Mussida, Chiara; Sciulli, Dario

Working Paper

A wider look at female employment and childbirth in Italy

GLO Discussion Paper, No. 1526

Provided in Cooperation with:
Global Labor Organization (GLO)

Suggested Citation: Mussida, Chiara; Sciulli, Dario (2024) : A wider look at female employment and childbirth in Italy, GLO Discussion Paper, No. 1526, Global Labor Organization (GLO), Essen

This Version is available at:
https://hdl.handle.net/10419/306679

A wider look at female employment and childbirth in Italy

Chiara Mussida[1], Dario Sciulli[2]

Università Cattolica del Sacro Cuore

chiara.mussida@unicatt.it

Dario Sciulli

Università di Chieti-Pescara

dario.sciulli@unich.it

Abstract

We explore the female employment-fertility relationship for a wide period, 2004-2019 in Italy. We adopt a dynamic approach when modelling both employment and fertility choices and allow for possible feedback effects from employment to future fertility decision. We also consider different employment outcomes and subgroup analysis. Our findings suggest childbirth has reduced the probability of female employment. The childbirth effect, however, evolved over time, and the related negative impact has increased after the Great Recession and the application of austerity measures. Full-time and permanent jobs were greatly affected by childbirth than part-time and temporary employment. Childbirth increases the probability of being a high-pay worker, indicating a greater ease to combine career and family, possibly because of the better accessibility of childcare services. Childcare tends to increase work intensity, suggesting a compensative role of other family-members in terms of household labor supply. Sub-groups analysis reveals negative childbirth-effect is stronger for younger females, in the North-Centre regions, among non-poor household and in presence of employed husbands.

Keywords: female employment, childbirth, dynamic model, feedback effects

JEL Codes: E24; J13; C61;

[1] Department of Economic and Social Sciences, Università Cattolica del Sacro Cuore, via Emilia Parmense, 84, 29122, Piacenza, Italy, and Global Labor Organization (GLO), chiara.mussida@unicatt.it

[2] Department of Economic Studies, University of Chieti-Pescara, Pescara, Italy, and Global Labor Organization (GLO), dario.sciulli@unich.it

Introduction

The relationship between female employment and fertility has widely attracted the interest of economists in the last forty years. Understanding the mechanisms underlying such relationship is important for several aspects. First, childbirth may affect the choice between market and non-market work, through the increase of women's reservation wages, thus determining a reduction in female labor supply. This may have consequences for the short and long-run perspectives for the career paths of mothers and future fertility decisions. Second, despite the rise of female employment in high-income countries, achieving desirable levels of it is still a goal to be pursued for many governments, especially in Southern Europe, where the convergence with Nordic and continental countries is far to be reached. Finally, since the 1970s, fertility rates known a long-term decline, with the consequence of going below the population replacement rate (i.e. Bloom et al., 2024). Despite a recent recovery in the last two decades in some countries, fertility rates remained very low in Southern Europe (below 1.3 in Italy and Spain in 2019, Eurostat).

The literature based on a life-cycle perspective, has stressed that female employment and fertility are dynamically interrelated (e.g. Nakamura and Nakamura 1985, Carrasco 2001, Michaud and Tatsiramos 2011). The effect of a childbirth on employment depends on previous fertility decisions and past employment history which, in turn, may affect fertility choice. For many years, the negative relationship between female labor supply and fertility was a staple in this stream of literature, as determined by two key-idea, i.e. the quantity-quality trade-off proposed by Becker (1960) and the opportunity cost of women's time (e.g. Hotz et al. 1997). More recently, however, empirical evidence on high-income countries has shown a weakening of the negative relationship or even a reversing, since female employment and fertility start showing a positive correlation in several countries (e.g. Del Boca 2002, Apps and Rees 2004), especially at the macro-level (see, for instance, Doepke et al., 2023). Researchers highlighted various mechanisms contributing to explain the reversed relationship. The reduction of the quantity-quality trade-off because of the expansion of public education and the reduction of the opportunity cost of women's time due to the marketization of childcare are among them (e.g. Doepke et al. 2021). Adequate public policies related to childcare provision, taxation, and parental leave, are also prominent explanations for the positive association between female labor supply and fertility within country and may contribute to clarify the existing differences across countries in such relationship. Government spending on early childhood education and promoting the availability of public childcare, for

example, may affect positively both total fertility rate and female employment (Brilli et al. 2016, Olivetti and Petrongolo 2017). The flexibilization of the labor market, through the wider use of temporary contracts and part-time jobs, possibly contributed to shape the relationship between female employment and fertility (e.g. Del Boca and Sauer 2009, Del Bono et al. 2012, 2015).

In light of the novelties emerged in the analysis of the employment-fertility relationship and the changing nature of the labor market characteristics, we offer a wide and empirically based perspective when studying the way childbirth affects female employment.

First, we assume a long-term view by embracing a sixteen-year period across the Great Recession and the austerity measures eras, exploiting 2004-2019 longitudinal sections of the EU-SILC microdata. Second, we analyze female employment from different perspectives, considering the multifaceted nature of the phenomenon. Beyond the classical approach to study employment, based on the dichotomy employment/non-employment or participating or non-participating the labor market, we deepen the analysis focusing, in turn, on the role of working time (full-time versus part-time jobs), contract type (permanent versus temporary employment), wage level (low-pay versus high-pay hobs), and, even, the household labor supply as measured by household work intensity. We focus on Italy, a country which is experiencing a declining fertility rate (one of the lowest in Europe, 1.25 in 2021 according to Eurostat Statistics), where the negative relationship between fertility and labor supply still holds, and that is far from reaching the 2010 Lisbon Agenda targets on female employment, and the objectives on public/private provision of childcare services at early ages.

The period analyzed was also crossed by important changes in the Italian labor market, because of the wider diffusion of temporary employment and part-time jobs, especially among young people and women, and rising labor income inequality (Eurostat Statistics 2023). In line with the existing literature (e.g. Michaud and Tatsiramos 2011), we assume a life-cycle perspective and adopt a dynamic empirical strategy which allows to model both employment and fertility processes and account for the potential endogeneity of childbirth in the employment equations.

According to our results, in the period 2004-2019, childbirth has reduced the probability of female employment by 4.9 p.p., a point estimate lower than that emerged in the previous decade (e.g. Michaud and Tatsiramos 2011). The childbirth effect, however, evolved over time, and the related negative impact has increased after the Great Recession and the application of austerity measures, a period in which the social expenditure for

family and children slightly declined together with an important decline in the fertility rate. Our analysis also shows that full-time and permanent jobs were greatly affected by childbirth than part-time and temporary employment. Quite interestingly, childbirth increases the probability of being a high-pay worker, indicating a greater ease to combine career and family, possibly because of the better accessibility of childcare services (including the costly ones) and the greater attachment to the labor market for workers in high-positions. Finally, childcare tends to increase work intensity, suggesting a compensative role of other family-members in terms of household labor supply. Sub-groups analysis reveals negative childbirth-effect is stronger for younger females, in the North-Centre regions, among non-poor household and in presence of employed husbands.

The paper is organized as follows. Section 2 reviews the existing literature. Section 3 presents the dataset and provides descriptive statistics. The empirical model is described in Section 4. Section 5 discusses the main findings, and Section 6 offers some concluding remarks.

2. Literature

There is a strand of literature exploring the relationship between fertility and (female) labour supply, i.e. labour market participation. In broad terms, given the wide and long-standing interest in the link between childbearing and labor supply, hundreds of empirical studies estimated this relationship.

The majority of these studies, for many years, found a negative association between fertility and female labour supply (i.e. Angrist and Evans, 1998; Del Boca and Sauer, 2009). The negative sign of this relationship was due to both economic and demographic issues. Having fewer children subsequently increased the female labour market attachment, which was a tendency starting since the postwar. This was confirmed by, among others, Goldin (1995) which suggest that only few women in the 1940s and 1950s were able to combine childbirth with a relatively strong labor force attachment. Other studies in this strand show that a reduction in female labour supply should increase the total childcare time of parents (i.e. Blau and Grossberg, 1992), thereby increasing fertility.

Some works found that decisions about fertility and labour market participation are interrelated and associated with both individual and household characteristics, especially the employment and earnings characteristics of all household members, as well as with the availability of childcare services (Herrarte et al., 2012) and, more broadly, the role of institutions. As suggested by Del Boca (2002), for instance, several institutional rigidities

are among the most important factors explaining the low fertility and low labour market participation rates of women in the past. The limited availability of both part-time jobs and affordable childcare services increased the costs of working for mothers, making it difficult to participate in the labor market without the support of other household members, i.e. informal care.

The relation between female labour market participation and fertility became more complex overtime (i.e. Blaum et al., 2024). Many countries, i.e. European countries and other developed countries, experienced significant changes in both female labour market participation and fertility in the last forty years. Some countries experienced an increase in female's participation in the labor market, especially among female with children (Del Boca and Sauer, 2009).

There is wide literature investigating the effect of increased female employment on childbirth as a result of the higher opportunity costs associated with the relatively stronger labour market attachment (Michaud and Tatsiramos, 2011).

Notably, the nature and sign of the relationship between female and labour supply changed through time.

In the last twenty years, empirical evidence on high-income countries has shown a weakening of the negative relationship or even a reversing, since female employment and fertility start showing a positive correlation in several countries, such as Italy (see, for instance, Del Boca, 2002). Researchers highlighted various competing mechanisms contributing to explain the reversed relationship (Bloom et al., 2014). First, the expansion of public education and the reduction of the opportunity cost of women's time due to the marketization of childcare (e.g. Doepke et al. 2023). Second, public policies related to childcare provision, taxation and parental leave. Government spending on early childhood education and promoting the availability of public childcare, for example, may affect positively both total fertility rate and female employment (Brilli et al. 2016, Olivetti and Petrongolo 2017). Finally, the flexibilization of the labor market, through the wider use of temporary contracts and part-time jobs, possibly contributed to shape the relationship between female employment and fertility (e.g. Del Boca and Sauer 2009, Del Bono et al. 2012, 2015).

