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Abstract

The literature on fertility in high-income countries indicates that employment has a more negative, or less positive, effect for women than for men, and that a country's egalitarian gender norms and family-friendly policies, and a woman's own higher-educational attainment, reduce these gender differences. We re-evaluate these findings for couples' first births in 24 countries in the 2004-2017 waves of the European Union's Statistics of Income and Living Conditions panel survey, incorporating predictor variables for annual employed hours up to three years before the year of exposure to first birth. We find a strongly positive female full-time employment effect that is pervasive across education and country-region groups. We find positive full-time employment effects for both women and their male partners, such that first-birth probabilities are highest when both are full-time employed, but that the magnitude of the full-time employment effect is greater for the woman. We attribute the novelty of our findings to the more recent period that we analyze, to the large set of countries that we include in our analysis, and to our observing women's employment lagged to at least one year before the year of exposure to conception and over either one or two full years' duration.

Keywords: fertility, female employment, European comparison, education, multiple imputation

Introduction

Female employment has been identified as a key factor for explaining fertility differentials between European countries, with countries with higher overall female employment levels tending now to have higher Total Fertility Rates (Engelhardt and Prskawetz 2004; OECD 2011; Luci-Greulich and Thévenon 2013, 2014; Oshio 2019). Mixed empirical findings are found, however, for the female employment–fertility association at the micro level in European countries. While there is substantial evidence of positive associations of male employment with fertility (Pailhe and Solaz 2012; Zhou and Kan 2019; Miettinen and Jalovaara 2020), the current literature provides few cases of positive association of female employment with fertility (Hofmann et al. 2017; Andersson et al. 2014), and many more cases of negative associations of female employment with fertility (Liefbroer and Corijn 1999; González and Jurado-Guerrero 2006; Schmitt 2012; Inanc 2015; Matysiak and Vignoli 2013).

On the theoretical side, the picture is ambiguous. The theory of employment effects on fertility is commonly placed in a framework of positive income effects and negative substitution effects (Becker 1960; Mincer 1958; Ayllón 2019). Egalitarian gender norms and strong family policies both are argued to reduce substitution effects (McDonald 2000, 2006; Neyer et al. 2013). This makes for an expected moderating effect of country or country group, towards a more positive (or less negative) female employment association with fertility in countries with egalitarian gender norms and strong family-policy regimes. The theoretical picture on the potential moderating effects of a woman's educational attainment is also ambiguous since education is expected to increase both women's income and substitution effects. European demographers have described women with high educational attainments as having much more to lose if they would begin childbearing without first being on a secure career trajectory, and

therefore more likely than lower-educated women to start a family only when stably employed (Kreyenfeld 2010; Barbieri et al 2015; Miettinen and Jalovaara 2020).

Empirical studies in Europe differ in their country and time coverage, but in most cases use data for single countries, where those data are now 10 to 15 or more years old. Meanwhile, both economic and social trends have continued in an almost uniform direction towards greater gender role equality in the workforce, albeit with substantial differences between countries in magnitudes of change. In the first decade of the new millennium, Knight and Brinton (2017) found declines in traditional gender employment and family attitudes in all 17 European countries of their study, while Kunze (2018) found that 14 out of 16 European countries experienced a narrowing of the gender wage gap.

Other factors of concern in the existing empirical literature are methodological. One is the extent to which studies sufficiently lag observation of women's employment relative to exposure to a birth and to exposure to a conception. Related to a tendency of studies to observe female employment relatively close in time to exposure to conception is a second concern, which is the challenge of small effective sample sizes in single-country studies or in studies with short periods of panel observation. Finally, studies have typically measured employment by a status at a point in time. This gives an incomplete picture especially of the duration and stability of the individual's employment. The characterizing of stability by whether the employment contract is 'temporary' or 'permanent' has proved a useful solution in several studies (de la Rica and Iza 2005; Lundström and Andersson 2012; Laß 2020), but is fraught with problems of data completeness and of conceptual comparability when conducting studies across different country contexts.

We are able to address all of the above challenges in the present study of first births in couples observed between 2004 and 2017 across 24 European countries. The woman's and her partner's employment statuses are operationalized as full-time, full-year employment versus all other employment statuses, where this employment is observed two full years before the exposure to conception-year. Our data are from the 2004-2017 waves of the European Union's Statistics of Income and Living Conditions (EU SILC) panel survey. The EU SILC panel design includes four years' duration for each household. Our observation plan to generate a sufficient lag in the employment variable requires sequences of three panel waves for each first-birth exposure predicted by at least one year of full-time, full-year employment, and requires four panel waves when predicting first births based on two years of full-time, full-year employment. We overcome the sample-size limitations implied by these observation constraints both by pooling data across countries and years with a country- and year-fixed effects statistical model, and by applying the method of multiple imputation for left-censored data (Rendall and Greulich 2016) to combine three-year sequences with four-year sequences of employment and first-birth exposure.

Our study's findings represent a major updating of the present state of knowledge about associations between employment and fertility in Europe. Unlike the overall tendency of existing studies towards findings of negative or zero associations of women's employment with fertility, with possible exceptions for highly-educated women and for women in countries with strong family-policy regimes, we find a strongly positive association of female full-time, full-year employment with first births that is pervasive across education and country-region groups. Moreover, we find that that the magnitude of women's positive association of full-time employment with first birth is greater than that for male partners' full-time employment.

This article is organized as follows: Section two gives an overview of the existing empirical literature, section 3 presents the data and our methods, section 4 shows the results and section 5 discusses and concludes.

Literature Review

We summarize findings by the country groups commonly used in the literature and that we will use in our empirical study. This follows the widely-recognized importance of country context for the female employment-fertility association (Engelhardt and Prskawetz, 2004; Da Rocha and Fuster, 2006; Myrskylä et al., 2011; Oshio, 2019).

