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Regional child care availability and fertility decisions in Spain

Pau Baizán
ICREA and Universitat Pompeu Fabra
E-mail: pau.baizan@upf.edu

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Department of Political & Social Sciences
Universitat Pompeu Fabra
Ramon Trias Fargas, 25-27
08005 Barcelona
http://www.upf.edu/dcpis/

Abstract

In this paper I explore two hypotheses: (1) Formal child care availability for children under three has a positive effect on fertility; and (2) Formal child care availability has different effects across contexts, according to the degree of adaptation of social institutions to changes in gender roles. Event history models with regional fixed effects are applied to data from the European Community Household Panel (1994-2001). The results show a significant and positive effect of regional day care availability on both, first and higher order births, while results are consistent with the second hypothesis only for second or higher order births.

Key words: child care, fertility, care regime, welfare regime, gender roles, social policy.

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Introduction

A growing body of research points to the crucial role of the social context, and in particular certain institutions such as parental leave policies, labor market arrangements, and access to affordable childcare, in allowing the combination of childrearing and employment. The Spanish context is characterized not only by low day care availability overall, but also by important regional differentials in fertility and female labor force participation, and other characteristics. Furthermore, during the last few decades, labor force participation of women and the proportion of children under three in childcare have increased substantially, while fertility has shown only small increases at the aggregate level since the mid 1990s.

The specification of relationships between these variables form the core of the existing theoretical arguments that support the hypothesis that child care availability has a positive effect on fertility, since day care is presumed to influence principally through reducing the conflict between labor force participation and childrearing (e.g. Ermisch 1989; Bernhardt 1993). In spite of well-founded theoretical arguments, previous empirical studies focusing on the association between availability of childcare services and fertility have provided inconsistent findings (e.g. Kravdal 1996; Hank and Kreyenfeld 2003; Andersson, Duvander and Hank, 2004; Del Boca 2002; Rindfuss et al. 2007). According to Rindfuss et al. (2007), these mixed findings may be due to the assumption that child care is an exogenous variable with respect to fertility. Yet, the coverage rate of day care may to a certain degree be endogenous to fertility and other (unobserved) characteristics of a given place, such as particular values, income, or labor force participation. This may be particularly the case in countries, such as Spain, with large regional variations in fertility, female employment rate, and day care coverage for children under 3 (In Spain, some regions have provisions of less than 5 percent, while others have currently reached nearly 45%). This study's focus is on the years 1993-2000, a period in which enrolment ratios between age 3 and 5 were essentially universal, while the coverage rate for children under 3 was (and still is) very heterogeneous at the regional level, and where enrolment for that last age group increased rapidly in some regions, in connection with particular regional policies.

The results obtained show a significant and positive effect of regional day care availability on fertility. This result is robust to several specifications of the model with respect to individual as well as regional variables.

2. Fertility and childcare

Different theoretical perspectives, including welfare regimes perspectives, neoclassic economics, and theories of cultural norms and individual values, offer insight into the link between childcare and fertility. A brief discussion of some key arguments of these approaches may be useful to evaluate how childcare availability can be related to fertility. As will be explained, all these theoretical perspectives basically lead to the hypothesis that an increased level of regional availability of childcare should lead to higher fertility at the individual level.

Researchers of comparative analysis state that institutional variation provides an explanation for cross-country variations in the relationship between women labor force attachment and fertility (Esping-Andersen 1999). They point to the important mediating effects of the availability of child-care, among other variables, in explaining such cross-national variation. This institutional feature is part of a larger "regime" of welfare, in which different elements do not vary randomly, but form part of qualitatively different systems of welfare. Individual countries cluster in each of the regimes. Thus, a characteristic of the "conservative" welfare states, in particular the Southern European version of this type of welfare state[1], is their "familialism", consisting in the internalization of welfare responsibilities by families (Orloff 1996; Saraceno 1996). Apart from the important exceptions of the health care and educational system, the welfare state is largely an income-transfer system, and is only marginally dedicated to provide services to families. This kind of welfare state basically assumes that married women are housewives who can care for their children, and thus provide little support in the form of public funding for childcare. In fact, the existing public childcare services are mainly considered to serve educational purposes and only to provide child care as a secondary goal (European Commission 2002). These Southern European welfare

[1] One could argue that these welfare regimes are partially the outcome of long standing cultural patterns and path dependency (Mayer 2001), and therefore endogenous to the choices of individuals in the population.

regimes also have a strongly regulated labor market, that focuses its support in a "family wage" and creates several impediments to part-time jobs.

However, several of these prototypical characteristics of the Southern European welfare state, have eroded considerably in Spain in the last few decades. Several reforms have have taken place, including a partial de-regulation of the labor market, an increase in social services, changes in family policy (e.g. an increase family benefits, extension of parental leave) and an important expansion of the child care system (see below) (Polavieja 2003; Arriba and Moreno 2005; Azmat and González 2008). Nevertheless, there is substantial variation among different regions regarding some of these changes, partly related with the political decentralization of the country.

Parallel to the above, an important increase in labor force participation of women has taken place, in particular of those with small children (Figure 1). Current proportions are close to those prevalent throughout West European countries, with the particularity that the large majority of jobs are full-time jobs, including the jobs of mothers (Rubery, Smith and Fagan, 1999). Cross-country comparisons have found that an institutional adaptation to the higher labor force participation of mothers is the expansion of (formal) non-parental childcare. There are signs of a similar evolution in Spain, as larger increases in childcare coverage have taken place in regions with high participation rates for women. Furthermore, the highest increases in total fertility rate have taken place in regions with relatively high female participation rate (Figure 2)[2]. As is known, Spanish TFR reached its lowest level in 1998 (1.16) and eventually this indicator recovered until 1.39 in 2007. The largest increases during the 1990s and early 2000s took place in areas which previously had the lowest fertility rates, already late age fertility patterns, and better economic performance. So far, however, the increase in fertility rate above age 30 has slowed but not reversed cohort fertility decline. At the same time, some regions that had previously the highest fertility rates continued to decline in TFR or only showed smaller increases.

More crucial for this analysis, the largest regional increases in TFR are taking place in regions with relatively high availability of formal childcare and where the increases in formal childcare have been more substantial. Nevertheless, the relationship between these two indicators is far from perfect (Figure 3). These changes seem to point to a regionally differentiated transition in the care regime, where care arrangements and

[2] Rosina and Del Boca (2007) made similar graphs for Italy and found even more striking results.

other institutions in society gradually adapt to the ongoing reconfiguration of gender roles (Hochschild 1989; Gershuny 2000; McDonald 2000).

