher education; and having been employed. The effect of the student status is in line with the idea that studying and childbearing can be hardly combined and that studying has a mechanical effect on delaying the first child. Higher and medium levels of completed education also have negative effects in all countries except in Denmark and Germany. This result suggests that the pure mechanical effect of being a student is not the only relevant dimension in delaying fertility produced by education. It rather shows that in several countries the “career planning” and the “consumption smoothing” motives (see Gustafsson, 2001) for more educated women contribute to the delay of the first childbirth. This is also suggested by the negative effect of the proxy for attachment to the labor market - the effect of having been employed - and the inverse-U shaped pattern of the effect of women’s earnings potential proxied by potential experience. This indicates that women face a higher hazard of childbirth as they get more experience in the labor market, when childbearing is less damaging to their future careers and current household income is relatively higher. Finally, the effect of being married or having been married but now divorced go in the expected direction of increasing the hazard of giving birth to the first child.

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<sup>13</sup> We do not describe in detail the estimates of the transition to the first parity, since they do not represent the main focus of our paper. Delaying of first birth in Europe has been recently investigated by Nicoletti and Tanturri (2008).

## 5.2 The effect of age at first birth on the transition to the second birth

We now turn to the main interest of the paper, which is the effect of delaying the first birth on the transition to the second birth. In this first specification, like in the previous literature, tempo effects are not allowed to differ by a woman's working status. Table 2 shows that the effect of delaying the first birth on the hazard of the second one varies across countries. For all Southern European countries (Greece, Italy, Portugal and Spain), we find a statistically significant postponement effect on the overall population, as the coefficient on the age at first birth is negative. That is, giving birth to the first child at an older age has a negative effect on the hazard of achieving a second birth. We also find a negative effect of age at first birth for Ireland and the U.K. and positive effects for Belgium, Denmark and France, which are, however, statistically insignificant,

To distinguish between a true causal effect of age at first birth from a spurious correlation due to unobserved heterogeneity, we estimate the two transitions jointly as in equation (6). The coefficient estimates in specification 1 of Table 3 suggest that, conditional on observed and unobserved heterogeneity, delaying the first birth lowers the transition to the second parity in Greece, Ireland, Italy, Portugal, Spain and the U.K.<sup>14</sup> The postponement effect, however, is statistically significant only for Greece, Portugal and Spain. We also find for Denmark and France that accounting for endogeneity of age at first birth leads to a significant catch-up effect: delaying the first birth positively affects the transition to the second birth. The findings for Denmark are consistent with those in Heckman et al. (1985) for Sweden, which is another Nordic country with similar institutional characteristics.

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<sup>14</sup> We only report in Table 3 the main variables of interest for the transition to the second birth. The full estimates from the jointly estimated model of specification 1 for both transitions are reported in Table A2 in the Appendix.

Table 4 shows the estimates of the unobserved heterogeneity distribution and the associated probabilities. The unobserved heterogeneity allows us to split a country's population among four different individual types: 1) fast parity achievers (HH), who are fast in achieving both parities; 2) slow parity achievers (LL), who are slow in achieving both parities; 3) slow 1st parity achievers (LH), who are relatively slow in achieving the first parity but faster in achieving the second one; and 4) slow 2nd parity achievers (HL), who are relatively fast in achieving the first parity but slower in achieving the second.

In Belgium, Denmark, France, Germany, Greece, Ireland, Portugal and Spain, the largest fraction of the population is composed of HH-type individuals, i.e. those who are relatively fast in achieving both parities. Among these countries, the largest fraction of fast achievers is observed for Ireland, which is also the country with the highest TFR in our sample. By contrast, in Italy and the U.K., the largest part of the population is represented by HL-type individuals: those who are fast in achieving the first parity but slow in achieving the second one. We also observe other differences in unobserved heterogeneity by country. For instance, in France and Greece, the second largest group in the population is represented by slow achievers. In other countries such as Belgium, Germany, Portugal and Spain, the second largest group is instead composed of HL-type individuals.

### **5.3 Explaining the cross-country variation in *tempo effects***

The previous analysis has revealed significant heterogeneity across countries for the effect of age at first birth on the timing of subsequent birth, with a significant postponement effect emerging in Southern Europe and a catch-up effect found in

Denmark and France. As we discussed in section 2, cross-country differences are likely to be determined by the relative magnitudes of *biological*, *socio-cultural* and *career* effects, which are likely to operate differentially both on working and non-working women and across countries. Hence, in order to obtain an idea of the relative importance of these effects, we estimate a specification in which age at first birth is interacted with the dummy for having been employed (specification 2).