Western Europe

Studies of the employment-fertility relationship in Germany generally find either negative or no associations of employment with entry to motherhood. Negative employment-first birth associations are found by Kreyenfeld (2010), using the German Socioeconomic Panel (SOEP) from 1984-2006; by Andersson, Kreyenfeld, and Mika (2014), using administrative data from 1981-2001; and by Özcan, Mayer, and Luedicke (2010), using the German Life History Study of the 1971 birth cohort in *East* Germany. No significant employment-first birth associations are found by Laß (2020), using the SOEP from 2001-2013; nor by Özcan et al (2010), using the German Life History Study of the 1971 birth cohort in *West* Germany. Two partial exceptions to the "negative or no association" finding for Germany are Kreyenfeld and Andersson's (2014) finding, using the SOEP from 1984 to 2010, of a positive employment association with first birth for women with the highest educational attainment, and Hofmann, Kreyenfeld, and Uhlendorff's (2017) finding, using 1978-2003 administrative data on

involuntary unemployment, of a positive relationship of female employment to probability of a first birth, though only under conditions of macroeconomic distress.

Schmitt's (2012) finding of a negative association of female employment with first birth in the U.K. in the ECHP between 1994 and 2000 is replicated in Inanc's (2015) study using the British Household Panel Survey (BHPS), extending the period analyzed from 1991 through 2009. Inanc's results are unique in finding a negative association of male employment with first birth. Comparing results from the period through 2009 with those from 2010-2017 in the BHPS's follow-on Household Longitudinal Study, and using a mixed employment-earnings predictor variable, Zhou and Kan (2019) found the usual positive association of the "male breadwinner" partnership role structure with fertility in the period through 2009 (relative to "dual earner"), but no association in the subsequent, 2010-2017 period, suggesting a change in climate away from traditional gender roles.

For France, Schmitt's (2012) finding of no significant association of employment with entry to motherhood is complemented by Meron and Widmer's (2002) finding, using data up to 1997, of offsetting associations of employment with fertility according to whether woman is not employed and out of the labor force (increasing the likelihood of giving birth) versus unemployed (decreasing the likelihood of giving birth), and by Pailhe and Solaz' (2012) finding from data through 2005 indicating no association between women's unemployment and first birth. Pailhe and Solaz (2012) find a positive effect of employment on first birth for men, whose unemployment reduces their first birth hazard. They also find a limited positive female employment-fertility relationship for higher-educated women, whose first birth hazard is greater when in stable, long-term employment than when in short-term employment. Kreyenfeld (2010) similarly finds a positive employment-fertility relationship in Germany that is, however, limited

to higher-educated women. For the Netherlands and Belgium, Liefbroer and Corijn (1999) find a negative association of women's employment with first birth among both Dutch women and women in the Flemish part of Belgium, using data from surveys with observations of fertility through 1990 or 1991. Using data for Dutch women and men through 2000, de Lange et al. (2014) find no association of employment with first birth for either women or men, nor do they find differences by women's educational attainment.

Southern Europe

We first note findings from two studies of Southern European countries that use the EU-SILC data as we do. Dantis and Rizzi (2020), using the EU-SILC 2005-2013 for Greece, found that having the man unemployed or inactive reduces the probability of first birth, whereas having the woman unemployed or inactive did not. Vignoli, Drefahl and De Santis (2012), using the EU-SILC 2004-2007 for Italy, also found a gender asymmetry in the employment association with first birth. The chance of having a child is higher for non-active women than for their employed counterparts, while the pattern for men is the opposite. However, they lacked the sample size to draw statistically significant conclusions. Both the Dantis and Rizzi and the Vignoli et al. studies used observations of women's employment immediately before the year of first birth exposure, allowing women to have potentially already been pregnant at the time of employment-status measurement. We consider this to be potentially a case of reverse causation from the conception to employment status.

Barbieri et al. (2015) studied the association of employment with entry to motherhood in Italy and Spain in years through 2005 or 2006 in two country-specific surveys, and lagged women's employment status by 12 months before the first birth exposure, again allowing at least

some women to have potentially already been pregnant at the time of employment-status measurement. Their findings similarly showed that the male partner's unemployment reduced the probability of first birth. For the woman's unemployment or inactivity, the probability of first birth is reduced in Italy for highly educated women, and in Spain it is reduced for both medium and highly educated women. Matysiak and Vignoli (2013) studied an earlier period in Italy, through 2003, and found a clearly negative association of female employment with first birth. Their observation of employment status was 7 months before the exposure to birth, asserting that from this point onwards women's awareness of being pregnant might affect their employment (implying reverse causation between employment and birth).

Northern Europe

In Norway, Kravdal (2002) finds no association between women's employment and first birth in the period 1992-98. In Finland, using administrative data for the period 1988 to 2009, Miettinen and Jalovaara (2020) finds an overall negative association between women's employment and first birth. However, they find that the direction of the employment-first birth association depends on her educational attainment. They found a negative association between employment and first birth for the least-educated women, but an increasingly positive association between employment and first birth the higher is the woman's educational attainment. Miettinen and Jalovaara's (2020) study also analyzed men's employment-fertility association, and found the direction to be positive. Andersson, Kreyenfeld, and Mika (2014) found that in Denmark 1981-2001, there was a positive association between female employment and first birth. A positive relationship of female employment to first birth in Denmark is also found in 1981-2001 by Kreyenfeld and Andersson (2014). Positive relationships of female employment to first birth

and male employment to first birth in Sweden are found in 1987-2004 by Lundström and Andersson (2012).

In addition to the above, single-country or two-country studies in specific country groups, two multi-country studies analyzed first births using the predecessor data source to the EU-SILC of our empirical study, the 1994-2000 European Community Household Panel (ECHP). The ECHP is important for both its cross-country harmonization and its panel design, allowing for a joint accounting for the woman's and her male partner's employment. González and Jurado-Guerrero (2006) pooled data from Germany, France, Italy, and Spain, and found a lower first-birth probability when she and her male partner are both employed ("dual-earner") relative to when only he is employed ("male breadwinner"), and a still lower first-birth probability when she was employed and her male partner was not. Schmitt's (2012) three-country study of the ECHP found negative associations of women's employment with first birth for both Germany and the United Kingdom, but no significant association for France. Male unemployment had no significant effects on the propensity to start a family in any of the three countries.