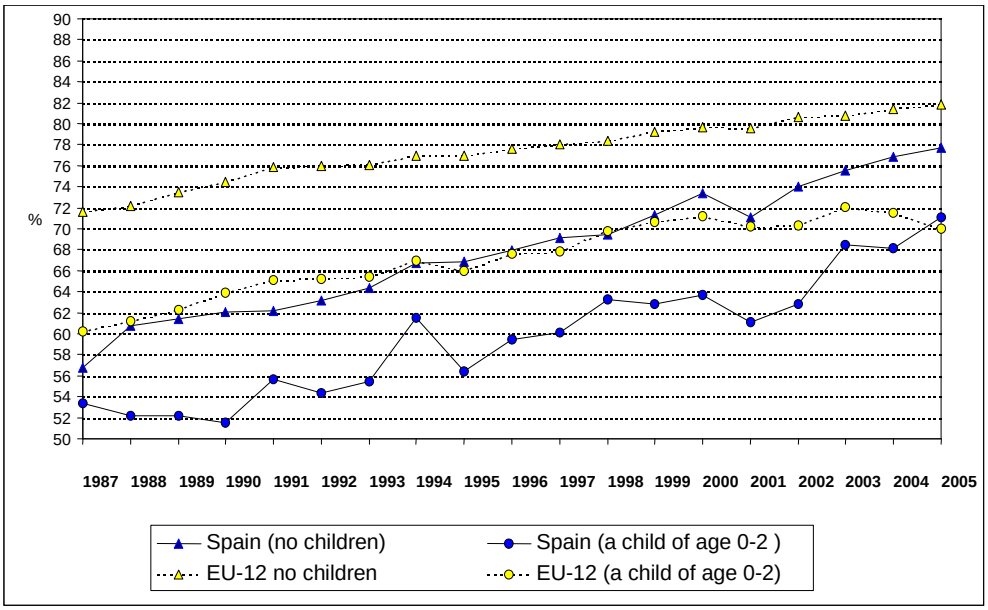

Figure 1. Women's labor force rate (age 25-49) by number of children and age of the youngest child in Spain and the EU-12 (1987-2005). Source: Data from Labor Force Surveys, Eurostat, second trimesters (http://epp.eurostat.ec.europa.eu/; at 18/10/2006). EU-12 includes Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, the Netherlands, Portugal and United Kingdom.

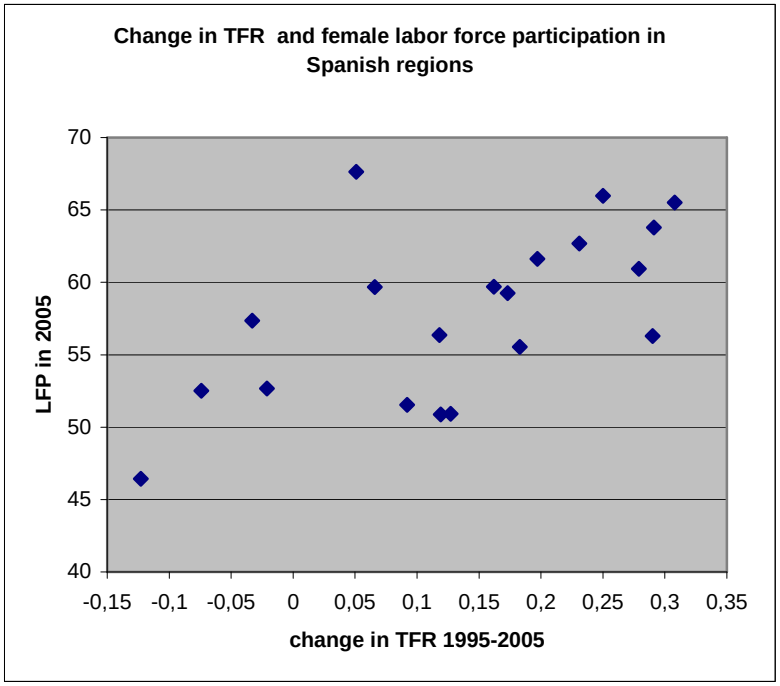

Figure 2. Source: Data from the Instituto Nacional de Estadística, 2008 (www.ine.es).

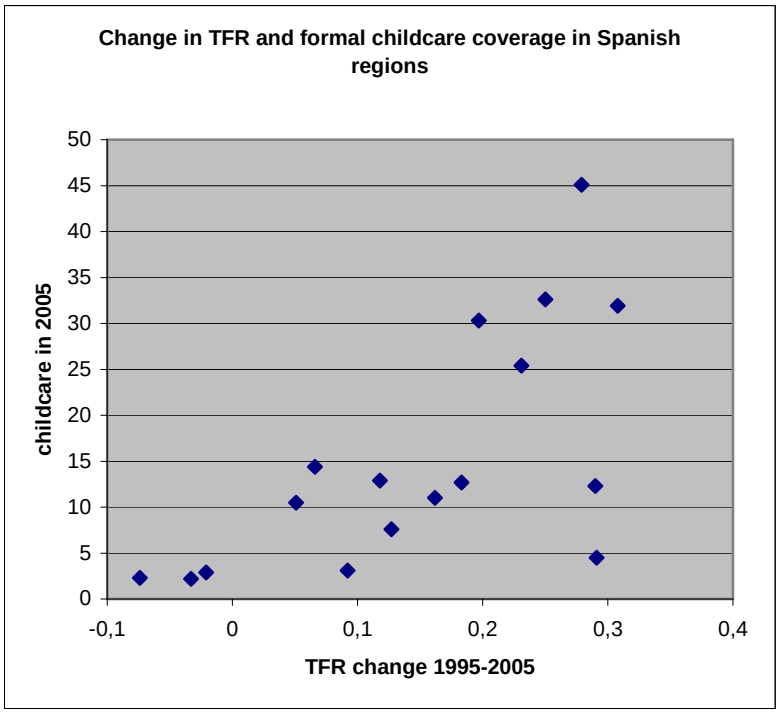

Figure 3. Source: Data from the Instituto Nacional de Estadística 2008 (www.ine.es).

The arguments stated so far have a counterpart at the individual level, where the increased availability of non parental care should diminish the relationship between paid work and fertility. The standard microeconomic model of fertility assumes a joint household utility function in which decisions about participation, care, fertility and child "quality" are closely interrelated, and are the result of a calculation of costs and benefits (Becker 1981; Cigno and Ermisch 1989; Hotz, Klerman and Willis, 1997). This model tends to focus on the cost of children: expenditure for market goods and in particular the opportunity cost of having children. The latter includes foregone wages while out of the labor force, along with earnings depreciation during this time. According to this theory, an increase in (non-labor) income leads to a higher demand of quantity and quality of children. This is expected to be true for an increase in men's wages since it is assumed that men do not to participate substantially in childcare. On the other hand, an increase in women's wages is expected to lead to a reduction in the demand of children by increasing opportunity costs. In this framework, the availability of affordable non–parental care would reduce the opportunity costs of childbearing and child rearing for women. We then expect that the availability of non parental care is positively associated with fertility and its timing, and several authors have empirically found a connection between these variables (Del Boca 2002; Rindfuss et al. 2007).