This latter process of labour market deregulation, which increased employment instability, led to a further strand of literature exploring the relationship between temporary/non-stable employment and fertility. Alderotti et al. (2021), for instance, explore the effects of employment instability on fertility in Europe. Their findings suggest that employment instability of men and women has a non-negligible negative effect on

fertility. For men, unemployment is more detrimental for fertility than temporary employment; conversely, a woman having a fixed-term contract is least likely to have a child. More in general, the negative effect of employment instability on fertility has become stronger over time, especially in Southern European countries, where social protection for households and the unemployed is least generous (Barbieri and Scherer, 2006). However, the effect of employment instability on fertility is not clear. On the one hand, some studies found a detrimental effect of employment instability on family formation, i.e. delaying the leave of parental home, smaller household size or even no children (Auer and Danzer, 2016; Billari, 2005; Busetta et al., 2019; Pieroni et al., 2023). Labour market dualism, rather than a rigid protection legislation, is negatively associated with fertility (Bastianelli et al., 2023; De Paola, et al., 2021). On the other hand, individuals might exploit periods of joblessness or precarious employment to have children, especially if they have other income sources or little future employment prospects (i.e. Vignoli et al. 2012).

Finally, some studies explored the relationship between women's wage and fertility. Ejrnaes and Kunze (2013) on Germany, for instance, found a negative selection back to full-time work for women after childbirth, that is a wage reduction for women in established/permanent employment. Some others, instead, investigated the birth timing and women career. According to Bratti (2023), most research finds that postponing the first birth is positively associated with mother's labor force participation and wages but may have negative effects on overall fertility, especially in the absence of supportive family-friendly policies. Picchio et al. (2021), on Italy, show there is a long-lasting wage penalty from motherhood postponement from completion of formal education. Fitzeberger et al. (2013), on Germany, found there are very strong negative employment effects, which are causally due to childbirth. Despite the employment loss reduced over the first five years following childbirth, it does not get null.

Inspired by the existing literature, we explore the relationship between fertility and employment in Italy by considering different employment outcomes, reflecting the multifaceted nature of female Italian employment.

3. Data

Our data are from the EU-SILC survey, which is conducted in most European Union countries by the relevant national institutes of statistics using harmonized definitions and survey methodologies (Eurostat, 2010). The

topics covered by the survey encompass living conditions, income, social exclusion, housing, work, demography, and education.

We explore EU-SILC longitudinal data files covering the period of 2004-2019. Since each longitudinal data file in the EU-SILC survey covers four years, we decided to use more data files to cover a longer period of time.[3] For each subperiod, i.e. four-year period, we consider the sample of individuals/households interviewed in at least three of the four successive waves. We select data for Italy. We focus on households with a woman of childbearing age, that is, in the age range from 18 to 50 years, i.e. fertile female. This selection leaves us with 113.899 observations for the period investigated. We estimate the employment and childbirth/fertility equations by adopting a model with a recursive structure (for details, see Section 4). Therefore, employment and childbirth/fertility are our variables of interest.

For the employment equation, we estimate our model by considering different outcomes: dummy for being employed (employee and self-employed) or not, working hours (part-time and full-time); contract type (temporary employment and permanent employment), distribution of the wage level (low paid, middle paid, and high paid)[4], and work intensity. Work intensity is calculated at the household level as "the number of months that all working-age household members have been working during the income reference year as a proportion of the total number of months that could theoretically be worked within the household."[5] The indicator is calculated for individuals below 60 years of age and by excluding students aged 18-24. In this study, we group work intensity into four categories: 0; (0; 0.25]; (0.25; 0.5]; 1. We also extend the Eurostat definition of work intensity to account for part-time employment, by assuming that this is equivalent to (approximately) 50% of full-time employment.

In this way, we are able to consider the most common measures of labor force attachment, which characterize the Italian employment and, more broadly, the labour market. Thus enables us to offer an exhaustive picture of the relationship between different employment outcomes and childbirth.

[3]For details on data preparation, see Borst and Wirth (2022), and for an application, see Barbieri et al. (2024).

[4] We consider the wage distribution: high paid are those with hourly wages higher than 3/2 of the median hourly wages; medium paid those with a wage between the low paid threshold, 2/3 of median hourly wage, and the high paid threshold. Low paid those with wage lower or equal to the mentioned threshold.

[5] For a detailed explanation, see the Eurostat website: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Persons_living_in_households_with_low_work_intensity.

As for childbirth/fertility, in line with the existing literature (see, for instance, Barbieri and Bozzon, 2016; Mussida and Sciulli, 2023), childbirth is defined as a new birth either in the current or in the previous year to the surveyed period. The inclusion of the previous year's births is to avoid misreporting and to account for the fact that the previous year of the EU-SILC survey coincides with the income year (for instance, for the 2005 survey year the income is from 2004—it is retrospective information), as well as because of the biological lag in decision-taking until childbirth.

Table 1 reports the weighted summary statistics for the variables used in the econometric analysis for the overall sample of households. The dependent variables used in our investigation are employment outcomes and childbirth. Figure 1 shows the evolution of childbirth and all the employment outcomes considered over the period explored, i.e. 2004-2019. From the top panel, we note a reduction of childbirth, especially since 2015 and a slight increase in employment. If we look at employment composition, we note an increase in part-time employment, while full-time working condition remained almost unchanged through the period. As for contract type, we see a slight increase for temporary contract. Notably, looking at the wage distribution, we see an increase in low paid jobs, a slight increase in medium paid, and unchanged proportion of unpaid jobs. Finally, we see an important increase in full work intensity (employment commitment) which exceeds the rise in zero work intensity. Overall, the slight increase in female employment observed through the period investigated, seems primarily composed by part-time jobs for low paid positions. Nonetheless, the increase in labour market attachment, as measured by work intensity, is a positive signal.

We now briefly describe the covariates included in each equation, keeping in mind that due to the model used, we also include lagged employment status, lagged childbirth dummies, initial employment condition, initial childbirth, and the average of time-varying covariates (for details, see Section 4).

For the both the equations, we control for certain characteristics of the fertile female as well as for household characteristics. The former include age (splitting into age ranges the overall 18-50 years of age considered), education, consensual union (on a legal basis or not). Household characteristics include whether a female is the head of household, the presence of children of different age ranges, i.e. 2-3 years of age and 4-15 years of age, the number of disabled and elderly persons (aged 65 or over) in the household, home ownership, the presence of a daughter in fertile age (from 18 to 50 years of age), the presence of a husband employed (either employee or self-employed), and the presence of other members employed in the households (other than

daughter and husband). We also control for the geographical area of residence, i.e. North-West, North-East, Centre, and South.

Finally, for identification purposes, in the childbirth equation we include a dummy variable for the presence of children (from 2 to 17 years of age) of the same sex in the household. This variable, as suggested by the literature (see, for instance, Angrist and Evans, 1998, and Michaud and Tatsiramos, 2011), allows dealing with simultaneity and it is used as an instrument for the effect of a birth on employment. It is also argued that parents with two children of the same sex are more likely to have a third one.

Finally, as we explore a long period of time, we include yearly dummy variables in our set of covariates.

4. Econometric approach

The wide literature of fertility effects on employment has stressed that both phenomena are dynamically interrelated, and their relationship is influenced by endogeneity issues (e.g. Del Boca et al. 2005). Current employment is affected by childbirth, but also by past fertility choices. At the same time, fertility choice may depend on past employment status, since the decision of having children is associated with various costs, including those raising from the interruption of career paths and worsening employment prospects (e.g. Garibaldi and Wasmer, 2004).

Accordingly, to the life-cycle perspective, we adopt a dynamic approach when modelling both employment and fertility choices and allow for possible feedback effects from employment to future fertility decision (e.g. Carrasco 2001, Michaud and Tatsiramos 2011). The resulting model corresponds to a first-order Markov chain bivariate model with random effects and recursive structure. Each equation includes the lagged dependent variables on their right-side to allow for dynamic aspects and the childbirth equation includes the lagged employment status to tackle feedback effects.

Our benchmark specification assumes both employment and childbirth outcomes are represented by binary variables, thus returning a dynamic bivariate probit model. The model is formalized as follows. Let us define e_{it} as the individual employment status of individual $i = 1 \ldots n$ at time $t = 1 \ldots T$. We assume that female employment status is described by the following benchmark model:

$$e_{it} = 1\{\gamma e_{it-1} + \beta b_{it} + \delta b_{it-1} + \omega x_{it} + \vartheta z_i + a_i + u_{it} > 0\} \quad (1)$$

where 1 is a binary indicator function, e_{it-1} is the lagged employment status, b_{it} is a dummy variable indicating whether a child was born in the household in the current or previous year or not, b_{it-1} is the lagged childbirth dummy variable, while x_{it} and z_i are vectors of strictly exogenous time-variant and time-invariant (respectively) individual and household characteristics. γ is the state dependence parameter, β is the parameter of interest describing the impact of childbirth on female employment, δ measures the impact of past childbirth, while ω, ϑ and φ are sets of parameters to be estimated. Finally, a_{ic} and u_{ict} represent the unobserved time-invariant individual effect and the idiosyncratic error term; we assume that these are both normally distributed and that u_{ict} is not serially correlated.

The childbirth equation reads as:

$$b_{it} = 1\{\alpha e_{it-1} + \kappa b_{it-1} + \tau x_{it} + \varphi z_i + \lambda s_{it} + h_i + \epsilon_{it} > 0\} \quad (2)$$

where s_{it} is a variable capturing the gender mix of existing children and introduced for identification purposes (e.g. Angrist and Evans 1998, Michaud and Tatsiramos 2011), h_{ic} is the random effects term and ϵ_{ict} is an idiosyncratic error we assume to be normally distributed. α, κ, τ, φ and λ are parameters to be estimated.