In summary, for Western Europe, there is a general pattern of negative or no associations between female employment and first birth, but also some limited evidence of a positive female employment-first birth association under certain conditions ---- for employed versus unemployed women in France (but a negative effect for employed versus inactive women), for highly-educated women in Germany, and for German women experiencing layoffs relative to retaining their jobs during a period of economic distress. For Southern Europe, the female employment-first birth relationship was also largely found to be either negative or zero. Exceptions were found of a positive female employment-first birth relationship among highly-educated women in Italy and Spain. Men's employment-first birth relationship was typically positive in both sets of

countries. In González and Jurado-Guerrero's (2006) estimates from couples at risk of first birth, pooled across Germany, France, Italy, and Spain in the EU-SILC's predecessor ECHP, their results pointed strongly to a negative female employment and positive male employment associations with first birth; the "male breadwinner" configuration, of his being employed while she was not employed, was associated with the highest first-birth probability across couple employment configurations. For Northern European countries, findings include an overall positive female employment-first birth relationship in Denmark and Sweden, no relationship in Norway, and of an overall negative female employment-first birth relationship, tempered by a somewhat positive relationship among highly-educated women, in Finland. Finally, for the only study of employment and first births that we know of specifically for the Central and Eastern European countries, Matysiak and Vignoli (2013) find no association between women's employment and first birth in Poland.

Methodological Issues: Timing of observation of women's employment and weaknesses of single-country studies; measuring employment at a point in time

There is considerable variation in the above studies in their lagging of observation of employment relative to exposure to birth, or of exposure to the conception of that birth. While it is sometimes difficult to ascertain what is the lag used in the studies, at least some of the studies appear to measure employment status in the year before the birth (González and Jurado-Guerrero 2006; Vignoli, et al. 2012; Barbieri et al. 2015; Dantis and Rizzi 2020; Miettinen and Jalovaara 2020). This implies a potentially shorter than nine-month period between observation of the pre-birth employment status and the birth, and therefore that some of the women will already be pregnant at the time of employment measurement. This raises a potential endogeneity bias whereby withdrawal from employment or reduction in hours can result from a conception. In

other cases, employment status may be observed immediately before the conception, when childbearing plans have already been made. In this latter case, we suggest that an endogeneity bias may occur when a couple's planning to have a child soon can result in decisions that prioritize the man's over the woman's full-time employment, as noted by Kravdal (2002). The 'tied mover' scenario, in which the couple moves for the man's job, is one such decision the couple might make that negatively affects the woman's employment (Boyle et al 2001). We show below in our descriptive results (Figure 1) that in almost all countries, the full-time employment rates of the male partner exceed those of the female partner among couples without having yet started families. This suggests that the prioritizing of the man's employment in the couple may often begin before a first birth or conception leading to that birth.

Another methodological issue arises from that fact that most of the studies on the relationship between employment and first birth, or any birth, use single-country data sources. Consequently they may lack statistical power to detect even substantial employment-fertility associations. For example, both de Lange et al.'s (2014) analysis of the Netherlands and Vignoli et al.'s (2012) analysis of Italy report statistically non-significant hazards of first birth for unemployed men that are half the estimated level of the hazard of first birth for employed men. Moreover, a weakness of relying on single-country data sources is that for many European countries, there exist no empirical studies of the relationship between employment and the transition to parenthood. For example, despite there being at least 10 Central and Eastern European countries of the former Soviet bloc that have been part of the European Union for between 15 and 30 years, we are able to find studies of only one country, Poland (Matysiak and Vignoli 2013). Those countries for which there are single-country analyses of the employment-fertility relationship tend to be the countries with greater strength of their demographic

disciplines (notably France, Italy, Germany, the Netherlands, Spain, the United Kingdom, and the Nordic countries), which results in the employment-fertility relationship in much of Europe going unexamined.

It is frequently supposed that not just being employed, but rather having stable, long-term employment is important for childbearing decisions. Studies differ, however, in their measurement of employment stability. González and Jurado-Guerrero (2006) find that for all women (independent of partner status), longer employment duration is associated with a higher first birth probability. A point-in-time proxy for employment duration or stability that has been used in several studies is whether a woman's employment is on a permanent or temporary contract. The typical finding is that temporary contracts reduce the likelihood of having a birth (de la Rica and Iza 2005; Lundström and Andersson 2012; Laß 2020; Alderotti et al. 2021). A problem for cross-national analysis is that contracts have different meanings across different countries, and may not be measured in the same way, or at all, across different countries. Such differences may account, for example, for the greater strength of effect of contract type in Southern European countries (de la Rica and Iza, 2005; Gutiérrez-Domènech M. 2008; Barbieri et al 2015; Vignoli, Tocchioni, Mattei 2020; Dantis and Rizzi 2020) relative to in Western European or Nordic countries (Kreyenfeld 2010; Sutela 2012; Laß 2020).

Data and Methods

We use 14 years of panel data from the European Union's Statistics of Income and Living conditions (EU-SILC, Eurostat 2012). The EU-SILC is a harmonized socio-economic survey covering the large majority of European countries. The survey captures individual and household situations by providing a set of economic and social variables that may be considered

as determinants for fertility decisions. Household members can be merged to each other, which allows for observation of a woman's partner's characteristics and of her children, including newborns. Our sample covers 24 European countries[1]. More details on included and excluded countries are provided in the Data Appendix. For about half of the countries, the panel starts in 2004, for the other half in 2005 (with the exception of Switzerland which starts in 2011 only). Countries excluded from our study are Germany, because it does not release its panel data due to data confidentiality reasons, Norway, Iceland, and Luxembourg due to coding-harmonization problems, and Romania, Bulgaria, Croatia and Slovakia because of biases in their period fertility measurement (see Greulich and Dasré 2017). France and Portugal follow households for more than four annual waves, but we only use the first four waves in order to obtain a harmonized panel data set in which each country is subject to the same period of exposure to attrition biases.