The effect of non-parental care or working time regulations are examples of how social institutions influence the options available to individuals, modifying the expected effects of the microeconomic model of fertility (Folbre 2001; Del Boca and Locatelli 2007)[3]. In particular, public policies help shape the context in which individual (or household) decision-making takes place, by providing incentives or disincentives to certain behaviors and by influencing behavioral norms. Different combinations of policies in domains such as tax, labor market, gender, care, family, can reduce (or increase) the cost of children (Gauthier and Hatzius 1997). Although some policies might reinforce the caring role of women, they can potentially be designed to support men who wish to do active fathering, for instance through a reduction of standard working hours or different kinds of fathers' leave (Gornick and Meyers 2003). Other labor market arrangements can also prove to be crucial for fertility, such as policies dealing with temporary jobs and job security, working time regulations, unemployment

[3] Most neoclassical economists place social institutions outside the scope of their analysis, i.e. they treat institutional arrangements as exogenous factors that are held constant.

benefits, the ease with which women return to the labor market after an interruption, or the availability of protected public employment (Aaberge, Colombino and Del Boca, 2005; Baizán 2007). Therefore, the interactions between policies and between policies and particular structural contexts should be considered. The opportunity costs of childbearing will be greater where social institutions do not facilitate the combination of parental and worker roles. These differences may be an important part of the explanation of the fertility differentials between Southern European countries and the Nordic countries (Kohler, Billari and Ortega 2006). By the same token, differences in social institutions and policies may by relevant in explaining regional differences in Spain.

In particular, the availability of subsidized childcare should influence participation and fertility decisions, by reducing potential wage losses and earnings depreciation. At the same time, childcare availability may induce some women to enter (or remain) in the labor market; and being in the labor market could lead to a reduction of their fertility. But for a majority of young women already present in the labor market, as is the case in most European countries, affordable childcare should lead to an increase of their fertility. Other things being equal, the overall effect on fertility of the availability of non mother childcare will depend on the proportion of women in the labor market: if a majority of women participate, its aggregate effect should be to increase fertility. In addition, an increase in labor force participation of women will reduce the available pool of informal care givers in a society, further exacerbating the child care deficit. Therefore, when a majority of women in a society participate in the labor market, formal day care will enhance the compatibility between paid work and childrearing.

Several sociological perspectives also emphasize the importance of role compatibility on fertility decisions in contemporary advanced countries, within contexts marked by the increased prevalence of values of individual autonomy and gender equality (Lesthaeghe 1995). In these societies, most women are socialized to expect that they will have a role as an individual beyond any family role they may have (Alwin 1996; Alberdi 1999). At the same time, children continue to be valued for their emotional and social benefits, since they are “economically worthless, but emotionally priceless” (Zelizer 1985), although it is acknowledged that they are an economic drain (Caldwell 1982). As a result, a majority of women in Western societies place a high value in both labor force participation and parenthood, while only relatively small minorities of

women attach a strong priority to either maternity or labor force achievement (Hakim 2000; Pfau-Effinger 2004). It is precisely because most women value both labor force participation and parental roles, that they face a dilemma if they perceive them as mutually incompatible. In such a situation, childcare availability can reduce the role incompatibility and raise fertility levels.

Furthermore, if men and women's family values and attitudes about gender roles shape fertility behavior (Bernhardt and Goldscheider 2006), these are themselves closely linked to the prevalent care regime and gender arrangements (Pfau-Effinger 2004; Bettio and Plantenga 2004; Lewis 1998). This suggests that the percentage of children in daycare may be correlated to other contextual variables, such as labor force participation, norms on the acceptability of childcare by non relatives and family obligations (e.g. a grandmother's obligations towards her grandchildren), gender equality norms, or the degree of flexibility in working time arrangements. In a context of difficult compatibility between labor force participation and childrearing, like that which has been prevalent in Spain in the last few decades, increases in labor force participation may lead to postponement and reduction of childbearing. But the continued expansion of the availability of formal childcare (stimulated by the demand created by the increase in participation) may eventually reduce this role incompatibility, allowing for increases in fertility. In addition, the effect of more women in the labor market may be more important than a simple compositional effect, as it may contribute to changing the norms about care. For instance, if the acceptability of formal childcare for children under 3 in a region is high, fewer women will withdraw from the labor market in connection with maternity and the effect of formal childcare availability will be stronger than in regions lacking this norm. It can be assumed that an extended provision of care facilities has a positive impact on the transition to a birth in regions where it is widely accepted that working mothers send their pre-school children to formal childcare. In regions where social acceptance for formal care arrangements is low, the formal care system is less relevant in individuals' childbearing decisions.

The theoretical models mentioned above suggests that the availability of childcare services enhances compatibility between paid work and parenthood and, at the same time, favors gender equity within couples through a defamiliazation of caring labor. Therefore, one expects that an increase in the availability of childcare services should have a positive effect on births. The arguments above also suggest that the effect of an

increase in the availability of formal child care will be more important in contexts (regions) where other social institutions and arrangements have more consistently adapted to changes in gender roles, and in particular where a majority of women participate in the labor market. Furthermore, if the deployment of childcare services across regions is not random but is in fact related to certain characteristics that simultaneously influence fertility (like a different organization of care and employment), then these two variables will be endogenous, and the modeling strategy must take this into account.

3. Child care system

Consistently with the predictions derived from the "welfare regime" perspective, in Spain the coverage of formal childcare services for infants aged less than 3 years is low: only 16,9 per cent of children aged 0 to 2 years had access to childcare services in 2005, while the corresponding figure for 1993 was 5,2 percent (Ministry of Education 2008). In contrast, educational enrolment is close to universal for the 4-5 age group (99.0 percent in1993), while the enrolment ratios for age 3 were 53,0 in 1993 and 98.8 in 2005. The percentage was close to universal by the 1990s in several regions. Here these enrolment ratios refer to formal childcare during the official timetables; after school care and non registered day care centers are not included in the figures. In fact, since 1983, when the Law of Education was issued, day care centers have been progressively included, through established curricula and quality requirements, in the general education system (González-López 2003).

Child care services in pre-primary schools are provided by both public and private sectors. The private sector accounts for 57 percent of enrolment for children under 3, while the public sector is largely dominant for the 3-5 age group (69 percent). Note, however, that public subsidies contributed to the financing of the private sector to some extent [4]. While the quality of publicly provided child care services is generally high in terms of staff qualifications and child to staff ratio, and parents pay a fraction of the real cost of the services, there are only a limited number of slots available. Furthermore, opening hours of child care centers in the public sector are typically too limited to

[4] In addition, during the 1990s, parents had access to income tax deductions that covered part of the costs of formal childcare (Azmat and González, 2008).

combine with a full time job[5]. It can be argued as well that long and unflexible work timetables in most jobs are responsible for the mismatch. Characteristics of the child care provided are much more heterogeneous in the private sector, although opening hours are often longer and parents face higher costs. Parents who cannot access a public childcare slot, either because of long waiting lists or because it is located too far away, may find a private sector slot available of a satisfactory quality. Nevertheless, private services might be too expensive for lower income groups and, as is the case for public child care, its availability is very uneven. Increasing quality requirements may have hindered the expansion of the private sector to a certain extent (González-López 2003).