The dynamic structure of the model and the possible misalignment between the start of the observed data and that of the start of the analyzed process, may determine the so-called initial conditions problem (Heckman, 1981). We adopt the Wooldridge (2005) method to deal with this. It is based on the use of an alternative conditional maximum likelihood (CML) estimator that considers the distribution conditional on the values in the initial period. This approach allows incorporating the Mundlak method (1978) to relax the assumption that individual-specific random effects are independent of other covariates (correlated random effects). Such modeling enables us to identify genuine state dependence, by distinguishing spurious effects due to unobserved heterogeneity.

Given this, the conditional densities of the unobserved effects are specified via the following auxiliary models:

$$a_i = \theta_0 + \theta_1 e_{i1} + \theta_2 b_{i1} + \theta_3 \bar{x}_i + \mu_i \quad (3)$$

$$h_i = \pi_0 \pm \pi_1 e_{i1} + \pi_2 b_{i1} + \pi_3 \bar{x}_i + \varepsilon_i \quad (4)$$

Where e_{i1} is the initial poverty status, b_{i1} is the value of the childbirth dummy variable at time 1, $\bar{x}_i$ is a set of time-averaged time-variant control variables calculated from periods 2 to T. Finally, θ_k and π_k are parameters to be estimated.

Considering that unobservable factors that may affect both fertility decisions and the probability of employment, we model the correlation between unobserved heterogeneity terms to reduce the risk of bias when estimating the effect of childbirth on employment. Thus, we assume that employment and childbirth equations are linked via random effects and that they are drawn from a bivariate normal distribution with zero mean and variance σ^2. Their association is captured by the correlation term $\rho = corr(\mu_i, \varepsilon_i)$[6].

As further analysis, we provide insights in the female employment-childbirth relationship by analysing various facets of employment condition and its link with fertility decision. We explore such relationship looking at the role of a) working time (full-time versus part-time); b) the type of contract (permanent versus temporary employment); c) wage levels (low-pay, medium-pay and high-pay), and finally d) the household labour supply perspective as summarized by the work intensity.

This requires the extension of the benchmark model, considering the categorical nature of 'new' employment outcomes. We assume female employment may be represented by ordinal variables when analysing outcomes, a), b) and d), while we adopt a multinomial outcome when analysing the outcome c), as suggested in Schnable et al. (2021), which stressed the importance of considering that the utility associated with each alternative may be not intrinsically ordered[7].

In both cases, the model extension relies on the modification of equation 1) and the change of the nature of the employment variable in the equation 2). Details are reported in the technical appendix.

Finally, because the estimated coefficients describe the sign of the relationship but are inappropriate for determining the magnitude of the impact between outcome and explanatory variables, we compute and report average marginal effects (AMEs).

5. Results

In this section, we describe the results obtained from different specifications of the dynamic bivariate model of employment and childbirth. We firstly present evidence from the benchmark dichotomous specification (Table 2) and then those with categorical outcomes, i.e. employment working time, employment contract type,

[6] The significance of ρ is suggestive of the importance of using a joint estimation approach to avoid inconsistent estimates (e.g. Ayllón, 2015).

[7] We extend the standard definition based on the dichotomy low/high pay levels, by adding the medium-pay level to the outcome specification. This allows to account for possible non-linear effect of childbirth on (wage level) employment outcome.

employment wage level and household labor supply, as measured by work intensity (Tables 3-6). We conclude with the description of results of subgroup analysis (Tables B2-B5). For each specification we report AMEs, standard errors and statistical significance related to employment (Panel A on the left side of each table) and to childbirth (Panel B on the right side of each table). For the sake of brevity, we show only estimates related employment and childbirth variables, while other AMEs related to other covariates are reported in the Appendix or are available upon request. Each table reported in the main text is accompanied by a graph which show the evolution of childbirth effect on the employment outcomes. These graphs are derived from augmented specifications where the childbirth dichotomous variable is interacted with year dummy variables.

5.1 Benchmark model

Results from the benchmark analysis rely on the estimation of Equations 1 and 2 applied to 2004-2019 IT-SILC data. Focusing on Panel A, we note the presence of genuine state dependence in female employment, as being employed in the previous period increases by 12.3 p.p. the probability of being currently employed. The AME related to the initial employment variable is equal to 0.287 and it is statistically significant. This certifies the importance of accounting for the initial conditions problem to avoid biased estimates of state dependence, and according to some interpretation (e.g. Ayllon 2015) it would be suggestive that the importance of past employment conditions for current employment tends to increase overtime.

Turning on the effect of childbirth on female employment, we note that childbirth reduces by 4.9 p.p. the probability of being employed of Italian females aged 18-50. Our result confirms the detrimental effect of fertility on female employment, and it is in line with previous research on Italy and other Southern European countries (e.g. Del Boca et al. 2005, Herrarte et al. 2012). However, our point estimate appears to be smaller in magnitude when compared to the estimated APE by Michaud and Tatsiramos (2011) based on 1995-2001 ECHP data. This possibly suggests the negative effect of childbirth on female employment has, on average, decreased since 1990s to the first two decades of 2000s. This would be consistent with the view for which the negative employment/labor force participation – fertility association, is weakening or even reversing over time (e.g. Doepke et al 2021). All in all, the negative effect associated to childbirth is possibly certifying the gap between the efficacy of public childcare services in Italy and that in Nordic and Continental Europe, as well as the limit in the use of flexible working hours, as we deeply discuss below.

The AMEs associated to past childbirth and initial childbirth are both positive, but they are smaller in magnitude and not statistically significant.

Focusing on Panel B of Table 2, one may observe estimates related to the childbirth equation. We note a positive a statistically significant (at 10% level) effect of past employment status. Firstly, it highlights the existence of feedback effects from employment to future childbirth and stresses the importance of adopting a bivariate approach to deal with possible endogeneity issues[8] and mitigate possible bias when estimating the effect of childbirth on employment. The estimated AME is 0.003, indicating that past employment increases by 0.3 p.p. the probability of childbirth. This suggests that being employed when fertility decision is taken, increases the probability of a newborn, indicating that a potential greater financial security is important for that choice.

More generally, joining evidence from panel A and B, evidence emerged suggests that childbirth determines a sort of redistributive effects in terms of female employment probabilities. This speculation is even more clear when looking at results from Table B1, we obtained from an augmented specification which include an interaction term between lag employment variable and childbirth variable. It results that the negative effect of childbirth on female employment is guided (and it is statistically significant) only for females who were employed in the previous period, while it is very small and not statistically significant for the not employed in the previous year. The Lag employment-childbirth interacted variable reveals that the probability of persisting in employment is reduced by 8.1 p.p. in case of childbirth.

Figure 1 shows results obtained by the augmented specification of the benchmark model, which allows to uncover how the predicted female employment probabilities by childbirth status has evolved along the period investigated. We note, with few exceptions, that predicted employment probabilities associated to childbirth is lower than that associated with no childbirth. Quite interestingly, the gap appears to have increased in concomitance with the Great Recession and after the application of austerity measures, while it slightly closed afterwards. Such trend is possible depending on various causes, including the pattern of public expenditure for family/children policies. The family/children function of the public spending has shrunken in 2010 (282,7 euros in PPS per head versus 302.3 euros in 2009) remained lower the level of the pre–Great Recession period

[8] This is further confirmed by the estimate of the rho parameter, which is relatively small in magnitude, negative and statistically significant. This indicates that both processes are affected by common unobservable factors, with effects that diverge across employment and childbirth.

in the years characterized by austerity measures and further declined in 2014 and 2015. This possible correlation stresses the importance of measures supporting fertility decisions and female employment, including childcare services and children-related benefits.

5.2 Other labor market outcomes

5.2.1 Employment Working hours: Part-time versus Full-time

Table 3 reports the results for the female employment-childbirth relationship by exploring the role of employment working hours, i.e. part-time and full-time, by taking not employed as base category.

For part-time employment we see relatively negligible persistence in the condition and in the possible transition from full-time to part-time (+0.4 pp. and +0.6 pp., respectively). For full-time employment, instead, we find both relatively higher probability of changing the employment working hours, i.e. from part-time for full-time, is 7.3 pp., and persistence in the full-time condition (the AME for the persistence is +0.125, that is +12.5 pp.). The significance of the parameters for initial employment statuses suggests that unobserved heterogeneity is a relevant issue, especially for full-time employment. The AME for initial childbirth, instead, does not exert a role on both the employment working hours investigated. If we look at the effect of childbirth on employment we find a negative association with both part-time (-0.1 pp.) and especially full-time employment (-4.3 pp.). The negative effect of children on female labour market outcomes regardless of their relative potential earnings and working time before childbirth, i.e. part-time versus full-time, is confirmed by the existing literature (i.e. de la Vega, 2022). More specifically, the lower detrimental effect of having a child on part-time employment compared with full-time (see Table 3) is likely due to the fact that part-time jobs enable women a better reconciliation of childcare with paid employment (Fitzenberger, 2013). Moreover, in Southern European countries, like Italy, public childcare is characterized by the rigidity in the number of weekly hours available (see, for instance, Del Boca et al., 2005, Doepke et al., 2023), and this makes this service more compatible with part-time working hours arrangement with respect to a full-time.

Interestingly, the results for childbirth equation suggest that only a previous full-time employment condition is positively associated with childbirth (+0.5 pp., see Table 3). This might be partly explained by the fact that full-time employment working hours typically ensure a higher job protection, as well as economic stability with respect to part-time employment working hours.

Figure 3a shows the evolution of the employment probabilities for full-timers (top left panel) and part-timers (top right panel) by childbirth status. Notably, we see that the birth of a child more clearly affect full-time employment, i.e. the predicted employment probability of female having no child is relatively higher than the one of female having child, with only few exceptions. Having a children, instead, does not exert a role on the predicted probability of working part-time. This confirms the role of part-time work for the conciliation of work and childcare.