We limit our main analyses to women aged 18 to 39 and who are partnered (either married or cohabiting) and childless in the year before the year of (first-)birth exposure. The upper age restriction is needed so that we may reasonably approximate a woman being of parity 0 from a household variable of her having no co-resident children. We additionally restrict our analyses to women who continue to live with a male partner through the end of their birth-exposure observed period in order to reduce fertility-linked attrition bias.

Details of our coding of the annual first-birth outcome and the employment predictor are described in the Data Appendix. In outline form, in our main models first-birth exposure occurs

[1] Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Lithuania, Latvia, Malta, Netherlands, Poland, Portugal, Serbia, Spain, Switzerland, Sweden, Slovenia, United Kingdom.

in Wave 3 or Wave 4, and employment observation occurs in Wave 1 ("year *t-2*") for first-birth exposures in Wave 3 and in Waves 1 and 2 ("year *t-3*" and "year *t-2*") for first-birth exposures in Wave 4. Employment is defined over a 12-month period as full-time, full-year. For our models that predict first births from two years of employment (*t-3* and *t-2*), we follow Rendall and Greulich (2016) in using multiple imputation for left-censored data to retain the same sample sizes as for our models predicting first births from only one year of employment (*t-2*). This means that for observation sequences of only three waves, the woman's prior year's employment is imputed from observed sequences of four waves. All standard errors for those models use standard algorithms for incorporating imputation uncertainty.

Even when using multiple imputation for left-censored data, our observation plan nevertheless requires a minimum of three consecutive years of panel observation for each first-birth exposure. This limits our 24-country 2004-2017 EU-SILC dataset to 12,060 years of first-birth exposure. We show that in an alternative observation plan in which full-time employment status is observed at the wave ("wave t") that begins the birth exposure year, as many as 28,410 years of first-birth exposure can be studied. However, we also show that the resulting endogeneity bias from that alternative observation plan is severe, reducing the female employment association with first birth from strongly positive to instead close to zero. We suggest in our Discussion section that this type of endogeneity bias at least partially explains differences between our study's findings and those in the current literature.

The underlying unobserved propensity for woman *i* in country *j* to have a first birth (*B*) is modelled as a function of the woman's and her partner's employment status (E^f, E^m), as (0,1) variables for full-time, full-year employed or not, plus a set of individual covariates (X^f_{ij}) for the

woman. Specifying C_j as a country dummy and T as a year dummy, this allows us to apply a binary logit model with country and time fixed effects:

$$B_{ij} = \alpha + \beta_1 * E^f_{ij} + \beta_2 * E^m_{ij} + \beta_3 * X^f_{ij} + C_j + T + \varepsilon_{ij}$$

$$\sim Logistic(0,1)$$

Covariates for the woman are age, marital status and education, as observed in the wave that marks the beginning of birth exposure. Age is included in cubic polynomial form and operationalized as 'age-18'. Education is divided into three levels: low (pre-primary, primary, lower secondary), medium (upper-secondary, post-secondary non tertiary) and high (tertiary). Sample weights are used for the descriptive statistics, but not for the regression analysis. Women with missing and zero sample weights are dropped from the sample.

We additionally estimated the above logistic equation separately for samples of women in each of the three education groups (high, medium, and low), and for samples of women in each of four country groups, Western, Eastern, Southern and Northern Europe. Northern European countries are typically considered to represent the ideal of employment-family compatibility more strongly than other countries, and Western European countries are considered to offer more employment-family compatible environments than Eastern and Southern European countries (Esping Andersen 1999; Thévenon 2013).

Results

Descriptives

Table 1 gives an overview of the variables used in our empirical analysis. These statistics are for women meeting the inclusion criteria of our main models, being women who have been partnered at least three years and who have been childless for at least two years after becoming partnered. The employment statuses of men and women in couples are seen to reflect the gendered character of employment in Europe that continues to favor men even before having a child. Of partnered women aged 18 to 39 whose employment status is observed for at least one 12-month period two years before the year of first-birth exposure (one year before the year of potential conception), 65% were full-time, full-year employed, 14 percentage-points lower than the 79% of their partners who were full-time, full-year employed. At the level of the couple, 56% of couples had both the woman and the man full-time, full-year employed. For as many as 24% of couples, only the male partner was full-time, full-year employed, compared with 9% in which only the woman was full-time, full-year employed. In 11% of couples, neither the woman nor the man was full-time, full-year employed. Of partnered women aged 18 to 39 whose employment status is observed for two 12-month periods before the year of first-birth exposure, 56% were full-time, full-year employed in both years, and 28% were not full-time, full-year employed in either year. Of the remainder, 9% attained full-time, full-year employment in only the second of the two years preceding the year of potential conception, and 6% exited full-time, full-year employment in the second of the two years. Of the control variables, which are observed in the wave that begins first-birth exposure, we see that a slight majority are married (58%, versus 42% non-maritally cohabiting). Women's median age is 31. Educational attainment is a substantively important variable for our analyses. We see that half (51%) of partnered women had a "high"

(tertiary) level of educational attainment, 38% had a medium level, and only 11% had a low level of educational attainment.