As has been argued for several other European countries with heavily regulated childcare provision, where public provision and subsidizing are important, the availability of childcare should be of crucial importance in fertility decisions, while its price may be less so (Hank and Kreyenfeld 2003; Del Boca 2002). Furthermore, some evidence exists that in the context of Southern Europe, informal care arrangements predominate (Nicodemo and Waldman 2009). In particular, certain studies point to the crucial role of grandmothers, not only as main providers of non parental care, but also to supplement formal arrangements during school holidays and to bridge the timetables of parents and children (Fernández-Cordón and Tobío-Soler 2005).

Another important feature of the day care system in Spain is its strong regional variability, which in part derives from the fact that regions are responsible, together with municipalities, for social services and educational services. As can be observed in Table 1 the last two decades have witnessed an important expansion of the coverage rate of day centers. The average proportion of children under 3 enrolled in preschool education was 5.2 in 1993-94, 8.9 in 2000-01 and 19.9 in 2007-08[6]. Yet, it should be noted that in the regions of the south and the center of Spain (excluding Madrid) the development of day care centers has been very slow (for instance, the coverage rate was 6.6 in Andalucia in 2007-08, while in the Basque Country it reached 48.1 in the same year).

[5] Typically, public day care centers open on weekdays, from 9am to 5pm (sometimes from 8am to 6pm), while private day care centers often open from 7am to 8pm. Therefore, often care provided by these centers is complemented by the help of a private childminder or a grandmother (Fernández-Cordón and Tobío-Soler 2005).

[6] The rate of expansion of daycare provision may be somewhat overestimated, because of deficiencies in the statistics, which have been gradually improved and standardized (González-López 2003).

Table 1. Percentage of children 0-2 enrolled in formal childcare

NUTS 1 region or Autonomous Community	*1993-94*	*2000-01*	*2007-08*
North West	*3.41*	*8.31*	*16.2*
Galicia	4.8	11.8	17.6
Asturias	0.7	1.8	10.5
Cantabria	1.1	1.9	19.2
North East	*3.7*	*13.5*	*37.0*
País Vasco	4.5	21.3	48.1
Navarra	4.7	13.1	27.3
Aragón	2.5	3.3	30.4
Rioja	0.8	2.6	6.4
Center	*1.1*	*2.1*	*6.4*
Castilla y León	1.5	2.9	12.3
Castilla-La M.	1.0	2.1	2.5
Extremadura	0.6	0.9	2.7
Madrid	*4.7*	*13.8*	*35.8*
East	*13.8*	*16.9*	*24.5*
Cataluña	19.9	26.6	33.1
Baleares	2.4	6.5	11.2
C. Valenciana	7.2	5.0	14.6
South	*0.7*	*1.9*	*8.0*
Andalucía	0.6	1.0	6.6
Murcia	1.5	7.7	16.1
Islas Canarias	*1.3*	*2.2*	*
Total	*5.2*	*8.9*	*19.9*

Source: Spanish Ministry of Education (2009; www.mec.es). Data on each Comunidad Autónoma was grouped, when necessary, into NUTS 1 regions, according to their population of children 0-2. NUTS 1 region refers to the standardized classification of the Statistical Office of the European Communities.
* not available.

4. Data sources and technique of analysis

The individual level data used for the analyses are from the Spanish sample of the European Community Household Panel survey (ECHP). This data source has several features that make it suited for the purposes of the paper as well as several limitations. The longitudinal design of ECHP makes it possible to follow up and interview the same set of private households and persons over several consecutive years. It thus supplies data on all household members in a dynamic way. The ECHP offers detailed data on fertility and partnership careers, and particularly on the labor market trajectories of each member of the household. For instance, it contains monthly data on labor force status, and yearly income of each member of the household, according to the source of income. It also contains a wealth of information on a number of individual characteristics, such

as educational background and health status. The first wave of the survey took place in 1994, and the panel was stopped after the 2001 wave. Although most of the data refers to the wave year or the previous year, the survey also offers a limited amount of retrospective information.

A potential problem to the analyses is panel attrition, if the outcome studied is correlated with drop out. The levels of attrition are similar to those of other panel surveys (Watson, 2002; Eurostat, 2001).

For this paper, we studied women born between 1957 and 1980 (i.e. they were between 15 and 42 years of age during the panel years), from 1993 to 2000. This resulted in a sample of 4303 women (11 cases were excluded because no information on the region of residence was available). The analyses were performed on 3080 first birth spells leading to 598 first births. In the case of second and higher order births, only women living in a partnership (marriage or cohabitation) were included, resulting in a sample of 2189 spells (of which 1077 for second births, 891 for third births and 221 for higher order births), and 545 births. Censoring may occur if: the woman reaches the end of the year 2000; drops-out from the survey; or, for 2nd or higher order births, in case the women divorces or separates from her partner, whatever comes first. Left censoring is avoided by including the age of the women (for first births) or the age of previous child in the baseline (for 2^{nd} + births); however, the period before the individual enters the panel is not included in the computations (Guo 1993).

Crucial for this analysis, the ECHP identifies the individual's region of residence in each wave. This feature makes it possible to link individual level information with other data sources at the regional level. Unfortunately, information is provided only at a relatively low level of desegregation, i.e. according to the European Union standardized classification of regions, NUTS, at level 1. Sometimes this level corresponds to administrative regions (Comunidad Autónoma), but is more often a grouping of neighboring Autonomous Communities. There are seven regions studied. The large size of the regions suggests that the actual availability is heterogeneous across households belonging to the same region[7]. This also implies that the effects of childcare will be underestimated statistically (see below).

[7] Ideally, one would be able to know the availability of childcare for particular households in geographical areas within a daily commute.

The regional level indicator of the availability of child care utilized is the percentage of children 0-2 enrolled in formal day-care out of the total children of that age. This data was obtained from the Ministry of Education[8]. This is not an indicator of availability of child care strictly speaking, but rather use of childcare; however, as argued in the previous section, since childcare is severely rationed, it is safe to assume that it reflects available day care opportunities in each region. Several other regional indicators were included in the analyses, such as the women's labor force participation rate and the women's unemployment rate, available from the National Institute of Statistics.

The empirical approach uses an event history model with fixed regional effects. Regional dummy variables are included in order to capture time invariant unobserved characteristics at the regional level, such as norms concerning childcare and fertility, and particularly the placement of childcare centers. Furthermore, in a multilevel model with random effects, it would be assumed that the error term is uncorrelated with the percentage of children enrolled in preschools and the other independent variables included (Goldstein 1995; Allison 2005). However, as explained above, the placement of childcare centers may in fact be endogenous to other (unobserved) regional characteristics that also affect fertility, leading to biased estimates (Angeles, Guilkey and Mroz 2005). Therefore, a fixed-effects approach was implemented.