The effect of delaying motherhood for non-working women, which is captured by the non-interacted coefficient of the age at first birth on the hazard of the second parity reported in Table 3 (specification 2), is negative in all countries except for Belgium, Germany and the U.K., where it is either positive but not significant or zero. This shows the existence of postponement effects on non-working women in a number of countries. It is interesting to note that the magnitude of the postponement effect varies across countries and it is higher and significant in Ireland and Southern European countries (Greece, Portugal, Italy and Spain). One possible way to rationalize this variation is in terms of differential socio-cultural effects across countries: some countries' social norms are likely to determine a larger social penalty for giving birth late. The fact that we do not find a postponement effect for non-working women in Germany, for instance, where the regulation regarding assisted reproductive technologies is very strict (Langdrige and Blyth, 2001), while we find a very strong effect in Greece, where a *laissez faire* approach prevails, might suggest that the biological effect is not the main driver of the cross-country differences in these postponement effects, and that socio-cultural differences may represent a more suitable explanation.

Estimates from specification 2 in Table 3, show that women who have been

employed are significantly less likely to progress to the second parity, except for Belgium, Germany and the U.K., where the effect is positive but not significant. The negative effect is likely to capture the higher opportunity cost of childbearing for working women. However, in those countries in which working women are less likely to progress to the second parity delaying the first birth has a *differential* positive effect. The interaction term between having been employed and age at first birth is meant to capture the career effect on the timing of the second birth that might be produced by delaying motherhood, which was discussed in section 2.<sup>15</sup> The sign and magnitude of this career effect determines the sign of the overall effect of delaying the first birth for working women (i.e. the sum of the main effect of age at first birth and the interaction term with employment). In countries such as Denmark and France, where the positive career effect for working women is relatively larger than the negative effect related to the socio-cultural and biological effects, the overall effect is positive and significant (the catch-up effect). In contrast, in countries such as Greece, Italy, Portugal and Spain, where the positive career effect is relatively small compared to the socio-cultural influences, the overall effect for working women is negative (the postponement effect).

As we have already discussed in section 2, the relative difference in the sign and magnitude of the career effect across countries might be explained by differences in their labor markets and childcare provisions. The flexible working arrangements and the high provision of public childcare in countries such as Denmark and France enabling women to easily combine work and childrearing may lead to a large catch-up effect as delaying motherhood by working women produces an income effect on fertility which is larger

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<sup>15</sup> The effect of age at first birth for Denmark refers to those women who have been employed. The effect of having been employed cannot be identified due to low variation, as most of women have been employed at least once in their lifetime.

than the substitution effect (related to the opportunity cost of childbearing). By contrast, the low level of external childcare and the lack of flexibility in Southern European labor markets create major difficulties in combining family and work and leads to a higher opportunity cost of childbearing. This may lead to a postponement effect as delaying motherhood does not produce on working women a career effect large enough to offset the negative biological and socio-cultural effects. Therefore, when considering the whole population, an overall postponement effect is likely to emerge in Southern European countries and a catch up effect in Denmark and France.

It is also worth noting that allowing the *tempo effects* to differ according to a woman's working status (i.e. including interaction terms) is crucial for the full understanding of the effect of delaying the first birth on the progression to higher parities. For instance, while the tempo effect for Ireland was insignificant in the specification without interactions (specification 1) in Table 3, the interaction in specification 2 shows that, in reality, this insignificant effect hides a significant postponement effect for non-working women.

Finally, we estimate another specification in which we interact age at the first birth with an indicator of being career oriented. We now consider women who have been employed and have upper secondary or higher education as being career oriented; as opposed to women who have either never being employed or have been employed but are low educated. In other words, we distinguish working women by their education level.<sup>16</sup>

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<sup>16</sup> We consider this further analysis as a robustness check. Although in the previous specifications we considered as career oriented those women who worked in the past, some of them might have left the labor market relatively early. This is less likely to be the case for highly educated women (see Bratti, 2003). It should be noted nonetheless that the career effect does not necessarily imply that women must be continuously attached to the labor force. Indeed, a sufficient condition to observe it would be that working women who delayed first birth accumulated more resources to afford a further birth, even if they decide to drop the labor force after their first childbirth. For Denmark, as in the