5.2.2 Employment contract type: Temporary versus permanent jobs

Table 4 shows the estimates of our model by considering the contract type, i.e. temporary versus permanent contract. As for state dependence, we see that, as expected, it is relatively higher for permanent contract compared with temporary contract (+42.6 pp and +1.8 pp., respectively). We also see that the estimated AME for a change in employment contract type is null for the transition from permanent to temporary contract (AME 0.000), while it is equal to +0.115 that is +11.5 p.p. for the opposite, that is an improvement of contract type from a temporary to a permanent contract. We also note that the initial employment conditions are significant and positive for both contract types: unobserved heterogeneity plays a role, especially for permanent contract. This further confirms the importance of accounting for the initial conditions problem to avoid biased estimates of state dependence, and according to some interpretation (e.g. Ayllon, 2015) it would be suggestive that the importance of past employment conditions for current employment tends to increase overtime.

Moving to childbirth equation, from Table 4 we see that the effect of the birth of a child on temporary employment is negligible, +0.2 pp., while there it is relatively stronger for permanent contract (+4.3 pp.).

Notably, we see that while there is a negative association between temporary employment and childbirth (-0.3 pp.), the association is instead positive for a permanent contract (+0.3 pp.).

The effect of employment instability, i.e. temporary contract, on fertility, as explained above (see Section 2), is not clear in the available literature and empirical evidence. Our findings are in line with the strand of literature suggesting a detrimental effect of employment instability on family formation, such as delaying the decision to leave the parental home, smaller household size or even no children (Auer and Danzer, 2016; Billari, 2005; Busetta et al., 2019; Pieroni et al., 2023). Moreover, labour market dualism, temporary versus

permanent employment contract types, rather than a rigid protection legislation, is negatively associated with fertility (Bastianelli et al., 2023; De Paola, et al., 2021).

Figure 3a (bottom panel) shows how the predicted female employment probabilities with a permanent and temporary contract, respectively, by childbirth status has evolved along the period explored (2004-2019). We note there is a relatively higher gap for the predicted probability of permanent employment, between women with no children and those with a childbirth. For temporary employment, the difference between the two categories is relatively lower.

5.2.3 Wage distribution

We investigated if and how the effect of childbirth varies across the wage distribution by considering the categories of low paid, medium paid, and high paid workers (for details, see Section 3). Table 5 reports the results for the employment outcomes and the childbirth equation. We see that the effect of childbirth on employment, in line with the literature (see, for instance, de la Vega, 2022) changes along the wage distribution: it is not significant for low paid workers, negatively and significantly associated with medium paid workers (-4.8 p.p.), and positively and significantly associated with high paid workers (+1 p.p.). These findings is in line with the literature on the marketization of wages (i.e. Doepke et al., 2023). In detail, in a couple where the wife's wage is lower than the cost of childcare, i.e. low paid worker, the female provide childcare on her own, and here we understand the negative effect of childcare on low paid job. If instead the female wage exceeds the cost of childcare, i.e. high-paid workers, the couple would buy as much care (hours) as possible from the market.

For the childbirth equation, we see that it is only a previous condition of medium paid worker increases childbirth (+0.7 p.p.). This finding suggest that probably a medium paid job is not enough to enable the reconciliation between paid and unpaid work, i.e. childcare.

From Figure 3b, we note that there is a significant gap between the medium-paid employment probability of female with no childbirth and those with a childbirth. This is due to the fact that likely, are those women in the middle of the wage distribution which more frequently give birth to a child. For those with a low paid workers there should be also a not stable employment condition, that is temporary and less secure employment. For

high paid, instead, the more secure employment/wage should be detrimental for the opportunity of having children.

5.2.4 Work intensity

Table 6 reports the findings for the household work intensity class considered and the childbirth equation. From the bottom part, we see the persistence in the categories of work intensity as well as the transition from one class to the following.

While for the lower work intensity classes ((0, 0.25] and (0.25, 0.5]) the sign of the AME for the persistence is negative, for higher work intensity classes ((0.5, 15] and 1, full work-intensity) the opposite is true. This suggest the relatively higher instability for jobs with reduced working hours compared with full-time jobs (lower or equal to full work intensity).

As for the effect of childbirth, we see that the AME are not significant but close to being significant. The sign of the AME suggest that there is a negative effect of the birth of a child for the household with relatively low work intensity, while the association between childbirth and household work intensity is positive for those working more (relatively higher work intensity). This is likely because work intensity is measured at the household level, and we need to consider also husband employment.

Form the childbirth equation (right panel of Table 6), we note that it is only full work intensity being positively associated with childbirth, according to the findings for full-time employment and permanent employment both positively associated with childbirth), as well as to the fact that it is measured at the household level. From Figure 4, we see that the gap between no childbirth and childbirth changes its sign within the range considered for work intensity. While from null work intensity to the median of the distribution there is an advantage in terms of employment probabilities for those not having children, the reverse is true for those with medium, and high work intensity.

5.3 Subgroup analysis

We provide additional evidence on the childbirth-female employment relationship by providing sub-group analysis with respect to the following control variables: age of females, area of residence (North-Centre versus South), equivalized household income (non-poor versus poor), and husband employment status.

Regarding the age variable, we split the sample between those aged 18-35 and those aged 36-50 (Table B2) Focusing on the childbirth-effect, we note the negative impact associated to a newborn is stronger for younger females than for those aged more than 35. This finding agrees expectations from the human capital theory for which older women encounter high opportunity costs of leaving employment, and then their attachment to the labor market is stronger.

Table B3 refers to the analysis by area of living. This analysis, in addition to shed light to the well-known territorial differences affecting the Italian labor market, was conducted to approximate potential effects deriving from different levels of child-care services. Even though the supply of child-care services is weak in the entire country, the situation of Southern regions appears to be particularly severe, being the available places equal to 12-13 every 100 for children aged 0-2 in the South, and over 30 every 100, in the North-Centre (ISTAT 2019). Despite this, the negative effect of childbirth on female employment is much stronger in the North-Centre (being -6.3 p.p.) than in the South, contradicting the expectation of finding a smaller effect in the North-Centre because of the positive role played by child-care services to support female employment in case of childbirth. This results, however, may be partly explained by the unbalanced demand for child-care services across territories and the contemporary differences in female employment rates. In other terms, despite the greater diffusion of public and private nurseries in the North-Centre, the higher pressure on such infrastructure due to the higher employment rates, may weaken their role in supporting female employment. The contrary for the South. All in all, our results possibly suggest that the structure (supply and accessibility costs) of childcare services in Italy are relatively inadequate to effectively support childbirth[9].

Table B4 considers the role of household income, analyzing poor/non poor households. Because poverty status is subjected to a certain degree of variability, which may determine uncertainty when interpreting results, we focus only on never poor and ever poor households. We find that childbirth reduces the probability of females being employed by 5.4 p.p. in case of non-poor households, while the effect is practically null for poor households. This finding possibly reveals that poverty is determined by persistence in non-employment positions, thus making ineffective childbirth on female employment, in line with results mentioned in the Section 5.1, according to which a newborn determines negative effects only for previously employed females.

[9] Further investigation, however, is needed in the light of recent policies aimed at increasing the availability of childcare services and increasing public support in terms of related benefits.

In addition, poverty may be determined by low work intensity at the household level which, at the same time, may increase the opportunity childcare is offered by other family members, thus alleviating the responsibilities of mothers.

Finally, Table B5 displays different childbirth effect on female employment conditional on the role of husband employment status. Because husband employment may be subjected to a certain variation over time, the two groups only include females living with husband ever employed and never employed. We find the effect of childbirth on female employment is stronger if women live with a husband ever employed (-5.7 p.p.), while the effect is smaller (-2.3 p.p.) and not statistically significant for women living with husband that never worked. Among others, this finding is possibly suggesting that the presence of a non-working husband may be helpful in childcare activities at home, thus contributing to relieve the charges on mothers. In this regard, the literature has suggested that cooperative fathers may help to conjugate career of females and family (e.g. Doepke and Kindermann 2017).

6. Concluding remarks

This paper explores the relationship between female employment and childbirth in Italy over the period 2004-2019, embracing the Great Recession and the austerity measures eras by exploiting longitudinal sections of the EU-SILC microdata. We analyze female employment from different perspectives, considering the multifaceted nature of the phenomenon going beyond the classical approach based on the dichotomy employment/non-employment. We also offer a subgroup analysis.

We adopt a dynamic approach when modelling both employment and fertility choices and allow for possible feedback effects from employment to future fertility decision.

In broad terms, our findings suggest that in the period 2004-2019, childbirth has reduced the probability of female employment by 4.9 p.p., a point estimate lower than that emerged in the previous decade. The childbirth effect, however, evolved over time, and the related negative impact has increased after the Great Recession and the application of austerity measures. Our analysis also shows that full-time and permanent jobs were more strongly affected by childbirth than part-time and temporary employment. Moreover, childbirth increases the probability of being a high-pay worker, indicating a greater ease to combine career and family, possibly because of the better accessibility of childcare services. Finally, childcare tends to increase work intensity,

suggesting a compensative role of other family-members in terms of household labor supply. Sub-groups analysis reveals negative childbirth-effect is stronger for younger females, in the North-Centre regions, among non-poor household and in presence of employed husbands.

The policy implications of our results suggest the importance of measures supporting fertility decisions and female employment. Interventions to reduce the detrimental effect of childbirth on female employment, such as the increase in the social expenditure for family and children, i.e. children related benefits are strongly recommended in a country such as Italy were those expenditure were reduced with the Great Recession and the years characterized by austerity measures. Further, the availability of childcare services should be enhanced, with a more widespread presence of services across the country, as well as a relatively higher efficacy of childcare services, for instance by increasing the number of hours offered. Our findings also suggest an important reconciliation role for part-time employment.

References

Alderotti, G., Vignoli, D., Baccini, M., & Matysiak, A. (2021). Employment Instability and Fertility in Europe: A Meta-Analysis. *Demography*, *58*(3), 871–900.

Angrist, J. D., Evans, W.N. (1998). Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size. *The American Economic Review*, 88(3): 450-477.