In order to statistically control for the possible effects of selection into a specific birth order, I have used a simultaneous equation approach, in which the equations for first births and second or higher order births have been estimated jointly.

$$\begin{cases} ln\, h_i^{B1}(t) = \gamma' T(t)_i + \beta' X_i + \varepsilon_i \\ ln\, h_{ji}^{B2}(t) = \gamma' T(t)_{ji} + \beta' X_{ji} + \varepsilon_i \end{cases}$$

where $ln\, h_{ji}(t)$ is the log of the rate for observation j belonging to individual i at time t for the first births process (B1) and the second or higher order births process (B2) respectively. $\gamma' T(t)_{ji}$ denotes the effect of duration, measured in months, on the hazard rate. Duration dependence is modeled with piecewise linear splines (also known as the Gompertz model or piecewise linear exponential model). Piecewise linear splines are

[8] Data on each Autonomous Community was grouped, when necessary, into NUTS 1 regions, according to their population of children aged 0-2. Since information on the provision of childcare was not available for every single year in Galicia and Navarra, information for missing years was interpolated.

used to approximate continuous functions (such as a baseline hazard or a non-proportional relative risk), by using functions that are linear within each (possibly open-ended) interval. Those linear functions are connected at points in time that are decided *a priori*: piecewise linear splines are then also continuous functions. X_{ji} represents a vector of independent variables, and β denotes the value of the estimated coefficients of the model for every variable. Lastly, I include a random term ε_i, in order to capture unobserved heterogeneity at the individual level, which is assumed to follow a normal distribution.

A different specification was also performed in order to address the issue of the possible endogeneity of the processes of labor market participation and fertility. Labor market participation decisions may be jointly determined by fertility intentions, for instance as a result of the existence of norms and values concerning labor force participation and family-building, and may be related to the extent to witch the roles of mother and worker are compatible. In this respect, the strength of the correlation between fertility and participation process should be connected to the incompatibility between them. In contexts where incompatibility is highest, women determine their behavior in the two domains jointly; whereas in contexts with higher compatibility, decisions concerning labor market and fertility may be more independent from one other. Thus, in order to deal with the possible endogeneity of labor force participation and fertility, it is included in a third equation (in models including the labor force status of the women). The additional equation is specified as a logistic regression in which the dependent variable reflects whether the woman is participating or not in the labor market in each of the survey waves (periods in which the woman is enrolled in education are excluded from the analysis).

$$\begin{cases} ln\, h_i^{B1}(t) = \gamma' T(t)_i + \beta' X_i + \varepsilon_i \\ ln\, h_{ji}^{B2}(t) = \gamma' T(t)_{ji} + \beta' X_{ji} + \varepsilon_i \\ ln[P_{ij} / (1-P_{ij})] = \alpha + \beta' X_{ij} + u_{ij} + \delta_i \end{cases}$$

In the last equation, P is the probability of individual i participating in the labor market by observation j. α is a constant term, X_{ij} is a vector of explicative variables and β denotes the value of the estimated coefficients of the model for every variable. u_{ij} is a

residual assumed to follow the logistic distribution, specific to each observation. Lastly, δ_i is a random (normally distributed) term specific to every individual, which has been included in order to account for the existence of heterogeneity among individuals related to variables not included in the model, as well as to account for the correlation of multiple observations belonging to the same individual. The random variables ε and δ capture unobserved heterogeneity, and are assumed to follow a joint bivariate normal distribution:

$$\begin{pmatrix} \varepsilon \\ \delta \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_\varepsilon^2 & \rho_{\varepsilon\delta} \\ \rho_{\varepsilon\delta} & \sigma_\delta^2 \end{pmatrix} \right)$$

in which $\rho_{\varepsilon\delta}$ is the correlation between the unobserved heterogeneity terms of the two processes. The model estimation was performed using full-information maximum likelihood, as implemented in the package aML (Lillard and Panis 2000).

As can be seen in the results (Table 3, in annex), the correlation between the heterogeneity terms obtained are significant. This means that there are indeed selection effects not picked up by the variables included in the models. However, the coefficients obtained are substantively identical for most variables in these last models (Models 5 and 6), particularly those concerning the proportion of regional childcare coverage (the main exception is, logically, the labor force status of the women, for which being a housewife loses part of its negative effect and significance). Thus, the presentation of results that follows will only concern the simpler specification that does not include an equation for labor force status[9].

5. Results

The results obtained from the analyses are presented in table 2a for the process of first births and table 2b for second or higher order births. As explained above, the equation for first birth and the equation for second and higher order births have been simultaneously estimated. Out of several models that were computed, including different sets of individual and regional level variables, I present 4 models here. The first includes several individual variables, considered to be exogenous with respect to

[9] A specification using whether the woman is working or not (instead of labor market activity) as a dependent variable, yielded similar results.

fertility, such as the level of education and the birth order, as well as a set of dummy variables for the region of residence and the proportion in childcare (Model 1). This last variable provides positive and significant results, with a coefficient of 0.06 (or a relative increase of 6 percent) for each percentage increase in the proportion of children in childcare, both in the case of first and higher order births. This effect is substantively large, taking into account that the percentage of increase in childcare coverage in certain regions has reached nearly 10 percent between 1993 and 2001, and by more that 20 percent between 2001 and 2007. The results obtained for the other variables included in the model are as expected. Thus, age follows a bell-shaped effect for first births, peaking at the ages 28-32, while it continuously declines for higher order births. In the equation for second and higher order births the "age of the youngest child" also follows a bell-shaped form, with the highest level around age 4. Women with a low educational level (less than higher secondary), have a significantly earlier timing of first birth, with a coefficient of 0.537; and in the case of higher parities, the highly educated show positive coefficients. This last result is in line with results obtained in several other countries (e.g. Kravdal 2001; Kreyenfeld 2002) and could be related to better possibilities for highly educated women to combine paid work and motherhood and to the higher opportunity costs of prolonging interruptions in their work trajectories for these women. The results for the regions fixed effects are consistent with the fertility levels and age at first birth for each region, as calculated from register data (INE 2008). They show a higher fertility and younger age at first birth in the South, Canary Islands and the Center.

In Model 2 I added several variables concerning the activity status, workplace and partner's income (this last variable for second and higher order births only). The inclusion of these variables implied an increase in the effect of the regional child care indicator (with a coefficient of 0.07) in the case of first births, while for higher order births this coefficient was practically unchanged (0.06). This is consistent with the strong impact of the activity status for first births, that shows negative effects of unemployment and being a student, but positive effects of being in other situations (e.g. dedicated to household tasks), comparing to being employed. Furthermore, holding a temporary employment delays first birth. In the case of second and higher order births, the activity status variables lose much of their importance and the coefficients are no longer significant. As predicted by the economics literature, the partner's income has a

strong positive effect on fertility; nevertheless, in the Spanish context, this variable may also reflect the partner's job security (Baizán 2007).

It can be noted that an alternative specification of the child care variable, as a dummy variable indicating different levels of coverage, also provides significant and positive results for the category corresponding to a coverage rate equal or higher than 15%. I also tried several interactions of the day care variable, in particular with the activity status of the women, expecting that the effect of child care would be higher for employed women (results not shown). However, the results did not provide significant differences between the categories, suggesting that an increased availability of day care has a general effect on fertility. It is possible that the interaction between women's labor force participation and formal childcare availability is not significant due to the interrelationship between childcare options, labor market situation and fertility. For instance, in the case of second and higher order births, those women who have a job may have already found some childcare arrangement, be it formal or informal, including father's participation in care or the adaptation of women's working hours, (otherwise working women would have previously quit their jobs), reducing fertility differentials between working and non-working women. Differences between working and non working women will also be diluted if the fact of not working is due to difficulties in accessing to a satisfactory childcare arrangement.