The overall career effect is once more theoretically ambiguous: on the one hand, more educated working women may have a higher income effect; but on the other hand, the opportunity cost is also higher. Specification 3 in Table 3 shows that for most countries where we found significant tempo effects in specification 2 (France, Greece, Italy, Portugal and Spain) the main results are qualitatively and quantitatively similar, except for Ireland. As for the career effect, it is worth noting the large and significant effect of the interaction term for Germany, which now suggests an overall catch-up effect. Higher career effects are now also observed for Italy and Portugal, when we consider working women with higher education. The overall effect for these women is then positive but not significant. Overall, we consider this as evidence that our results are robust to alternative definitions of career oriented women.

#### **5.4 Simulations**

The above analysis has shown that there are statistically significant *tempo effects* in some European countries and that their magnitude and sign vary across countries. To gauge the magnitude of these effects on fertility, we compute the conditional probability to progress to the second birth within five years after the first birth under different scenarios with respect to the age at first birth. The first scenario is when the age at first birth is 25, which is close to the average observed in most European countries. The second scenario is where the age at first birth increases to 30. We distinguish between working and non-working women, and we fix other characteristics at their mean sample values at the country level.

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previous specifications, we cannot identify the effect of age at first birth separately for the two groups of women as being employed and having high education are perfectly correlated.

Table 5 reports the difference in the probability in having a second childbirth within five years of the first birth, induced by a change in the age at first birth from 25 to 30. The effects are estimated by women's working status and by country. Here we comment only on the effects that were found to be statistically significant. It can be seen immediately the large catch-up effects for working mothers in Denmark and France, where delaying age at motherhood by five years leads to an increase in the likelihood of having a second childbirth within the following five years by almost 20 percentage points (p.p.) and 12 p.p., respectively. Catch up effects are also observed for working women in other countries, although they are much smaller in magnitude. As for non-working women, our simulations predict large postponement effects for Greece (-11.5 p.p.), Ireland (-10.6 p.p.) and Italy (-7.1 p.p), and smaller effects for Spain and Portugal (-5.5 and -3.2 p.p., respectively).

## **6. Conclusion**

We investigate the effect of delayed motherhood on fertility dynamics by focusing on the effect of the age at first birth on the transition to the second parity for a number of European countries using highly comparable data from the European Community Household Panel. We account for the potential endogeneity of age at first birth by estimating a multivariate discrete-time duration model, which accounts for correlated unobserved heterogeneity across parities. We show that the effect of delayed motherhood differs both across countries and with the woman's working status. For non-working women, delaying the first birth is likely to *lower* the likelihood of progressing to the second parity because of biological and socio-cultural factors. For working women, the

career-planning motive to delay the first birth, since working “late mothers” can accumulate more labor market experience and earn higher wages, could *raise* the likelihood of progressing to the second parity when the positive career effect is large enough to offset the negative biological and socio-cultural effects acting on all women.

These two opposite forces produced by delaying the first birth on the transition to the second child, which appear to exist between working and non-working women, also vary across countries. The positive career effect for working women is found to be larger in countries with high childcare provision and availability of part-time opportunities, and where family and work can be more easily reconciled, such as Denmark and France, leading overall to a catch-up effect in the population. The negative biological and socio-cultural effect is found to be higher in Southern European countries and Ireland, where social norms inflict a relatively larger social penalty for giving birth late, leading overall to a postponement effect.

Our analysis suggests that the relative magnitude of these two opposite forces that co-exist and act differentially on women according to their working status determines the sign and the magnitude of *tempo effects* in the overall population. As for the magnitude of these *tempo effects*, our estimates suggest that delaying the age of motherhood by five years - from 25 to 30 - leads to a positive effect on the likelihood of having a second childbirth within five years from the first of as much as 19 p.p. for countries such as Denmark, and a negative effect of as much as -12 p.p. in Southern European countries such as Greece.

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Table 1. Institutional details and summary statistics.