Auer, W., Danzer, N. (2016). Fixed-Term Employment and Fertility: Evidence from German Micro Data, *CESifo Economic Studies*, 62(4): 595-623.

Barbieri, P., & Scherer, S. (2009). Labour market flexibilization and its consequences in Italy. *European Sociological Review*, 25, 677–692.

Barbieri, P. and Cutuli, G. and Scherer, S. (2024). In work poverty in Western Europe. A longitudinal perspective, *European Societies*, DOI: 10.1080/14616696.2024.2307013 (forthcoming).

Barbieri, P. and Bozzon, R. (2016). Welfare, Labour Market Deregulation and Households' Poverty Risks: An Analysis of the Risk of Entering Poverty at Childbirth in Different European Welfare Clusters, *Journal of European Social Policy*, 26, 99-123.

Bastianelli, E., Guetto, R., Vignoli, D. (2023). Employment Protection Legislation, Labour Market Dualism, and Fertility in Europe. *European Journal of Population*, 39(15).

Billari, F. (2005). Partnership, childbearing and parenting: Trends of the 1990s. In W. Haug, M. Macura, & A. L. Mac Donald (Eds.). The new demographic regime: Population challenges and policy responses (pp. 63–94). Geneva, Switzerland: United Nations.

Blau, F. D., Grossberg, A.J. (1992). "Maternal Labor Supply and Children's Cognitive Development." *The Review of Economics and Statistics*, 74(3): 474-481.

Borst, M. and Wirth, H. (2022) 'EU-SILC tools: eusilcpanel_2020 - first computational steps towards a cumulative sample based on the EU-SILC longitudinal datasets; Update'. (GESIS Papers, 2022/10). Köln: GESIS - Leibniz-Institut für Sozialwissenschaften.

Bratti, M. (2023). Fertility postponement and labor market outcomes. IZA World of Labor: 117.

Brilli, Ylenia, Daniela Del Boca, and Chiara D. Pronzato. 2016. "Does Child Care Availability Play a Role in Maternal Employment and Children's Development? Evidence from Italy. *Review of Economics of the Household* 14 (1): 27–51.

Busetta, A., Mendola, D., & Vignoli, D. (2019). Persistent joblessness and fertility intentions. *Demographic Research*, 40, 185–218.

Del Boca D. (2002) 'The Effect of Child Care and Part-time on Participation and Fertility of Italian Women', *Journal of Population Economics* 15: 549–573.

Del Boca, D., Sauer, R.M. (2009). Life cycle employment and fertility across institutional environments, *European Economic Review*, 53(3): 274-292.

Del Bono, Emilia, Andrea Weber, and Rudolf Winter-Ebmer. 2012. "Clash of Career and Family Fertility Decisions after Job Displacement." *Journal of the European Economic Association* 10 (4): 659–683.

Del Bono, Emilia, Andrea Weber, and Rudolf Winter-Ebmer. 2015. "Fertility and Economic Instability: The Role of Unemployment and Job Displacement." *Journal of Population Economics* 28 (2): 463–478.

de la Vega, N. (2022). The differential effect of childbirth on men's and women's careers, *Labour Economics*: 78, 102249.

De Paola, M., Nisticò, R., Scoppa, V. (2021). Employment protection and fertility decisions: the unintended consequences of the Italian Jobs Act, *Economic Policy*, 36(108): 735–773.

Doepke, Matthias, and Fabian Kindermann. 2017. “Intrahousehold Decision Making and Fertility.” In Demographic Change and Long-Run Development, edited by M. Cervellati and U. Sunde. MIT Press.

Doepke, M., Hannusch, A., Kindermann, F., Tertilt, M. (2023). The economics of fertility: a new era, Handbook of the Economics of the Family, Ed(s): Shelly Lundberg, Alessandra Voena, North-Holland, 1(1): 151-254.

Ejrnœs, M., Ejrnæs, M., Kunze, A. (2013). Work and Wage Dynamics around Childbirth. *The Scandinavian Journal of Economics*, 115(3): 856-877.

Fitzenberger, B., Sommerfeld, K., & Steffes, S. (2013). Causal effects on employment after first birth—A dynamic treatment approach. *Labour Economics*, 25, 49–62.

Goldin, C. (1995). The U-Shaped Female Labor Force Function in Economic Development and Economic History. In: Schultz TP Investment in Women’s Human Capital and Economic Development. University of Chicago Press ; 1995. pp. 61-90.

Herrarte, A., Moral-Carcedo, J., Sáez, F. (2012). The impact of childbirth on Spanish women’s decisions to leave the labor market. *Review of Economics of the Household*, 10: 441–468.

Michaud, P., & Tatsiramos, K. (2011). Fertility and female employment dynamics in Europe: The effect of using alternative econometric modelling assumptions. *Journal of Applied Econometrics*, 26(4), 641–668.

Mussida, C. and Sciulli, D. (2023). Childbirth and poverty in Europe: A dynamic bivariate approach, *Review of Income and Wealth*, 69(1): 34-59.

Olivetti, C., Petrongolo, B. (2017). The Economic Consequences of Family Policies: Lessons from a Century of Legislation in High-Income Countries. *Journal of Economic Perspectives*, 31(1): 205-230.

Picchio, M., C. Pigini, C. Staffolani, and A. Verashchagina. “If not now, when? The timing of childbirth and labor market outcomes.” *Journal of Applied Econometrics* 36:6 (2021): 663–685.

Pieroni, L., d’Agostino, G., Lanari, D., Scarlato, M. (2023). Temporary employment and fertility in Italy: The effect of two labor market reforms in the early 2000s, *Economic Modelling*, 124: 106298.

Vignoli, D., Drefahl, S., & De Santis, G. (2012). Whose job instability affects the likelihood of becoming a parent in Italy? A tale of two partners. *Demographic Research*, 26, 41–62.

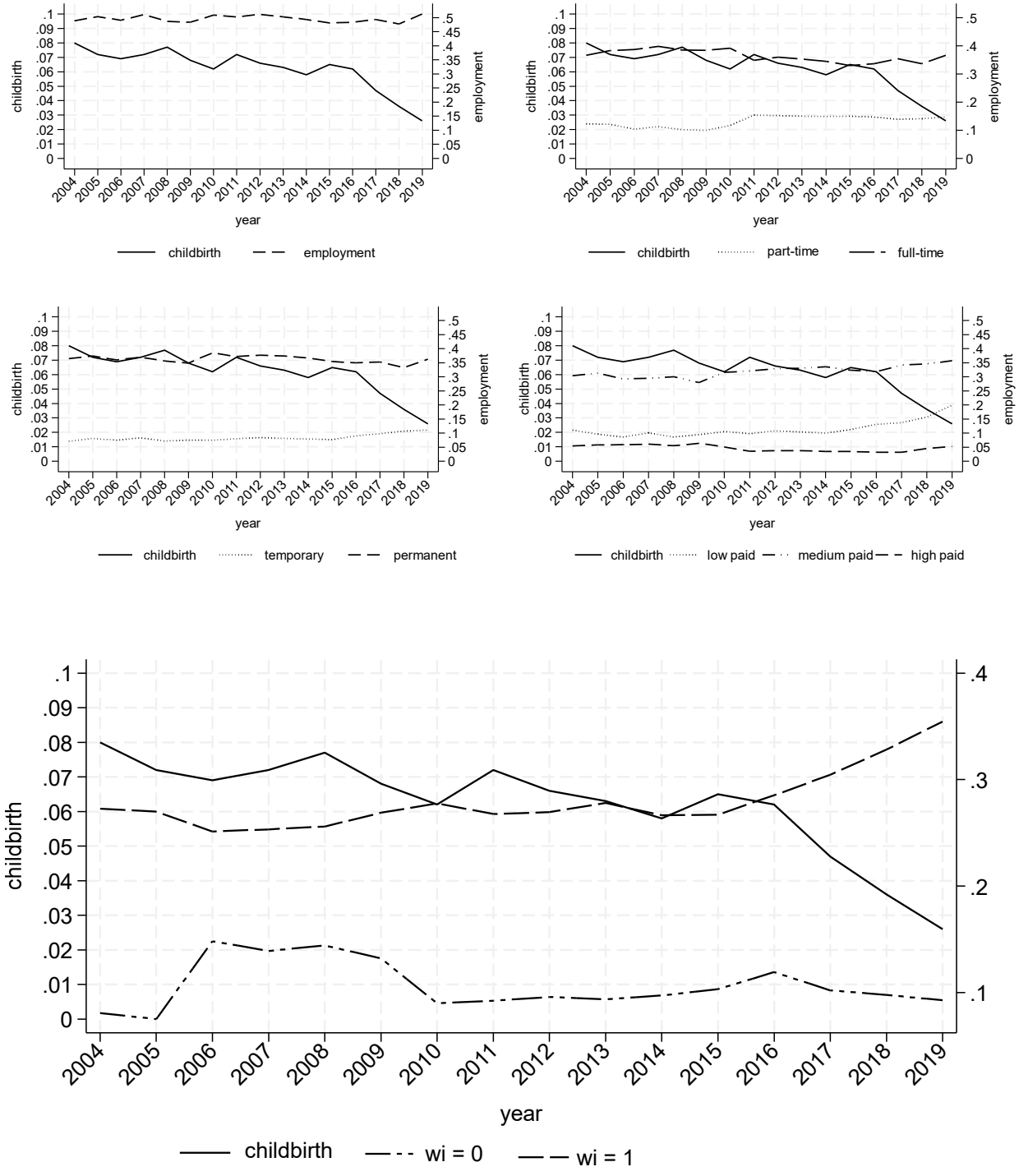
Tables

Table 1 Descriptive statistics

Variable	Mean	Std. dev.
Dependent variables		
Employment	0.543	0.500
Working hours		
Part-time	0.149	0.356
Full-time	0.394	0.491
Contract type		
Temporary	0.086	0.280
Permanent	0.420	0.494
Wage distribution		
Low paid	0.085	0.278
Medium paid	0.359	0.480
High paid	0.053	0.224
Work intensity		
0	0.081	0.274
(0, 0.25]	0.077	0.266
(0.25, 0.5]	0.375	0.484
(0.5, 1)	0.185	0.388
1	0.282	0.450
Childbirth	0.064	0.244
Covariates		
Female in childbearing age [18-24]	0.069	0.253
Female in childbearing age [25-34]	0.257	0.437
Female in childbearing age [35-44]	0.390	0.488
Female in childbearing age [45-50]	0.284	0.451
Female in childbearing age low educated	0.399	0.490
Female in childbearing age middle educated	0.541	0.498
Female in childbearing age highly educated	0.208	0.406
Female in childbearing age in consensual union	0.634	0.482
HH female	0.391	0.488
Presence of children aged 2-3	0.080	0.272
Presence of children aged 4-15	0.396	0.489
Number of persons with disabilities	0.093	0.331
Number of elderly persons	0.063	0.281
Homeowner	0.394	0.489
Daughter in fertile age [18, 50]	0.137	0.344
Housband employed	0.649	0.477
Presence of other members employed	0.198	0.398
North-West	0.249	0.433
North-East	0.184	0.388
Centre	0.190	0.393
South	0.376	0.484
Presence of children of the same sex	0.121	0.326
Observations	113,899	