Previously, it was suggested that the placement of childcare centers may be endogenous to other (unobserved) regional characteristics that also affect fertility. I therefore explored the inclusion of several contextual variables to take this into account. In particular, the percentage of women's labor force participation at the regional level was included in Model 3. The results of this last variable show significant coefficients, with a positive sign for first births and a negative sign for second births. The inclusion of the labor force participation of women leads to non significant results for the proportion of children in childcare for the first birth process (0.03); by contrast, it leads to a strengthening of the effect and significance of the coefficient for higher births (0.13). One should keep in mind however that the time-varying rate of women's labor force may also be correlated with childcare provision, which possibly leads to biased results. The effects of regional unemployment rate for women and the proportions of part-time jobs were also tested (results not shown), providing negative but not significant

coefficients, that did not substantially changed the coefficients of the child care indicator. These results suggest ambiguous effects of unemployment, and are consistent with the idea that part-time jobs indicate a precarious situation in the Spanish labor market, rather than a voluntary reduction of working hours to accommodate care needs.

Finally, in Model 4, the effect of an interaction between the region and the availability of childcare was tested. The expectation was that the effect of childcare would be stronger in the East, North-East and Madrid (regions with higher percentages of women's labor force participation and higher recent increases in TFR), and weaker in the South, Center and the Canary Islands. The results obtained do not fit the expectations for first births, for which positive significant coefficients are obtained for the East and the South regions. On the contrary, the results for second or higher order births are consistent with these expectations, since they show negative interaction coefficients in the Canary Islands, Centre and South, although this is only significant in the last region.

6. Conclusion

Three main hypotheses have been explored in this paper. The first one sustains that an increase in formal day care availability for children under three should have a positive effect on fertility at the individual level in Spain in the 1990s and early 2000s. The effect of day care is hypothesized to be based on the reduction of the conflict between labor force participation and childrearing through a defamiliazation of caring labor. A second argument suggests that the effect of an increase in the availability of formal child care will be more important in contexts (regions) where other social institutions and arrangements have more consistently adapted to changes in gender roles, and in particular where a majority of women participate in the labor market. And finally, it has also been argued that the deployment of childcare services across regions is not random, but is related to several characteristics of the regions, such as a different organization of care and employment, that simultaneously influence fertility. As a result, the availability of childcare and fertility will be endogenous, and the modeling strategy adopted in this research (fixed effects) is designed to account for that situation.

The results obtained are consistent with the hypothesis, derived from the main existing theoretical perspectives on the issue, that an increase of childcare coverage has a

positive effect on fertility. Across different specifications, a significant positive effect of the percentage of children aged 0-2 enrolled in childcare is found on first births as well as second and higher order births. This effect is substantively large, as it implies increases in the relative risk of fertility of at least 5 per cent for each percent increase in the proportion of children in childcare. These analyses are based on the assumption, put forward above, that there are time-invariant regional characteristics that affect both child care availability and fertility, during the period considered. Although I have not modeled explicitly the process of placement of day care centers (for which no data are available), this process could be related to the proportions of women present in the labor market and the growing acceptability of formal childcare centers in several regions (presumably also related to the decreasing availability of relatives to care for children). The inclusion of the aggregate proportion of women in the labor market in one of the models provided mixed results, since the effect of the indicator for childcare availability lost its significance for first births, while its positive effect increased for second and higher order births.

However, several limitations in the available data, such as the short period of observation (nine years) and the large geographical units studied, should be emphasized. Since a longer period of observation and smaller regions should provide sharper results in principle, the results obtained here should be interpreted with some caution.

The methods utilized also intended to analyze the complex interrelationships that affect fertility processes. These include the existence of selection effects (found to be significant) that influence different birth orders. In addition, testing whether fertility and the employment status are endogenous processes yielded significant results, but they were not found to affect the impact of childcare. However, the analyses performed may not fully capture that interrelationship, given the sample size and the limited number of years in observation. Furthermore, care processes, in addition to employment and fertility may be interrelated, and this may partly explain lack of significant effects found in the interaction between women's employment and the regional childcare variable.

The results obtained partially supported the hypothesis that formal childcare availability has different effects according to the degree of adaptation of social institutions to changes in gender roles in each region. This argument was tested with an interaction between the women's region of residence and the availability of childcare indicator, providing results consistent with the hypothesis only for second and higher order births. On the one hand, these mixed results may be related to the importance of other

providers of care, such as other family members, which may have the effect of reducing the impact of the interaction. On the other hand, it may also be the case that the differences between Spanish regions are less important than expected.

Overall, the results obtained suggest that the adaptation of institutions to changing gender roles that is taking place in Spain, and the concomitant changes in the care regime, particularly the increased availability of formal childcare, are involved in the explanation of the recent increases in TFR. If this interpretation is correct, these institutional changes may lead to still further fertility increases in the future.

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Table 2a. **Multi-level estimation of the transition to a first birth**

	Model 1		Model 2		Model 3		Model 4	
Individual-level	*Coeff.*	S.E.	*Coeff.*	*S.E.*	*Coeff.*	*S.E*	*Coeff.*	*S.E*
Age (spline)								
15-23	*0.222*	0.047***	*0.108*	0.048**	*0.102*	0.048**	*0.099*	0.049**
23-28	*0.256*	0.034***	*0.168*	0.035**	*0.166*	0.035***	*0.166*	0.035***
28-32	*0.040*	0.042	*-0.004*	0.043	*-0.003*	0.043	*-0.006*	0.044
32-36	*-0.150*	0.072 **	*-0.149*	0.07**	*-0.143*	0.074*	*-0.144*	0.074*
36+	*-0.578*	0.223***	*-0.592*	0.225***	*-0.614*	0.226***	*-0.612*	0.227***
Educational level								
High	*-0.043*	0.116	*0.038*	0.119	*0.026*	0.121	*0.023*	0.122
Middle (ref.)								
Low	*0.539*	0.109***	*0.261*	0.113**	*0.257*	0.115**	*0.265*	0.116**
Activity status								
Employed (ref.)								
Other inactive			*0.340*	0.132***	*0.407*	0.135***	*0.416*	0.137***
Student			*-1.484*	0.147***	*-1.526*	0.149***	*-1.539*	0.151***
Unemployed			*-0.433*	0.120***	*-0.447*	0.122***	*-0.447*	0.123***
Type of contract								
Permanent (ref.)								
Temporary			*-0.419*	0.154***	*-0.428*	0.157***	*-0.425*	0.159***
Self employed			*-0.011*	0.232	*-0.012*	0.236	*-0.021*	0.239
Health status								
Good (ref)								
Bad			*-0.786*	0.213***	*-0.792*	0.215***	*-0.786*	0.217***
Missing			*-0.344*	0.10***	*-0.290*	0.106***	*-0.249*	0.112**
Regional-level								
Child care	*0.055*	0.027 **	*0.073*	0.030**	*0.029*	0.037	*0.040*	0.039
Women's labor force					*0.083*	0.039**		
Region NE (ref.)								
NW	*0.329*	0.180*	*0.347*	0.185*	*0.228*	0.196	*-0.502*	0.588
Madrid	*0.017*	0.192	*-0.058*	0.19	*-0.262*	0.216	*-0.460*	0.622
Centre	*0.622*	0.253**	*0.720*	0.277***	*0.836*	0.285***	*-0.038*	0.685
East	*-0.052*	0.230	*-0.246*	0.238	*-0.302*	0.243	*-3.337*	1.681**
South	*0.588*	0.250**	*0.682*	0.275**	*0.541*	0.284	*-0.198*	0.510
Canary Islands	*0.921*	0.267***	*1.069*	0.287***	*0.566*	0.380	*0.352*	0.732
Child care*NW							*0.129*	0.087
Child care* Madrid							*0.044*	0.066
Child care*Centre							*0.333*	0.379
Child care*East							*0.217*	0.113*
Child care*South							*0.441*	0.264*
Child care*Canary Is.							*0.282*	0.374
Constant	*-6.273*	0.410***	*-4.562*	0.449***	*-7.314*	1.382***	*-4.2340*	0.501***