	(1)		(2)	(3)	(4)	(4)	(5)	(6)	(7)
	Child-Care Coverage <sup>a</sup>		Part-Time <sup>c</sup>	Sample Size <sup>d</sup>	Has Worked <sup>d</sup>	Career Oriented <sup>de</sup>	Share of	Share of Women with	Mean Age
	%		%		%	%	Childless Women <sup>df</sup>	more than 1 Child <sup>df</sup>	at First Birth <sup>df</sup>
	0-3 Years old	3-6 Years old					%	%	
Belgium	30	97	36.9	718	94.84	72.56	14.01	52.47	26.07
Denmark	64	91	34.7	537	98.88	94.59	14.35	46.03	26.87
France	29	99	31.4	810	92.83	64.19	13.55	57.01	25.17
Germany	10	78	37.2	737	75.84	59.43	18.54	38.54	25.21
Greece	3	46	10.0	1232	76.94	52.19	13.10	63.16	24.07
Ireland	38	56	30.1	880	95.79	63.86	13.76	63.84	25.89
Italy	6	95	15.6	1801	72.62	44.19	20.30	40.97	26.16
Portugal	12	75	16.7	1018	84.57	25.44	14.63	48.97	23.86
Spain	5	84	17.1	1689	87.98	47.06	18.10	46.66	25.79
UK	34 <sup>b</sup>	60 <sup>b</sup>	44.0	898	95.87	49.88	17.54	49.60	26.25

Source: a) Employment Outlook 2001. The data for coverage refer to the proportion of young children using formal child-care arrangements which include both public and private provision; b) England only; c) Eurostat 1999; d) ECHP(1994-2001); e) has worked with upper secondary or higher education f) for women aged 35+ at the last observed wave.

Table 2. Transition to first and second birth under the independence assumption.

	Belgium		Denmark		France		Germany		Greece		
	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	
<b><i>Duration to First Birth</i></b>											
Student	-0.790	0.252	-0.576	0.182	-1.484	0.433	-0.786	0.181	-0.506	0.217	
High Education	-0.151	0.134	0.149	0.281	-0.377	0.142	0.668	0.145	-0.352	0.113	
Medium Education	-0.088	0.123	0.450	0.282	-0.353	0.103	0.331	0.132	-0.345	0.100	
Married	2.000	0.109	1.542	0.119	1.960	0.094	2.236	0.105	4.181	0.138	
Divorced	0.799	0.132	0.285	0.153	1.142	0.138	0.632	0.133	1.788	0.197	
Has Been Employed	-1.513	0.254	-		-1.381	0.231	0.036	0.169	-0.062	0.119	
Years since First Job	2.131	0.449	2.025	0.460	2.573	0.449	1.146	0.378	0.637	0.263	
Years since First Job <sup>2</sup>	-1.312	0.258	-1.021	0.243	-1.492	0.246	-0.505	0.225	-0.338	0.160	
Constant	-2.186	0.289	-3.385	0.397	-2.024	0.247	-3.794	0.221	-5.055	0.213	
<b><i>Duration to Second Birth</i></b>											
Age at First Birth	0.016	0.024	0.021	0.027	0.028	0.024	-0.008	0.022	-0.051	0.014	
High Education	0.380	0.163	1.139	0.441	0.115	0.168	-0.108	0.177	-0.422	0.120	
Medium Education	0.135	0.146	1.141	0.438	-0.021	0.118	-0.066	0.165	-0.178	0.102	
Married	0.302	0.167	0.554	0.139	0.663	0.123	0.637	0.183	1.045	0.261	
Divorced	-0.262	0.189	-0.059	0.195	0.022	0.172	-0.166	0.193	-0.367	0.251	
Has Been Employed	-0.192	0.333	-		-0.744	0.352	0.354	0.253	0.301	0.147	
Years since First Job	0.570	0.446	1.395	0.607	0.884	0.478	0.284	0.418	-0.238	0.251	
Years since First Job <sup>2</sup>	-0.529	0.201	-0.631	0.232	-0.627	0.190	-0.208	0.201	0.067	0.130	
First Child a Boy	-0.016	0.110	-0.043	0.130	-0.018	0.100	0.170	0.120	-0.020	0.083	
Constant	-2.409	0.605	-4.242	0.761	-1.802	0.535	-2.060	0.570	-1.074	0.417	
Log-Likelihood/N	-211.42		-218.34		-204.55		-205.34		-173.73		

(continues)

Table 2. Transition to first and second birth under the independence assumption (continued).