Table 1 and Figure 1 about here

Figure 1 illustrates the percentages of women and their partners full-time employed in the 12-month period two years before the year of first-birth exposure (left panel) as well as the relative gender gap (right panel) for each country in our sample. Consistently across European countries, there is a larger proportion of partnered men than partnered women who are full-time employed, noting again that this is before having children and before having a pregnancy ending in a first birth. Male employment patterns are relatively similar across Europe (generally over 70% full-time, full-year employed, with exceptions in the Netherlands, Serbia, Finland and Sweden), but female employment differs widely. The proportion of partnered women who are full-time, full-year employed before the year of potential conception is above 70% in the UK, the Czech Republic, Lithuania, Malta and Hungary, and below 50% in the Netherlands and Serbia. The relative gender difference is below 10% in Ireland, Lithuania, Latvia, the Czech Republic and Finland, and above 20% in Italy, Greece, Switzerland, the Netherlands, and Serbia. Overall, the gender difference is, with some exceptions, relatively low in Eastern Europe and relatively high in Southern Europe. The gap is also relatively high in Western Europe, with the notable exception of Ireland.

By specification of observed female and male employment

Table 2 shows our main regression results of first-birth probabilities by female and male full-time, full-year employment observed two years before the year of first-birth exposure, alternately specifying independent female and male-partner full-time employment effects (Model 1), and specifying joint configurations of the woman's and her male partner's full-time employment (Model 2). In a third specification (Model 3), we observe the woman's and her male partner's employment status immediately before the period of exposure to first birth. The purpose here is to investigate the dependence of the estimated woman's full-time employment association with first-birth propensity on the timing of observation of her employment status. All regressions include controls for marital status (married versus cohabiting) and age, and include both year and country fixed effects.

Table 2 about here

Our main objectives for the regression analyses presented in Table 2 are to see whether the association between female full-time employment and first birth is positive, and whether the association between female full-time employment and first birth is different from the one between male full-time employment and fertility. In our main models throughout the paper, employment is measured over an entire 12-month period, and therefore it is more accurately described as "full-year, full-time employment", but we abbreviate it to "full-time employment" throughout. Our first main finding is that female and male full-time employment, measured over a 12-month period two years before exposure to first birth, are each independently positively associated with the birth of a first child (Model 1). The magnitude of the estimated coefficient

for female employment is high (0.323) and statistically significant at the $p < .001$ level. The estimated coefficient for the male partner's full-time employment is only about one third as high (0.126) and is statistically significant only at the $p < .10$ level.

Model 2 specifies the woman's and her partner's full-time employment as a joint configuration. This allows us to statistically test directly whether, within a couple, the woman's or the male partner's full-time employment has a stronger association with first birth. We find that, compared to both being full-time employed, each of the two configurations in which the woman is not full-time employed (male-partner-only full-time employed and neither full-time employed) are associated with a lower first-birth probability. The difference between both being full-time employed and only the woman full-time employed, on the other hand, is smaller and not statistically significant. In results not shown, the coefficient for only the woman being full-time employed is significantly different from only the man being full-time employed ($p=0.029$).

Figure 2 about here

Figure 2 illustrates the different probabilities of first birth for the four possible employment combinations of couples (predicted by Model 2, margins at means). The configuration which has the highest predicted first birth probability (0.186) is 'both partners full-time employed', whereas 'neither full-time employed' has the lowest first-birth probability (0.127). The configurations of 'only the woman full-time employed' (0.172) and 'only the male partner full-time employed' (0.145) both have statistically higher predicted first birth probabilities than the 'neither full-time employed'. The first-birth probability for 'male partner only full-time employed' is statistically-significantly lower than the probability for 'only the

woman is full-time employed' and the probability for 'both are full-time employed.' That is, the traditional, 'male breadwinner' configuration ranks third after both of the configurations that include the woman in full-time employment, and above only the configuration in which neither is full-time employed.

Finally, the regression results of Model 3 in Table 2 show that when employment statuses are measured immediately prior to first-birth exposure, the results are consistent with the existing literature on associations between female and male employment and first birth: The woman's full-time employment has no significant association (coefficient of 0.034 $p > 0.10$), whereas the first-birth association of her male partner's full-time employment is strongly positive (0.299, $p < .001$). These female and male coefficients notably exhibit a reversal compared to the female and male coefficients of Model 1, in which employment is observed two years before the first-birth exposure period; in that specification, only the woman's coefficient is strongly positive (0.322, $p < .001$). We attribute this reversal to endogeneity of women's, but not men's, employment with the birth in our Model 3 specification.

By education

Analyses by three women's education groups are shown in Table 3 and Figure 3. Model 4 is based on the full sample with controls for female education, while Models 5, 6 and 7 are based on sub-samples for low-educated, medium-educated and high-educated women. As we noted above, theoretical and empirical treatments of differences in first births by education in Europe have emphasized the greater importance of a attaining a stable employment trajectory in the first-birth decision-making of more highly-educated women. We operationalize this trajectory here with analyses of full-time, full-year employment over one year or two years' duration before the

year of potential conception leading to a first birth. In Model 4, that pools women across all education groups and includes education as a series of dummy variables, we find two categories of women who have significantly lower first-birth probabilities than women who are full-time employed in both years (the reference category): woman who are not full-time employed in either of the two years *t-3* and *t-2*, and women who are full-time employed only in the earlier of the two years (*t-3*) ---- that is, who exited full-time, full-year employment in the second of the two years. As shown in Figure 3(a), the predicted first birth probability (evaluated at the means of other covariates) is highest for women employed full-time, full-year in both of the two years and lowest for women who are full-time, full-year employed in neither of the two years, and is the second-lowest for women who have just lost their full-time, full-year employment. In this pooled model, educational attainment is positively associated with first birth, with the highest-educated women (tertiary education) having the highest probability of having a first child, consistent with the findings of previous European studies (e.g., d'Albis et al. 2017). When evaluated at the means of other covariates, highly-educated women full-time, full-year employed in both years *t-3* and *t-2* have an annual first-birth probability of 0.202, compared with 0.174 for medium-educated and 0.170 for low-educated women (Figures 3(d), (c), and (b) respectively).