Significance: '*'=10%; '**'=5%; '***'=1%.

Table 2b. **Multi-level estimation of the transition to a second or higher order birth**

	Model 1		Model 2		Model 3		Model 4	
Individual-level	*Coeff.*	*S.E.*	*Coeff.*	*S.E.*	*Coeff.*	*S.E.*	*Coeff.*	*S.E.*
Age of youngest child								
0-1 years	*1.603*	0.424***	*1.623*	0.428***	*1.611*	0.429**	*1.619*	0.432***
1-4 years	*0.150*	0.065**	*0.164*	0.066**	*0.181*	0.067***	*0.183*	0.068***
4-6 years	*-0.036*	0.082	*-0.025*	0.083	*-0.008*	0.083	*-0.004*	0.084
6+ years	*-0.126*	0.033***	*-0.124*	0.033***	*-0.126*	0.033***	*-0.125*	0.034***
Age 15-33	*-0.020*	0.015	*-0.030*	0.015*	*-0.028*	0.016*	*-0.029*	0.016*
Age 33+	*-0.156*	0.037***	*-0.166*	0.038***	*-0.161*	0.038***	*-0.161*	0.038***
Second birth (ref.)								
Third birth	*-1.577*	0.125***	*-1.602*	0.127***	*-1.633*	0.130***	*-1.631*	0.132***
Fourth or higher birth	*-1.433*	0.198***	*-1.430*	0.202***	*-1.473*	0.206***	*-1.465*	0.210***
Education Middle (ref.)								
High	*0.279*	0.137**	*0.238*	0.145	*0.251*	0.148*	*0.262*	0.150*
Low	*0.056*	0.121	*0.089*	0.125	*0.079*	0.128	*0.080*	0.129
Activity status								
Employed (ref.)								
Other inactive			*-0.026*	0.129	*-0.004*	0.133	*0.001*	0.136
Student			*-0.763*	0.500	*-0.779*	0.516	*-0.792*	0.522
Unemployed			*-0.176*	0.154	*-0.141*	0.159	*-0.142*	0.162
Type of contract								
Permanent (ref.)								
Temporary			*-0.339*	0.225	*-0.317*	0.232	*-0.312*	0.236
Self employed			*-0.104*	0.260	*-0.107*	0.266	*-0.100*	0.270
Partner's income								
Low or Middle (ref)								
High income			*0.299*	0.104***	*0.299*	0.107***	*0.298*	0.109***
Income missing			*-0.179*	0.551	*-0.202*	0.553	*-0.199*	0.572
Regional-level								
Child care	*0.060*	0.028**	*0.061*	0.028**	*0.125*	0.037***	*0.079*	0.0379**
Women's labor force					*-0.099*	0.037***		
Region NE (ref.)								
NW	*-0.040*	0.186	*0.025*	0.190	*0.205*	0.204	*-0.234*	0.580
Madrid	*-0.026*	0.196	*-0.089*	0.201	*0.124*	0.223	*0.285*	0.607
Centre	*0.475*	0.260*	*0.530*	0.263**	*0.456*	0.272*	*1.481*	0.619**
East	*-0.569*	0.234**	*-0.539*	0.236**	*-0.571*	0.239*	*0.641*	1.845
South	*0.491*	0.256*	*0.557*	0.259	*0.784*	0.277**	*1.313*	0.457***
Canary Islands	*0.146*	0.279	*0.261*	0.285	*0.944*	0.385*	*0.630*	0.770
Child care*NW							*0.056*	0.086
Child care* Madrid							*-0.044*	0.068
Child care*Centre							*-0.547*	0.337
Child care*East							*-0.086*	0.127
Child care*South							*-0.463*	0.213**
Child care*Canary Is.							*-0.138*	0.379
Constant	*-3.555*	0.604***	*-3.428*	0.624***	*0.380*	1.346	*-3.717*	0.686***
σ_ε	*0.249*	0.232	*0.288*	0.203	*0.399*	0.157**	*0.419*	0.154***
ln-L	-6900.02		-6811.78				-16039.57	

Significance: '*'=10%; '**'=5%; '***'=1%.

ANNEX

Table 3a. **Multi-level estimation of the transition to a first birth. Simultaneous estimation of fertility and labor force participation**

	Model 2		Model 3		Model 4	
Individual-level	*Coeff.*	*S.E.*	*Coeff.*	*S.E*	*Coeff.*	*S.E*
Age (spline)						
15-23	*0.105*	0.048**	*0.099*	0.049**	*0.096*	0.049*
23-28	*0.167*	0.035***	*0.164*	0.035***	*0.164*	0.035***
28-32	*-0.006*	0.042	*-0.005*	0.043	*-0.008*	0.043
32-36	*-0.152*	0.073**	*-0.146*	0.073 **	*-0.147*	0.074 **
36+	*-0.591*	0.225***	*-0.612*	0.225***	*-0.611*	0.226***
Educational level						
High	*0.038*	0.118	*0.026*	0.120	*0.023*	0.120
Middle (ref.)						
Low	*0.244*	0.113 **	*0.239*	0.114**	*0.245*	0.114**
Activity status						
Employed (ref.)						
Other inactive	*0.244*	0.139*	*0.240*	0.142*	*0.244*	0.144*
Student	*-1.517*	0.145***	*-1.557*	0.148 ***	*-1.568*	0.150***
Unemployed	*-0.470*	0.121***	*-0.486*	0.122***	*-0.485*	0.123 ***
Type of contract						
Permanent (ref.)						
Temporary	*-0.402*	0.154***	*-0.408*	0.156***	*-0.402*	0.156 ***
Self employed	*-0.019*	0.228	*-0.020*	0.231	*-0.028*	0.233
Health status						
Good (ref)						
Bad	*-0.854*	0.214 ***	*-0.860*	0.215 ***	*-0.854*	0.216***
Missing	*-0.345*	0.103***	*-0.286*	0.107***	*-0.246*	0.112**
Regional-level						
Child care	*0.074*	0.030**	*0.030*	0.037	*0.041*	0.039
Women's labor force			*0.082*	0.039**		
Region NE (ref.)						
NW	*0.345*	0.184*	*0.225*	0.194	*-0.501*	0.584
Madrid	*-0.041*	0.190	*-0.241*	0.214	*-0.444*	0.616
Centre	*0.711*	0.274***	*0.820*	0.284***	*-0.061*	0.685
East	*-0.239*	0.234	*-0.290*	0.243	*-3.211*	1.674 *
South	*0.675*	0.270**	*0.529*	0.283 *	*-0.211*	0.507
Canary Islands	*1.057*	0.281***	*0.553*	0.379	*0.364*	0.730
Child care*NW					*0.128*	0.086
Child care* Madrid					*0.045*	0.066
Child care*Centre					*0.337*	0.378
Child care*East					*0.210*	0.113*
Child care*South					*0.439*	0.262*
Child care*Canary Is.					*0.2634*	0.373
Constant	*-4.495*	0.445***	*-7.200*	1.378***	*-4.151*	0.501***