	Ireland		Italy		Portugal		Spain		UK	
	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.
<b><i>Duration to First Birth</i></b>										
Student	-0.619	0.297	-0.392	0.162	-0.441	0.194	-0.406	0.153	-0.151	0.257
High Education	-0.150	0.172	-0.268	0.124	-0.451	0.165	-0.383	0.093	-0.366	0.108
Medium Education	-0.249	0.110	-0.319	0.073	-0.174	0.120	-0.233	0.088	-0.291	0.125
Married	2.942	0.122	3.510	0.094	3.270	0.111	3.470	0.098	1.756	0.095
Divorced	1.225	0.205	0.479	0.147	1.505	0.150	1.638	0.135	0.888	0.107
Has Been Employed	-1.243	0.404	-0.297	0.115	-0.259	0.149	-0.387	0.143	-1.601	0.287
Years since First Job	2.509	0.649	0.506	0.220	-0.085	0.252	0.823	0.224	2.756	0.415
Years since First Job <sup>2</sup>	-0.871	0.293	-0.269	0.114	0.093	0.140	-0.456	0.109	-1.229	0.187
Constant	-4.188	0.347	-4.165	0.144	-3.693	0.200	-4.543	0.172	-2.905	0.286
<b><i>Duration to Second Birth</i></b>										
Age at First Birth	-0.041	0.031	-0.030	0.013	-0.063	0.017	-0.045	0.014	-0.017	0.023
High Education	0.410	0.217	0.261	0.171	0.666	0.194	0.084	0.113	0.084	0.136
Medium Education	0.042	0.128	0.070	0.087	0.178	0.147	-0.020	0.100	0.169	0.151
Married	1.234	0.178	1.120	0.211	0.268	0.176	0.763	0.165	0.988	0.138
Divorced	0.335	0.220	0.023	0.215	0.002	0.185	0.074	0.170	0.170	0.144
Has Been Employed	-0.529	0.620	-0.430	0.178	-0.490	0.188	0.122	0.192	-0.656	0.404
Years since First Job	0.660	0.636	0.155	0.264	-0.316	0.257	-0.025	0.232	0.882	0.452
Years since First Job <sup>2</sup>	-0.241	0.213	-0.146	0.109	0.097	0.107	0.003	0.090	-0.452	0.170
First Child a Boy	-0.139	0.102	0.153	0.076	0.105	0.092	0.102	0.076	0.196	0.102
Constant	-0.848	0.770	-1.537	0.383	-0.118	0.429	-1.107	0.371	-1.531	0.552
Log-Likelihood/N	-176.30		-230.26		-212.34		-213.79		-212.00	

Note: The model is estimated assuming that there is no unobserved heterogeneity. Other controls include year dummies to capture time-varying policies or macro-economics factors and duration dependence dummies. For Denmark, the variable has been employed is not identified due to low variation as most of women have been employed at least once in their lifetime.

Table 3. The effect of age at first birth on the duration to second birth.

	Belgium		Denmark <sup>a</sup>		France		Germany		Greece	
	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.
<b>Specification 1</b>										
Age at First Birth	0.048	0.039	0.133	0.040	0.057	0.030	0.006	0.027	-0.037	0.018
Has Been Employed	0.135	0.421	-		-0.957	0.395	0.508	0.309	0.390	0.163
Log-Likelihood/N	-211.39		-218.31		-204.52		-205.30		-173.70	
<b>Specification 2</b>										
Age at First Birth	0.058	0.115	-		-0.061	0.067	0.003	0.039	-0.074	0.025
Age at First Birth*Has Been Employed	-0.010	0.116	0.133	0.040	0.137	0.072	0.004	0.050	0.055	0.030
Has Been Employed	0.360	2.545	-		-3.792	1.536	0.416	1.151	-0.796	0.661
Log-Likelihood/N	-211.39		-218.31		-204.52		-205.30		-173.70	
<b>Specification 3</b>										
Age at First Birth	0.033	0.050	-		-0.003	0.036	-0.035	0.033	-0.057	0.021
Age at First Birth*Career	0.027	0.048	0.133	0.040	0.143	0.040	0.085	0.043	0.024	0.026
Career	-1.883	1.521	-		-3.892	1.015	-1.599	1.103	-0.430	0.639
Log-Likelihood/N	-211.39		-218.31		-204.52		-205.30		-173.70	
<b>Ireland</b>										
<b>Italy</b>										
<b>Portugal</b>										
<b>Spain</b>										
<b>UK</b>										
<b>Specification 1</b>										
Age at First Birth	-0.039	0.034	-0.021	0.017	-0.043	0.022	-0.046	0.017	-0.016	0.025
Has Been Employed	-0.545	0.664	-0.592	0.227	-0.844	0.222	0.103	0.228	-0.693	0.446
Log-Likelihood/N	-176.28		-230.24		-212.29		-213.76		-211.98	
<b>Specification 2</b>										
Age at First Birth	-0.195	0.053	-0.056	0.024	-0.089	0.048	-0.123	0.036	0.085	0.086
Age at First Birth*Has Been Employed	0.225	0.061	0.053	0.026	0.054	0.051	0.094	0.039	-0.107	0.087
Has Been Employed	-5.290	1.150	-1.759	0.625	-2.008	1.116	-2.039	0.916	1.590	1.929
Log-Likelihood/N	-176.28		-230.24		-212.29		-213.76		-211.98	
<b>Specification 3</b>										
Age at First Birth	-0.058	0.034	-0.049	0.017	-0.059	0.024	-0.082	0.021	-0.001	0.027
Age at First Birth*Career	0.048	0.030	0.073	0.023	0.071	0.040	0.073	0.026	-0.007	0.027
Career	-2.161	1.079	-1.790	0.616	-2.552	1.225	-1.484	0.720	-2.356	1.040
Log-Likelihood/N	-176.28		-230.24		-212.29		-213.76		-211.98	