Note: Mean (percentages) and standard deviations.
Source: Authors' elaborations on EU-SILC data

Figure 1. Evolution of dependent variables for employment and childbirth, 2004-2019



Source: Authors' elaborations on EU-SILC data

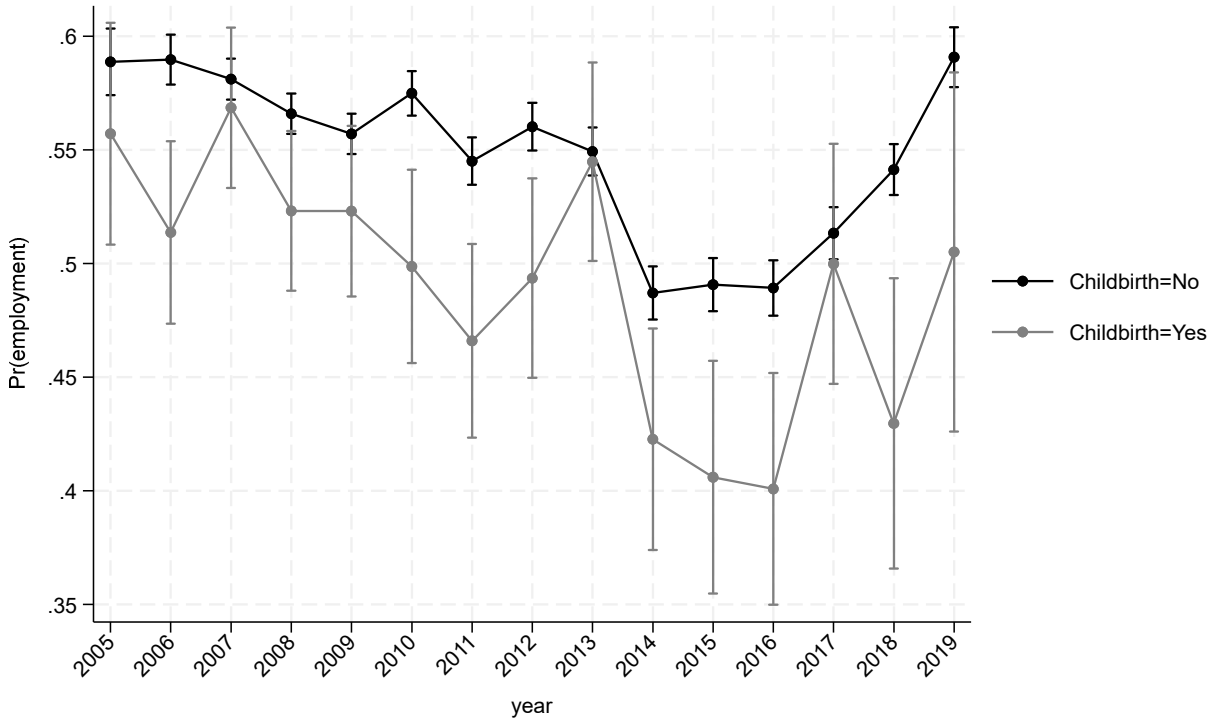
Table 2. Female employment and childbirth equation

	Employment equation			Childbirth equation		
	AME	s.e.		AME	s.e.	
Employment time t-1	0.123	0.006	***	0.003	0.002	*
Employment time 1	0.287	0.004	***	0.002	0.002	
Childbirth time t	-0.049	0.014	***			
Childbrirth time t-1	0.012	0.008		0.068	0.003	***
Childbirth time 1	0.015	0.011		-0.039	0.003	***
ρ_{eb}	-0.086	0.047				
Corr (μ, ε)	0.023	0.052				
Observations	79812					
Log-likelihood	-38515.36					

Source: Authors' elaborations on EU-SILC data

Note: We control for the set of covariates described in Section 3, including year dummies. *p < .10, **p < .05, ***p < .01.

Figure 2. Predicted probabilities of female employment by childbirth and year



Source: Authors' elaborations on EU-SILC data

Table 3 Employment working hours and childbirth equation

	Employment equation						Childbirth equation		
Outcome:	Part-time			Full-time					
	AME	s.e.		AME	s.e.		AME	s.e.	
Non-employment time t-1				base-category					
Part-time time t-1	0.004	0.001	***	0.073	0.005	***	0.000	0.002	
Full-time time t-1	0.006	0.001	***	0.125	0.007	***	0.005	0.002	**
Non-employment time 1				base-category					
Part-time time 1	0.089	0.004	***	0.253	0.008	***	0.003	0.002	
Full-time time 1	0.016	0.003	***	0.586	0.010	***	0.002	0.002	
Childbirth time t	-0.001	0.000	***	-0.043	0.012	***			
Childbirth time t-1	0.000	0.000		0.003	0.007		0.068	0.003	***
Childbirth time 1	0.000	0.000		0.013	0.010		-0.039	0.003	***
Peb	-0.090	0.038							
Corr (μ, ε)	0.033	0.042							
Observations	79812								
Log-likelihood	-61232.9								

Source: Authors' elaborations on EU-SILC data

Note: We control for the set of covariates described in Section 3, including year dummies. *$p < .10$, **$p < .05$, ***$p < .01$.

Table 4. Employment contract type and childbirth equation

	Employment equation						Childbirth equation		
Outcome:	Temporary contract			Permanent contract					
	AME	s.e.		AME	s.e.		AME	s.e.	
Non-employment time t-1				base-category					
Temporary contract time t-1	0.018	0.002	***	0.115	0.007	***	-0.003	0.002	*
Permanent contract time t-1	0.000	0.001		0.426	0.011	***	0.003	0.002	**
Non-employment time 1				base-category					
Temporary contract time 1	0.030	0.001	***	0.279	0.010	***	0.001	0.002	
Permanent contract time 1	0.030	0.001	***	0.290	0.010	***	0.004	0.001	***
Childbirth time t	-0.002	0.001	***	-0.034	0.013	***			
Childbirth time t-1	0.001	0.000	*	0.014	0.008	*	0.067	0.003	***
Childbirth time 1	0.000	0.001		0.006	0.010		-0.039	0.003	***
ρeb	-0.121	0.056							
Corr (μ, ε)	0.014	0.042							
Observations	71436								
Log-likelihood	-43807.07								

Source: Authors' elaborations on EU-SILC data

Note: We control for the set of covariates described in Section 3, including year dummies. *$p < .10$, **$p < .05$, ***$p < .01$.

Table 5. Employment wage distribution and childbirth equation

	Employment equation									Childbirth equation		
Outcome:	Low-pay			Medium-pay			High-pay					
	AME	s.e.		AME	s.e.		AME	s.e.		AME	s.e.	
Non-employment time t-1												
Low-pay time t-1	0.093	0.007	***	0.074	0.007	***	-0.024	0.004	***	0.001	0.003	
Medium-pay time t-1	-0.078	0.005	***	0.245	0.009	***	-0.012	0.004	***	0.007	0.003	**
High-pay time t-1	-0.087	0.007	***	0.096	0.011	***	0.120	0.008	***	0.005	0.005	
Non-employment time 1												
Low-pay time 1	0.181	0.008	***	0.187	0.008	***	0.021	0.004	***	0.001	0.003	
Medium-pay time 1	0.082	0.006	***	0.353	0.009	***	0.041	0.003	***	0.002	0.003	
High-pay time 1	0.059	0.012	***	0.258	0.014	***	0.136	0.008	***	-0.001	0.004	
Childbirth time t	-0.004	0.007		-0.048	0.008	***	0.010	0.004	***			
Childbirth time t-1	0.015	0.006	**	-0.007	0.007		0.010	0.004	***	0.112	0.003	***
Childbirth time 1	0.009	0.009		0.003	0.010		0.001	0.005		-0.067	0.003	***
ρeb	-0.399											
Corr (μ, ε)	0.147											
Observations	70396											
Log-likelihood	-50826.28											

Source: Authors' elaborations on EU-SILC data

Note: We control for the set of covariates described in Section 3, including year dummies. *$p < .10$, **$p < .05$, ***$p < .01$.