Table 3 and Figure 3 about here

Our results from the three separate regressions for low, medium, and high-educated women, shown in Models 5, 6 and 7 and Figures 3(b), (c), and (d), show that education does not, in general, moderate the relationship between employment and first birth. For all education groups, women who are not full-time employed in either year have a significantly lower

probability of first childbirth relative to women who are full-time employed in both years. Highly educated women have, independent of their employment status, a higher probability of first birth in comparison to lower educated women. The difference between women full-time employed in neither year and women who are full-time employed in both years is the most striking for low-educated women. Their first-birth probability for full-time employed in neither year, at 0.093, is only just over half that for high-educated women not full-time employed in either year (0.165). Medium-educated women are in-between at a 0.130 first-birth probability.

Overall, these results show that the positive female employment association with fertility is not limited to higher educated women, but instead holds for all education groups. Note that in all Models of Table 4, we control for partner employment status (observed in the more recent of the two years only). This implies that independent of the partner's employment, woman's stable pre-birth full-time employment is a strong predictor of first childbirth across all education levels.

By geographic region

We estimate four separate regressions by country group. A country-by-country analysis is not feasible due to sample size limitations. There is, of course, a great variety of within-group heterogeneity concerning the contextual and normative setting, but we abstain from considering them here. The purpose of our analysis in this section is simply to see whether the associations between female and male-partner employment and first childbirth are broadly the same for the four country groups, or whether there are instead striking differences. To do this, we limit the full-time employment predictor variable to that in the year prior to exposure to conception ($year_{t-1}$) in a specification that is identical to that for Model 2 in Table 2, except for the addition here of women's education as a control variable.

Table 4 about here

Table 4's regression coefficient estimates show more similarities than differences between the four country groups.[2] Generally, the configuration of both the woman and her male partner full-time employed is the most favorable to first births and the configuration of neither full-time employed is the least favorable to first births. The contrast between 'both' and 'neither' full-time employed is statistically significant for each of the four country groups. Strong evidence for the positive effect of women's full-time employment on first birth is seen in the statistically-significant contrasts between 'both full-time employed' and 'male partner only full-time employed' for the Western, Eastern, and Southern European country groups. That is, first birth probabilities are reduced in the "male breadwinner" configuration of only the male partner being full-time employed relative to the configuration of also having the woman be full-time employed. In one country-region, Southern Europe, the first-birth probability of the 'woman only full-time employed' statistically exceeds that of the first-birth probability for the 'male partner only full-time employed' ($p=0.003$, not shown), whereas for no country-region is the reverse true. Finally, in one country-region, Western Europe, the first-birth probability is reduced when either the woman or her male partner is not full-time employed, relative to 'both full-time employed'.

[2] A regression with interactions between country groups and employment configurations yielded only non-significant coefficients for the interaction terms (results available on request).

Discussion

The existing literature on fertility in Europe indicates that employment has a more negative, or less positive, effect for women than for men, but that a country's egalitarian gender norms and family-friendly policies, and a woman's own higher-educational attainment, may reduce these gender differences. Our study's findings, using harmonized EU-SILC panel data across 24 countries to analyze first births in couples, largely contradict these conclusions. First, we find a strongly positive association of full-time, full-year employment of women on the annual hazard of first birth, controlling for partner's full-time, full-year employment. Second, we find this positive association to be both general across European country groups and general across women's educational attainments. Third, although we find that there is evidence for a positive association of men's employment with first birth, it is weaker than the association we find with women's employment. By country group, in Southern, Western, and Eastern European countries, first-birth probabilities are higher when both the woman and her partner were full-time employed, relative to when only her male partner was full-time employed. Only for the Western-Europe country group, however, do we also find that the first-birth association for the male partner's full-time employment is higher when both are full-time employed than when only the *woman* is full-time employed. When the magnitudes of estimated associations between the woman's and her male partner's full-time, full-year employment and first birth are statistically compared, we find that both overall, and for the Southern-Europe country group, the association for the woman's employment is greater than that for the man's employment. That is, proceeding to a first birth depends more on the woman's securing stable full-time employment than it does on the man's securing stable full-time employment.

The previous study that may be considered closest to ours is that of González and Jurado-Guerrero (2006), who pooled data from couples at risk of first birth in Germany, France, Italy, and Spain in the EU-SILC's predecessor ECHP. They found results that pointed strongly to negative female-employment and positive male-employment associations with first birth; the "male breadwinner" configuration of the man employed and the woman not employed was associated with the highest first-birth probability across couple employment configurations. We found instead that this configuration ranked third in magnitude, behind both of the configurations that included the woman employed (respectively, the both-employed and the only-woman-employed configurations). Two noteworthy differences between our study and their's are the periods covered, 2004-2017 versus 1994-2000, and their observation of employment one year before the first-birth exposure versus our observation of employment two years before the first-birth exposure. The only specification in our study that came close to replicating González and Jurado-Guerrero's (2006) overall finding (and that of much of the existing literature) of a negative or zero female-employment and a strongly positive male-employment association was when we observed employment immediately before the period of first-birth exposure. We attributed this finding to endogeneity of employment with first birth for women but not for men.

Our results are especially remarkable for their contrasts with the previous literature on the country-region often considered to have the lowest employment-family compatibility for women, Southern Europe. For that country group, we found not only that the first-birth probabilities of both couple configurations in which the woman was not full-time employed were lower than when both the woman and her male partner were full-time employed. Additionally, the first-birth probability of the 'woman-only full-time employed' was above the first-birth probability for 'male-partner-only full-time employed' (this result was seen to hold also when pooling over all

country-regions). This finding contrasts, in particular, with previous findings from at least five studies of Southern European countries, all of which pointed to a continuing predominance of the man's over the woman's employment circumstances (Dantis and Rizzi 2020; González and Jurado-Guerrero 2006; Vignoli, Drefahl, and De Santis 2012; Matysiak and Vignoli 2013; Barbieri et al. 2015).