Note: Specification 2 allows for an interaction of age at first birth with ever been employed. Career in Specification 3 is defined as ever being employed with higher or medium level of education. Each model is estimated allowing for correlated unobserved heterogeneity. Table A2 reports the coefficient estimates for other controls for specification 1. We also include year dummies to capture time-varying policies or macro-economics factors and duration dependence dummies. a) For Denmark, in all specifications the effect of age at first birth refers to those women who have been employed. The variable has been employed is not identified due to low variation as most of women have been employed at least once in their life-time.

Table 4. Estimated unobserved heterogeneity distribution.

	Belgium		Denmark		France		Germany		Greece	
	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.
<b>Duration to First Birth</b>										
$\epsilon_{1_1}$	-4.927	0.893	-2.880	0.548	-3.955	0.558	-6.808	0.924	-4.888	0.235
$\epsilon_{1_2}-\epsilon_{1_1}$	2.735	0.764	-1.154	0.253	2.181	0.411	3.459	0.822	-2.459	0.405
<b>Duration to Second Birth</b>										
$\epsilon_{2_1}$	-5.314	1.137	-6.018	0.990	-1.940	0.606	-1.994	0.697	-1.082	0.471
$\epsilon_{2_2}-\epsilon_{2_1}$	2.655	0.710	-inf		-2.089	0.809	-inf		-inf	
Probabilities										
$P1(\epsilon_{1_1}=\epsilon_{1_1}, \epsilon_{2_2}=\epsilon_{2_1})$	0.086	LL	0.547	HH	0	LH	0.057	LH	0.879	HH
$P2(\epsilon_{1_1}=\epsilon_{1_1}, \epsilon_{2_2}=\epsilon_{2_2}-\epsilon_{2_1})$	0	LH	0	HL	0.124	LL	0.073	LL	0.048	HL
$P3(\epsilon_{1_1}=\epsilon_{1_2}-\epsilon_{1_1}, \epsilon_{2_2}=\epsilon_{2_1})$	0.195	HL	0.258	LH	0.818	HH	0.715	HH	0	LH
$P4(\epsilon_{1_1}=\epsilon_{1_2}-\epsilon_{1_1}, \epsilon_{2_2}=\epsilon_{2_2}-\epsilon_{2_1})$	0.719	HH	0.195	LL	0.058	HL	0.155	HL	0.073	LL
	Ireland		Italy		Portugal		Spain		UK	
	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.
<b>Duration to First Birth</b>										
$\epsilon_{1_1}$	-4.064	0.361	-3.999	0.156	-3.615	0.224	-4.590	0.189	-6.807	4.472
$\epsilon_{1_2}-\epsilon_{1_1}$	-2.032	0.735	-3.788	0.578	-3.087	0.532	-3.068	0.484	3.976	4.133
<b>Duration to Second Birth</b>										
$\epsilon_{2_1}$	-0.859	0.833	-2.414	0.805	-2.788	1.536	-2.424	0.788	-1.704	0.636
$\epsilon_{2_2}-\epsilon_{2_1}$	-1.795	0.636	1.605	0.229	2.849	1.093	1.820	0.429	1.457	1.036
Probabilities										
$P1(\epsilon_{1_1}=\epsilon_{1_1}, \epsilon_{2_2}=\epsilon_{2_1})$	0.907	HH	0.502	HL	0.216	HL	0.278	HL	0.090	LL
$P2(\epsilon_{1_1}=\epsilon_{1_1}, \epsilon_{2_2}=\epsilon_{2_2}-\epsilon_{2_1})$	0	HL	0.423	HH	0.725	HH	0.650	HH	0	LH
$P3(\epsilon_{1_1}=\epsilon_{1_2}-\epsilon_{1_1}, \epsilon_{2_2}=\epsilon_{2_1})$	0	LH	0.073	LL	0.050	LL	0.071	LL	0.723	HL
$P4(\epsilon_{1_1}=\epsilon_{1_2}-\epsilon_{1_1}, \epsilon_{2_2}=\epsilon_{2_2}-\epsilon_{2_1})$	0.093	LL	0.002	LH	0.009	LH	0.001	LH	0.187	HH