Significance: '*'=10%; '**'=5%; '***'=1%.

Table 3b. **Multi-level estimation of the transition to a second or higher order birth. Simultaneous estimation of fertility and labor force participation**

	Model 2		Model 3		Model 4	
Individual-level	*Coeff.*	*S.E.*	*Coeff.*	*S.E.*	*Coeff.*	*S.E.*
Age of youngest child						
0-1 years	*1.608*	0.429***	*1.613*	0.429***	*1.622*	0.432***
1-4 years	*0.161*	0.062***	*0.173*	0.067***	*0.174*	0.067***
4-6 years	*-0.023*	0.081	*-0.008*	0.084	*-0.005*	0.084
6+ years	*-0.121*	0.033 ***	*-0.124*	0.033***	*-0.123*	0.033***
Age 15-33	*-0.032*	0.015**	*-0.031*	0.016**	*-0.032*	0.016**
Age 33+	*-0.169*	0.037 ***	*-0.163*	0.038***	*-0.163*	0.038***
Second birth (ref.)						
Third birth	*-1.573*	0.123***	*-1.596*	0.130***	*-1.592*	0.130***
Fourth or higher birth	*-1.373*	0.191***	*-1.399*	0.205***	*-1.385*	0.207***
Education Middle (ref.)						
High	*0.222*	0.145	*0.233*	0.147	*0.244*	0.148
Low	*0.088*	0.124	*0.081*	0.127	*0.080*	0.128
Activity status						
Employed (ref.)						
Other inactive	*-0.191*	0.137	*-0.181*	0.142	*-0.181*	0.143
Student	*-0.848*	0.507 *	*-0.871*	0.522 *	*-0.886*	0.526 *
Unemployed	*-0.247*	0.154	*-0.217*	0.158	*-0.221*	0.160
Type of contract						
Permanent (ref.)						
Temporary	*-0.317*	0.226	*-0.288*	0.232	*-0.284*	0.235
Self employed	*-0.064*	0.257	*-0.063*	0.262	*-0.055*	0.264
Partner's income						
Low or Middle (ref)						
High income	*0.279*	0.104***	*0.279*	0.106***	*0.278*	0.108***
Income missing	*-0.183*	0.573	*-0.2016*	0.575	*-0.195*	0.581
Regional-level						
Child care	*0.063*	0.028 **	*0.126*	0.037***	*0.080*	0.080**
Women's labor force			*-0.097*	0.037***		
Region NE (ref.)						
NW	*0.012*	0.191	*0.187*	0.204	*-0.221*	0.578
Madrid	*-0.090*	0.201	*0.115*	0.222	*0.242*	0.606
Centre	*0.507*	0.263 *	*0.434*	0.271	*1.423*	0.617**
East	*-0.560*	0.234 **	*-0.593*	0.239**	*0.387*	1.833
South	*0.547*	0.258**	*0.770*	0.276***	*1.292*	0.456***
Canary Islands	*0.247*	0.284	*0.920*	0.384**	*0.651*	0.769
Child care*NW					*0.050*	0.086
Child care* Madrid					*-0.039*	0.068
Child care*Centre					*-0.532*	0.336
Child care*East					*-0.070*	0.126
Child care*South					*-0.463*	0.212**
Child care*Canary Is.					*-0.162*	0.378
Constant	*-3.224*	0.608***	*-0.201*	1.345	*-3.473*	0.679 ***

Significance: '*'=10%; '**'=5%; '***'=1%.

Table 3c. **Probability of women's labor force participation. Simultaneous estimation of fertility and labor force participation.**

	Model 2		Model 3		Model 4	
Individual-level	*Coeff.*	*S.E.*	*Coeff.*	*S.E.*	*Coeff.*	*S.E.*
Age	*0.006*	0.011	*0.001*	0.011	*0.005*	0.011
Education						
Middle (ref.)						
High	*1.252*	0.110 ***	*1.247*	0.110 ***	*1.247*	0.110 ***
Low	*-0.909*	0.092***	*-0.912*	0.092***	*-0.913*	0.092***
Health status						
Good (ref.)						
Bad health	*-0.520*	0.100***	*-0.520*	0.100 ***	*-0.520*	0.100 ***
Missing	*0.183*	0.083 **	*0.181*	0.083**	*0.181*	0.084**
Unemployed in the last 5 years	*0.749*	0.104 ***	*0.761*	0.104 ***	*0.762*	0.104 ***
Partnership status						
In partnership (ref)						
No partner	*1.787*	0.116 ***	*1.782*	0.116***	*1.781*	0.116***
Children						
No (ref.)						
Yes	*-1.950*	0.111***	*-1.940*	0.111***	*-1.938*	0.112***
Partner's income						
Low	*0.229*	0.079***	*0.229*	0.079***	*0.229*	0.079 ***
Middle (ref)						
High income	*-0.155*	0.082 *	*-0.154*	0.082*	*-0.154*	0.082 *
Income missing	*0.778*	0.485	*0.773*	0.485	*0.771*	0.486
Regional-level						
Female unemployment	*-0.008*	0.006	*-0.008*	0.006	*-0.008*	0.006
Constant	*2.385*	0.449 ***	*2.402*	0.450***	*2.405*	0.451º***
ln-L	*-14261.156*		*-14255.066*		*-14253.087*	
σ_{ε} fertility	***0.252***	**0.114 ** **	***0.352***	**0.171****	***0.364***	**0.169****
σ_{δ} participation	***2.625***	**0.073 *** **	***2.625***	**0.073 *** **	***2.625***	**0.074*****
Correlation	***-0.598***	**0.212 *** **	***-0.455***	**0.238***	***-0.451***	**0.227****

Significance: '*'=10%; '**'=5%; '***'=1%.