We suggest that the discrepancies between our findings and the findings of previous studies are attributable to three factors: the more recent period of our study; the longer lag between our observation of woman's employment status and exposure to first birth; and our having defined employment as full-time, full-year for at least one year's duration. A fourth potential factor is the selectivity of our couple sample relative to that of other studies. In our case, we selected only couples for whom a first birth had not occurred before at least their second year of living together as a couple, and therefore we do not claim generalizability of our findings to all couples.

Regarding the longer lag, we observed a woman's employment approximately two years before observing her first-birth exposure, thereby ensuring that in no case will a conception leading to a first birth have occurred during the year of employment observation. In previous studies this is typically not guaranteed, as their lags between employment and first-birth exposure are shorter. We suggest that reverse causality running from the conception, or even from plans to conceive soon, to the woman's employment cannot be ruled out as a factor contributing to previous estimates of no association or a negative association of female employment with first-birth propensities. The shorter lags of other studies may have been especially important in their having estimated stronger positive associations of male than female employment with first-birth propensities, as we showed empirically in our alternative

specification in which employment status was observed in the quarter immediately before the period of first-birth exposure. This affirmed that only for the woman is there likely to be any endogeneity between employment and the conception or birth. Other researchers have suggested that women's employment behavior may be impacted by their plans to conceive (e.g., Kravdal 2002), and there is already strong evidence that women's labor supply decisions are made in anticipation of other family-demographic events (e.g., Özcan and Breen 2012). Further work is suggested to better understand this possibility in the case of women's and couples' decisions to start a family.

On the length of the period over which employment is observed, we found that a woman's full-time employment, either in both of the two years before the year of conception or in only the more recent of these two years, was positively and statistically significantly associated with the hazard of first birth. In previous studies, of Barbieri et al. (2015) for Italy and Spain, of Kreyenfeld (2010) for Germany, and of Miettinen and Jalovaara (2020) for Finland, the authors argued that higher-educated women may be exceptions to the overall negative or zero employment association with first birth, as they have more to lose if they would begin childbearing without first attaining a secure career trajectory. We evaluated the importance of attaining of stable employment trajectory across education groups by estimating models that predicted first birth from two consecutive years of observation of full-time, full-year employment, where the later of these two years was again a year before the year of potential conception, and two years before the year of exposure to first birth. We were able to estimate this model separately for high-, medium-, and low-educated women without loss of sample size by applying the method of multiple imputation for left-censored data, which Rendall and Greulich (2016) previously demonstrated can be used to combine three-year sequences with four-year

sequences of employment and first-birth exposure in the EU-SILC. We found in the present study that, across all three education groups, the woman's having been full-time employed for two full years was associated with the highest first-birth probability, followed by her having been full-time employed only the most recent year (in the year before the year of potential conception). Having not been full-time employed in either of those two years was associated with the lowest first-birth probability, and having just exited full-time employment the next lowest. Not only did the positive association of full-time, full-year employment with first birth hold for all education groups; we also found that the magnitude of contrast between being full-time employed in both years versus in neither year was greatest for low-education women.

We consider it important too that previous studies are almost all of periods earlier than those covered by our study. We noted that both a narrowing of the gender pay gap (Kunze 2018) and an ongoing movement of social attitudes away from traditional gender roles (Knight and Brinton 2017) have continued across European countries during the 2000s. We would expect these trends to have moved the employment-fertility association in a direction away from that of a "male breadwinner" model. We therefore consider our study's results to represent an important substantive update of the picture of women's employment-fertility associations extending into the second decade of the new millennium. Knight and Brinton (2017) describe a multiplicity of paths away from traditional gender role attitudes found across European countries. Goldscheider et al. (2015) similarly describe varieties of ways in which, across high-income countries, there have been ongoing evolutions towards greater gender equality in employment and family roles. They highlight, however, that advances in gender equality in employment have been coupled with slower evolution towards gender equality in family roles. This observation may also be viewed as consistent with the results of the present study. Our findings are not that a woman's

achieving stable full-time employment is as important for a couple to start a family as the man's achieving stable full-time employment, but rather that the woman's achieving stable full-time employment is more important. Given the socioeconomic context of ongoing assumptions of a greater family role for women especially immediately following the birth, and also more generally for subsequent childrearing and household responsibilities, one may conjecture that it may be even more important for the woman than for the man to secure a stable employment trajectory before first birth, a trajectory that can then be maintained into the childrearing phase of the life course.

Another factor interacting with gender role attitudinal change may be increasing economic uncertainty and increasing male unemployment in Europe. Zhou and Kan (2019), citing the role of the late 2000s economic recession, suggest that increasing economic uncertainty can lead to an egalitarian family model's overcoming a traditional one in promoting fertility, as economic uncertainty increases the importance of women's economic resources. In this context, we note also Hoffman et al's (2017) finding of a positive female employment effect in Germany that was limited to periods of economic distress. We view this type of explanation also as compatible with, and complementary to, Knight and Brinton's (2017) "flexible egalitarianism" attitudinal group, in which views of men's and women's employment and family roles are adaptive to economic circumstances rather than ideologically committed to a single model of gender roles.

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Tables

Table 1: Descriptive statistics

	Proportion (weighted)
Woman full-time employed in $year_{t-2}$	0.65
Male partner full-time employed in $year_{t-2}$	0.79
Only male partner full-time employed in $year_{t-2}$	0.24
Only woman full-time employed in $year_{t-2}$	0.09
Both full-time employed in $year_{t-2}$	0.56
Both not full-time employed in $year_{t-2}$	0.11
Woman full-time employed in $year_{t-3}$	0.62
Woman full-time employed in $year_{t-2}$ and $year_{t-3}$	0.56
Woman full-time employed in $year_{t-2}$ but not in $year_{t-3}$	0.09
Woman full-time employed in $year_{t-3}$ but not in $year_{t-2}$	0.06
Woman not full-time employed, neither in $year_{t-2}$ nor in $year_{t-3}$	0.28
Median age	31
Married	0.58
Low education (pre-primary, primary, lower secondary)	0.11
Medium education (upper-secondary, post-secondary non tertiary)	0.38
High education (tertiary)	0.51
Sample N[a]	12,060

Note: a. Sample N = 4,431 for the observed $year_{t-2}$ and $year_{t-3}$ combinations of employment status.