Note: These estimates are based on specification 1 of Table 3. Unobserved heterogeneity is defined as a discrete distribution with two mass points for the unobserved term in each transition. The second mass point is defined as the deviation from the first. Four different individual types are distinguished: 1) fast parity achievers (HH), who are fast in achieving both parities; 2) slow parity achievers (LL), who are slow in achieving both parities; 3) slow 1st parity achievers (LH), who are relatively slow in achieving the first parity but faster in achieving the second one; and 4) slow 2nd parity achievers (HL), who are relatively fast in achieving the first parity but slower in achieving the second.

Table 5. Effect of a 5-year delay in motherhood on the probability of having a second birth within 5 years from the first.

	Non-Working	Working
Denmark	-	0.192
Belgium	0.031	0.021
France	-0.089	0.119
Germany	0.005	0.012
Greece	-0.115	-0.029
Ireland	-0.106	0.024
Italy	-0.071	-0.003
Portugal	-0.032	-0.006
Spain	-0.055	-0.019
UK	0.096	-0.034

Note: These estimates are based on specification 2 of Table 3. This table shows the change in the predicted probability of having the second child within 5 years of the first one induced by an increase in the age at motherhood from 25 to 30. Positive differences represent catch up effects and negative ones postponement effects. The effect on fertility is computed at country specific sample mean values for the other regressors.

Table A1. Means of main variables.

	Belgium	Denmark	France	Germany	Greece	Ireland	Italy	Portugal	Spain	UK
Age	32.29	32.31	32.56	30.83	32.41	32.49	32.17	32.35	32.18	32.08
Married	0.70	0.49	0.59	0.66	0.81	0.75	0.77	0.79	0.74	0.61
Divorced	0.17	0.14	0.12	0.15	0.06	0.06	0.05	0.10	0.08	0.19
Number of Children	1.42	1.23	1.58	1.08	1.40	1.71	1.05	1.40	1.13	1.33
High Education	0.43	0.52	0.24	0.36	0.32	0.16	0.12	0.10	0.30	0.36
Medium Education	0.33	0.44	0.42	0.45	0.30	0.49	0.44	0.17	0.21	0.15
Low Education	0.22	0.04	0.32	0.19	0.37	0.35	0.44	0.73	0.49	0.48
Mean Duration to 1st Birth	11.64	12.36	10.96	11.68	10.41	11.61	12.74	10.13	12.17	12.44
Mean Duration to 2nd Birth	6.05	5.94	6.26	6.50	5.47	4.59	6.56	7.65	6.49	5.49
Number of Observations	718	537	810	737	1232	880	1801	1018	1689	898

Note: The sample is for women aged 28-37 at the first observed wave from ECHP (1994-2001).

Table A2. Transition to first and second birth with correlated unobserved heterogeneity.