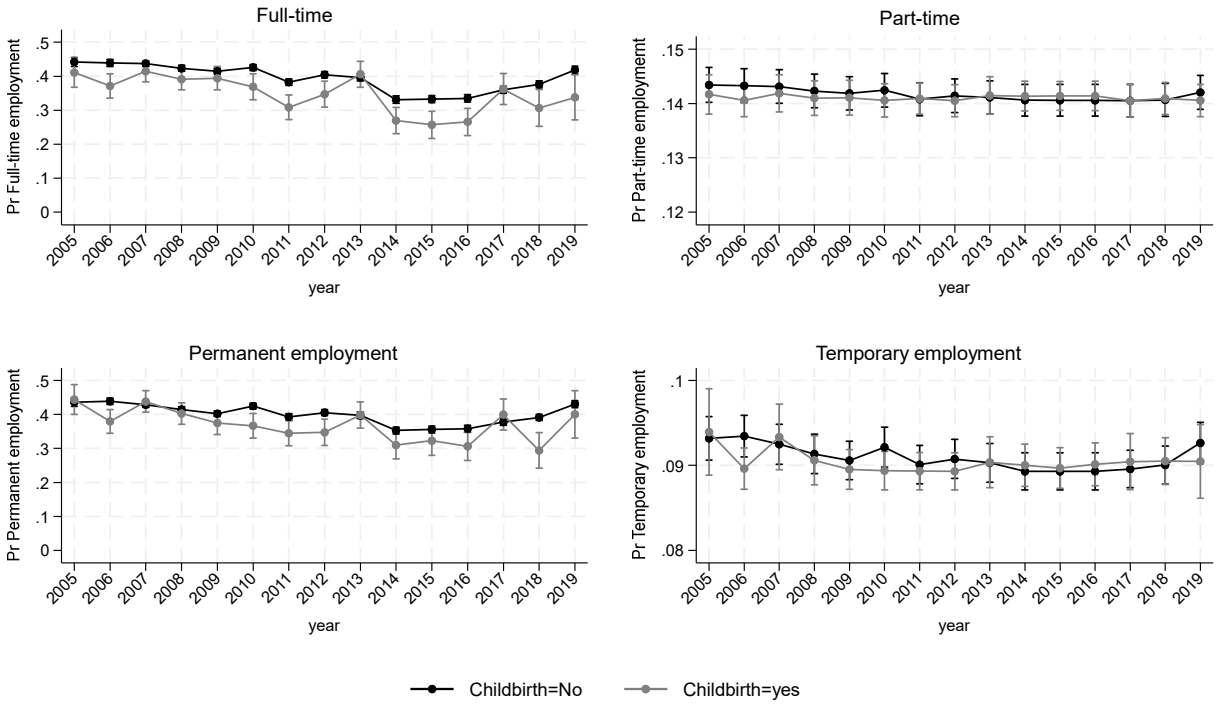
Table 6. Work intensity and childbirth equation

	Work intensity												Childbirth equation		
Outcome:	(0, 0.25]			(0.25, 0.5]			(0.5, 1)			1					
	AME	s.e.		AME	s.e.		AME	s.e.		AME	s.e.		AME	s.e.	
Work intensity t-1															
0							base-category								
(0, 0.25]	-0.007	0.002	***	-0.005	0.001	***	0.012	0.003	***	0.017	0.004	***	0.002	0.003	
(0.25-0.5]	-0.026	0.002	***	-0.029	0.001	***	0.041	0.003	***	0.068	0.004	***	0.001	0.002	
(0.5, 1)	-0.045	0.002	***	-0.075	0.003	***	0.065	0.004	***	0.140	0.005	***	0.004	0.003	
1	-0.070	0.003	***	-0.172	0.006	***	0.077	0.004	***	0.280	0.008	***	0.008	0.003	***
Work intensity time 1															
0							base-category								
(0, 0.25]	-0.021	0.003	***	0.003	0.002	*	0.040	0.005	***	0.030	0.004	***	-0.004	0.003	
(0.25-0.5]	-0.048	0.002	***	-0.023	0.002	***	0.087	0.004	***	0.083	0.003	***	-0.004	0.002	
(0.5, 1)	-0.078	0.003	***	-0.098	0.004	***	0.133	0.006	***	0.181	0.005	***	-0.005	0.003	*
1	-0.110	0.003	***	-0.277	0.007	***	0.134	0.005	***	0.421	0.008	***	0.000	0.003	
Childbirth time t	-0.004	0.003		-0.006	0.004		0.003	0.002		0.016	0.011				
Childbirth time t-1	0.006	0.002	***	0.010	0.003	***	-0.005	0.001	***	-0.025	0.006	***	0.067	0.003	***
Childbirth time 1	0.000	0.002		0.000	0.003		0.000	0.002		0.000	0.008		-0.039	0.003	***
ρeb	-0.042	0.044													
Corr (μ, ε)	0.010	0.032													
Observations															
Log-likelihood															

Source: Authors' elaborations on EU-SILC data

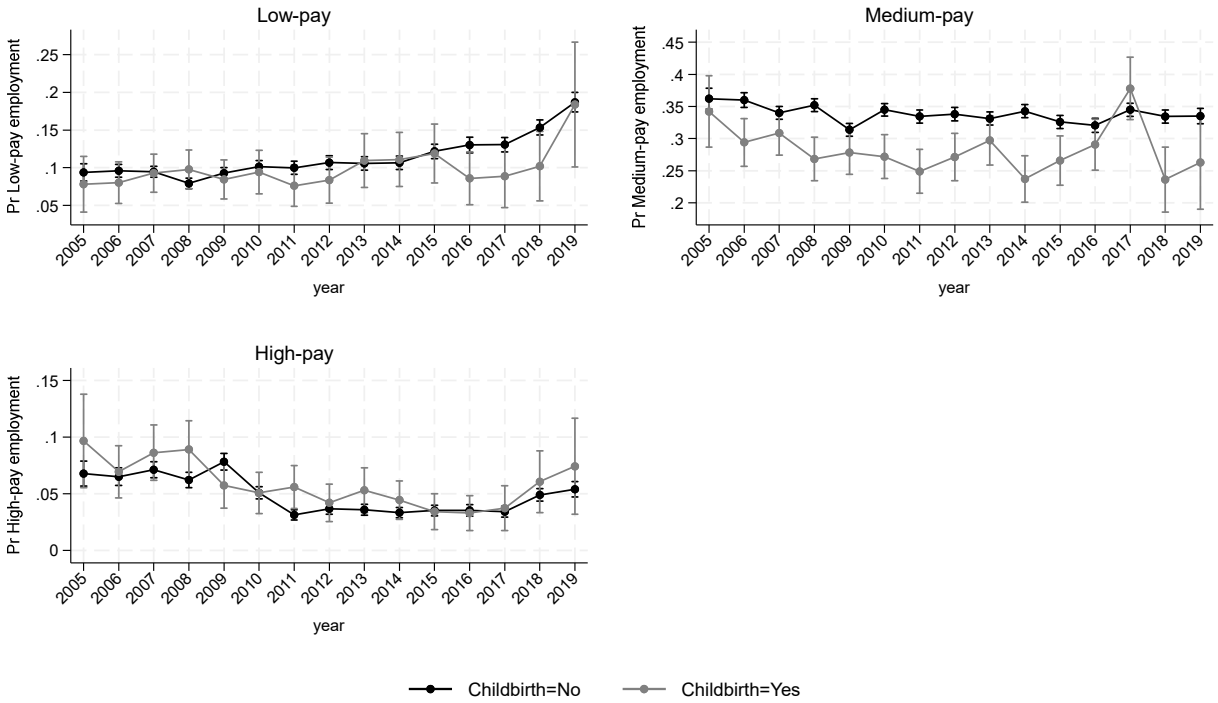
Note: We control for the set of covariates described in Section 3, including year dummies. *p < .10, **p < .05, ***p < .01.

Figure 3a. Predicted probabilities for employment working time (top panel) and contract type (bottom panel) by childbirth and year



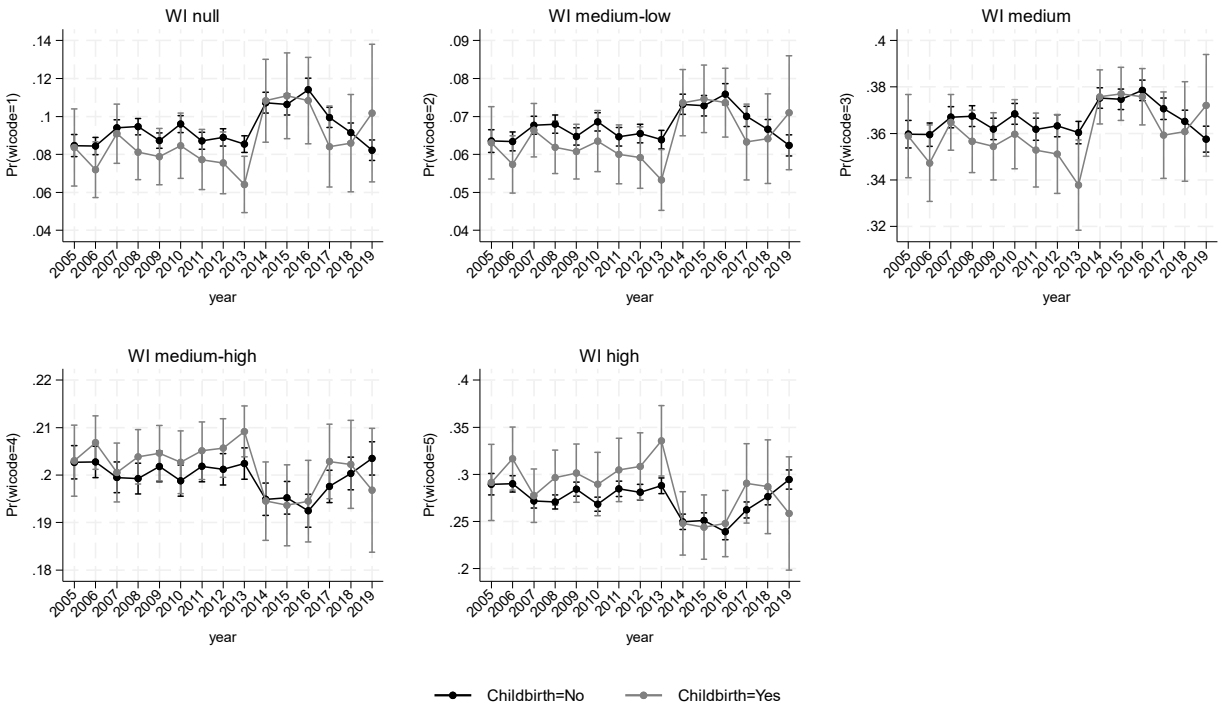
Source: Authors' elaborations on EU-SILC data