	Belgium		Denmark		France		Germany		Greece	
	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.
<b><i>Duration to First Birth</i></b>										
Student	-0.789	0.256	-0.553	0.187	-1.362	0.437	-0.816	0.188	-0.394	0.224
High Education	-0.234	0.162	0.177	0.316	-0.560	0.168	0.626	0.174	-0.532	0.129
Medium Education	-0.044	0.147	0.461	0.314	-0.466	0.122	0.172	0.159	-0.419	0.112
Married	2.298	0.124	1.669	0.145	2.198	0.107	2.617	0.124	4.382	0.146
Divorced	1.154	0.170	0.434	0.181	1.401	0.183	0.603	0.156	1.992	0.214
Has Been Employed	-1.478	0.274	-		-1.401	0.244	-0.164	0.188	-0.042	0.129
Years since First Job	2.080	0.474	2.002	0.484	2.429	0.471	1.279	0.415	0.460	0.283
Years since First Job <sup>2</sup>	-1.155	0.288	-0.957	0.257	-1.203	0.267	-0.454	0.258	-0.098	0.185
<b><i>Duration to Second Birth</i></b>										
Age at First Birth	0.048	0.039	0.133	0.040	0.057	0.030	0.006	0.027	-0.037	0.018
High Education	0.599	0.238	1.624	0.484	0.033	0.197	0.082	0.244	-0.657	0.142
Medium Education	0.242	0.191	1.591	0.482	-0.036	0.137	-0.055	0.208	-0.317	0.120
Married	0.414	0.226	0.887	0.165	0.841	0.150	0.697	0.233	1.280	0.293
Divorced	-0.206	0.262	0.161	0.238	0.152	0.199	-0.334	0.258	-0.402	0.292
Has Been Employed	0.135	0.421	-		-0.957	0.395	0.508	0.309	0.390	0.163
Years since First Job	0.640	0.534	0.472	0.792	0.813	0.518	0.241	0.502	-0.250	0.297
Years since First Job <sup>2</sup>	-0.624	0.234	-0.397	0.353	-0.642	0.207	-0.143	0.259	0.093	0.170
First Child a Boy	0.012	0.149	-0.063	0.156	0.020	0.116	0.143	0.164	0.011	0.097
Log-Likelihood/N	-211.32		-218.31		-204.52		-205.30		-173.70	

(continues)

Table A2. Transition to first and second birth with correlated unobserved heterogeneity (continued).

	Ireland		Italy		Portugal		Spain		UK	
	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.
<b><i>Duration to First Birth</i></b>										
Student	-0.585	0.304	-0.333	0.167	-0.349	0.205	-0.403	0.159	-0.085	0.262
High Education	-0.344	0.190	-0.560	0.141	-0.703	0.183	-0.518	0.104	-0.335	0.132
Medium Education	-0.380	0.126	-0.474	0.083	-0.415	0.133	-0.233	0.097	-0.256	0.147
Married	3.088	0.130	3.739	0.101	3.561	0.122	3.729	0.112	1.978	0.116
Divorced	1.716	0.286	1.417	0.198	1.929	0.185	2.153	0.179	1.085	0.161
Has Been Employed	-1.124	0.429	-0.267	0.123	-0.255	0.159	-0.381	0.154	-1.682	0.387
Years since First Job	2.136	0.689	0.252	0.253	-0.282	0.266	0.657	0.263	2.640	0.450
Years since First Job <sup>2</sup>	-0.625	0.319	-0.142	0.144	0.283	0.150	-0.327	0.146	-1.098	0.213
<b><i>Duration to Second Birth</i></b>										
Age at First Birth	-0.039	0.034	-0.021	0.017	-0.043	0.022	-0.046	0.017	-0.016	0.025
High Education	0.381	0.239	0.258	0.217	0.670	0.280	0.141	0.144	0.102	0.151
Medium Education	-0.018	0.152	0.081	0.111	0.073	0.194	0.030	0.127	0.179	0.170
Married	1.403	0.237	1.371	0.255	0.601	0.235	1.033	0.205	1.085	0.168
Divorced	0.568	0.280	0.145	0.271	0.333	0.276	0.199	0.219	0.184	0.163
Has Been Employed	-0.545	0.664	-0.592	0.227	-0.844	0.222	0.103	0.228	-0.693	0.446
Years since First Job	0.596	0.681	0.321	0.328	-0.114	0.306	-0.044	0.275	0.931	0.498
Years since First Job <sup>2</sup>	-0.176	0.234	-0.229	0.136	-0.034	0.142	0.024	0.111	-0.476	0.186
First Child a Boy	-0.118	0.110	0.210	0.097	0.158	0.119	0.141	0.097	0.211	0.113
Log-Likelihood/N	-176.28		-230.24		-212.29		-213.76		-211.98	

Note: These estimates are based on specification 1 of Table 3.