Figure 3b. Predicted probabilities for employment along the wage distribution by childbirth and year



Source: Authors' elaborations on EU-SILC data

Figure 4. Predicted probability for work intensity classes by childbirth and year



Source: Authors' elaborations on EU-SILC data

Appendix A

Ordinal outcomes

The case with ordinal outcomes may be represented assuming the latent employment propensity y_{it}^* taking the following form:

$$y_{it}^* = \gamma_1 y_{it-1} + \gamma_2 b_{it-1} + \gamma_3 b_{it-1} + \gamma_4 x_{it} + \gamma_5 z_i + g_i + \varepsilon_{it}. \quad (5)$$

Finally, the observed ordinal variable identifying the employment outcome reads as:

$$y_{it} = \begin{cases} 0 & \text{if } y_{it}^* \leq k_1, \\ 1 \text{ if } k_1 < y_{it}^* \leq k_2, \\ \\ n & \text{if } y_{it}^* > k_{n.}, \end{cases} \quad (6)$$

The outcome *y* assumes different specifications according to the employment dimension analyzed. In case of (working hours) employment, it is specified in three-digits which take values 0=non-employment, 1=part-time employment and 2=full-time employment. In the case of the contract-type dimension, it takes the following values: 0=non-employment, 1=temporary employment and 2=permanent employment. Finally, in the case of work intensity, the outcome digits are: y=0 if work intensity is null, y=1 if work intensity ∈ (0, 0.2], y=2 if work intensity ∈ (0.2, 0.5], y=3 if work intensity ∈ (0.5, 1), and y=4 in case of full work intensity.

Multinomial outcome

We model the observed (wage level) employment as the result of a utility maximization process, and assume the related outcome follows a multinomial distribution. We define the unobserved latent utility l_{ijt}^* associated with each labour market state *j* as follows:

$$l_{ijt}^* = \beta_{1j} l_{ijt-1} + \beta_2 b_{it-1} + \beta_3 x_{it} + \beta_4 z_i + g_i + v_{ijt}. \quad (7)$$

The connection between the latent and the observed labour market state can be derived by the assumption that the observed state has maximal propensity:

$$l_{it} = j \text{ if } l_{ijt}^* = \max_l(l_{ikt}^*) \qquad \text{for } j,k = 0,1,2,3; j \neq k; i = 1 \dots N; t = 2 \dots T \quad (8)$$

where $l_{ijt} = (l_{i0t}, l_{i1t}, l_{i2t}, l_{i3t})$ is a column vector that contains value j in correspondence to the labour market state employed by individuals at time t and zero otherwise.

This results in a four-digit variable, taking value 0 in case of non-employment, value 1 in case of low-pay, value 2 in case of medium-pay, and value 3 in case of high-pay. In this specific case, we assume error terms of both equations have now been drawn from a Type-1 extreme value distribution. This implies the model corresponds to a bivariate multinomial logit-logit specification.

Appendix B

Table B1. Female employment and childbirth equation with interaction term

	AME	s.e.	
Employment time t-1	0.121	0.006	***
Employment time 1	0.285	0.004	***
Childbirth time t	-0.005	0.016	
Childbirth time t x Employment time t-1	-0.081	0.009	***
Childbrirth time t-1	0.011	0.009	
Childbirth time 1	0.013	0.011	

Source: Authors' elaborations on EU-SILC data

Note: We control for the set of covariates described in Section 3, including year dummies. *$p < .10$, **$p < .05$, ***$p < .01$.

Table B2. Female employment and childbirth equation by age group

	Age less than 36						Age more than 35					
	Employment equation			Childbirth equation			Employment equation			Childbirth equation		
	AME	s.e.		AME	s.e.		AME	s.e.		AME	s.e.	
Employment time t-1	0.150	0.010	***	-0.001	0.004		0.140	0.008	***	0.005	0.002	**
Employment time 1	0.272	0.009	***	0.011	0.003	***	0.245	0.005	***	-0.003	0.002	
Childbirth time t	-0.056	0.029	*				-0.047	0.017	***			
Childbrirth time t-1	-0.003	0.015		0.079	0.005	***	0.023	0.011	**	0.061	0.004	***
Childbirth time 1	0.022	0.019		-0.048	0.005	***	0.008	0.012		-0.032	0.003	***
ρeb	0.001	0.072					-0.161	0.076				
Corr (μ, ε)	-0.007	0.085					0.053	0.071				
Observations	31433						48379					
Log-likelihood	-17675.71						-20202.20					

Source: Authors' elaborations on EU-SILC data

Note: We control for the set of covariates described in Section 3, including year dummies. *$p < .10$, **$p < .05$, ***$p < .01$.

Table B3. Female employment and childbirth equation by area of living

	North-Centre						South					
	Employment equation			Childbirth equation			Employment equation			Childbirth equation		
	AME	s.e.		AME	s.e.		AME	s.e.		AME	s.e.	
Employment time t-1	0.130	0.007	***	0.004	0.002		0.112	0.010	***	0.000	0.003	
Employment time 1	0.285	0.005	***	0.002	0.002		0.284	0.006	***	0.005	0.003	
Childbirth time t	-0.063	0.017	***				-0.015	0.026				
Childbrirth time t-1	0.021	0.010	**	0.068	0.004	***	-0.012	0.016		0.067	0.006	***
Childbirth time 1	0.009	0.013		-0.041	0.003	***	0.031	0.019		-0.033	0.005	***
ρ_{eb}	-0.145	0.056					0.083	0.090				
Corr (μ, ε)	0.058	0.062					-0.077	0.096				
Observations												
Log-likelihood	-26509.87						-11899.45					

Source: Authors' elaborations on EU-SILC data

Note: We control for the set of covariates described in Section 3, including year dummies. *p < .10, **p < .05, ***p < .01.

Table B4. Female employment and childbirth equation by household income condition

	Never poor						Ever Poor					
	Employment equation			Childbirth equation			Employment equation			Childbirth equation		
	AME	s.e.		AME	s.e.		AME	s.e.		AME	s.e.	
Employment time t-1	0.117	0.006	***	0.003	0.002		0.110	0.014	***	0.005	0.005	
Employment time 1	0.274	0.004	***	0.002	0.002		0.244	0.011	***	0.002	0.004	
Childbirth time t	-0.054	0.015	***				-0.001	0.036				
Childbrirth time t-1	0.016	0.009	*	0.071	0.004	***	-0.025	0.023		0.078	0.010	***
Childbirth time 1	0.013	0.012		-0.048	0.003	***	0.072	0.026	***	-0.032	0.006	***
ρ_{eb}	-0.098	0.056					-0.046	0.153				
Corr (μ, ε)	0.019	0.059					-0.061	0.142				
Observations	59976						13149					
Log-likelihood	-30407.23						-6042.74					

Source: Authors' elaborations on EU-SILC data

Note: We control for the set of covariates described in Section 3, including year dummies. *p < .10, **p < .05, ***p < .01.

Table B5. Female employment and childbirth equation by husband employment

	Husband ever employed						Husband never employed					
	Employment equation			Childbirth equation			Employment equation			Childbirth equation		
	AME	s.e.		AME	s.e.		AME	s.e.		AME	s.e.	
Employment time t-1	0.108	0.008	***	0.003	0.004		0.115	0.010	***	0.001	0.001	
Employment time 1	0.253	0.003	***	0.005	0.003	*	0.265	0.009	***	-0.001	0.001	
Childbirth time t	-0.057	0.013	***				-0.023	0.039				
Childbrirth time t-1	0.016	0.008	**	0.087	0.004	***	-0.001	0.025		0.016	0.002	***
Childbirth time 1	0.015	0.010		-0.051	0.004	***	0.072	0.032	**	-0.007	0.002	***
ρ_{eb}	-0.126	0.062					-0.207	0.103				
Corr (μ, ε)	0.058	0.066					0.036	0.096				
Observations	44771						22824					
Log-likelihood	-19900.867						-10093.158					

Source: Authors' elaborations on EU-SILC data

Note: We control for the set of covariates described in Section 3, including year dummies. *p < .10, **p < .05, ***p < .01.

Table B6. Female employment and childbirth equation: Covariates

	Employment equation			Childbirth equation		
	AME	s.e.		AME	s.e.	
Aged 18-24			base-category			
Aged 25-34	0.039	0.010	***	-0.009	0.004	*
Aged 35-44	0.046	0.011	***	-0.011	0.005	**
Aged 45-50	0.048	0.011	***	-0.018	0.005	***
Low education			base-category			
Medium education	0.072	0.005	***	0.005	0.002	**
High education	0.116	0.006	***	0.012	0.002	***
Married/Cohabitant	0.029	0.004	***	0.022	0.002	***
Householder	0.148	0.004	***	0.003	0.001	***
Kids aged 2-3	-0.014	0.010		-0.113	0.003	***
Kids aged 4-15	-0.005	0.008		-0.061	0.003	***
Number of HH members with disabilities	-0.028	0.005	***	-0.006	0.002	***
Presence of self-sufficient elderly	-0.036	0.007	***	0.000	0.003	
Home owner	-0.020	0.007	***	-0.004	0.002	*
Daughter	-0.079	0.005	***	0.002	0.002	
Husband employed	0.054	0.005	***	0.002	0.002	
Other employed in the household	0.120	0.005	***	-0.012	0.003	***
North-West	0.015	0.004	***	0.000	0.001	
North-East	0.022	0.004	***	0.003	0.001	**
Centre			base-category			
South-Islands	-0.062	0.004	***	-0.001	0.001	
Same sex children				-0.007	0.002	***

Source: Authors' elaborations on EU-SILC data

Note: We control for the set of covariates described in Section 3, including year dummies. *$p < .10$, **$p < .05$, ***$p < .01$.

Figure B1 Probability of childbirth by past employment status.