Table 2: Logistic regression of first birth for partnered women aged 18 to 39 by own and partner's full-time employment status

	M1	M2	M3
Woman full-time employed in $year_{t-2}$	0.323***		
	(5.76)		
Male partner full-time employed in $year_{t-2}$	0.126+		
	(1.95)		
Full-time employed in $year_{t-2}$			
both		*Ref.*	
woman only		-0.098	
		(-1.13)	
male partner only		-0.308***	
		(-4.83)	
neither		-0.469***	
		(-5.33)	
Woman full-time employed at wave t			0.034
			(0.83)
Male partner full-time employed at wave t			0.299
			(5.18)
Married	0.798***	0.798***	0.765***
	(13.89)	(13.89)	(19.49)
Age	-0.649***	-0.650***	-0.924***
	(-5.70)	(-5.70)	(-11.92)
Age^2	-0.0401***	-0.0401***	-0.0636***
	(-4.30)	(-4.30)	(-10.51)
Age^3	0.000799***	0.000800***	0.00140***
	(3.35)	(3.35)	(9.48)
Constant	10.47***	10.92***	16.29***
	(4.31)	(4.50)	(9.93)
N	12,060	12,060	28,410
Pseudo R^2	0.046	0.046	0.039

Data Source: EU-SILC, 24 European countries, 2004-2017.

Notes:
t statistics in parentheses; + p<0.10, * p<0.05, ** p<0.01, *** p<0.001;
all models include country- and year-fixed effects;
wave t is the wave marking the beginning of first-birth exposure;
$year_{t-2}$ is the 12-month period approximately two years before first-birth exposure (see Appendix).

Table 3: Logistic regression of first birth for partnered women aged 18 to 39, by education and two-year sequence of full-time employment of women and their partners

	M4 All	M5 low educated	M6 medium educated	M7 high educated
Woman full-time employed				
in $year_{t-2}$ and $year_{t-3}$	*Ref.*	*Ref.*	*Ref.*	*Ref.*
in $year_{t-2}$ but not in $year_{t-3}$	-0.206	-0.228	-0.406+	-0.122
	(-1.33)	(-0.44)	(-1.87)	(-0.65)
in $year_{t-3}$ but not in $year_{t-2}$	-0.266*	-0.593	-0.285	-0.170
	(-1.98)	(-1.48)	(-1.21)	(-0.81)
neither in $year_{t-2}$ nor in $year_{t-3}$	-0.352***	-0.738*	-0.359**	-0.260*
	(-4.96)	(-2.51)	(-3.17)	(-2.46)
Partner full-time employed in $year_{t-2}$	0.106	-0.188	0.197+	0.0941
	(1.61)	(-0.86)	(1.83)	(1.02)
Woman's education				
low	*Ref.*	/	/	/
medium	0.270**	/	/	/
	(2.63)			
high	0.433***	/	/	/
	(4.22)			
Married	0.800***	0.777***	0.712***	0.862***
	(13.82)	(3.38)	(7.74)	(10.70)
Age	-0.647***	-0.577+	-0.638***	-0.461*
	(-5.67)	(-1.68)	(-3.39)	(-2.24)
Age^2	-0.0410***	-0.0314	-0.0369*	-0.0233
	(-4.38)	(-1.19)	(-2.42)	(-1.26)
Age^3	0.000856***	0.000601	0.000715+	0.000264
	(3.57)	(0.96)	(1.86)	(0.50)
Constant	10.50***	8.890	10.30*	6.952
	(4.31)	(1.22)	(2.57)	(1.56)
N	12,000	1,173	5,029	5,734

Data Source: EU-SILC, 24 European countries, 2004-2017.

Notes: t statistics in parentheses; + p<0.10, * p<0.05, ** p<0.01, *** p<0.001;
all models include country- and year-fixed effects;
$year_{t-3}$ employment status is multiply-imputed when missing due to left-censoring;
education: low (pre-primary, primary, lower secondary); medium (upper-secondary, post-secondary non-tertiary); high (tertiary).

Table 4: Logistic regression of first birth for partnered women aged 18 to 39 by country-region

	M8 Western Europe	M9 Eastern Europe	M10 Southern Europe	M11 Northern Europe	M12 All
Full-time employed in year$_{t-2}$					
both	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
woman only	-0.422*	-0.063	0.175	-0.205	-0.0962
	(-2.34)	(-0.39)	(1.24)	(-0.62)	(-1.11)
male partner only	-0.398**	-0.276*	-0.280**	0.0311	-0.288***
	(-3.18)	(-2.22)	(-2.72)	(0.12)	(-4.48)
neither	-0.303+	-0.511**	-0.429**	-0.653*	-0.435***
	(-1.91)	(-2.81)	(-2.70)	(-2.37)	(-4.87)
Woman's education					
low	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
medium	0.474+	0.161	0.267*	0.137	0.274**
	(1.81)	(0.59)	(2.02)	(0.26)	(2.67)
high	0.475+	0.431	0.429**	0.277	0.432***
	(1.82)	(1.57)	(3.25)	(0.53)	(4.22)
Married	0.793***	0.732***	0.840***	0.855***	0.796***
	(7.99)	(6.99)	(7.30)	(4.46)	(13.79)
Age	-0.915***	-0.637**	-0.527**	-0.543	-0.653***
	(-4.05)	(-2.66)	(-3.01)	(-1.00)	(-5.72)
Age^2	-0.0674***	-0.0341+	-0.0332*	-0.0161	-0.0414***
	(-3.66)	(-1.81)	(-2.27)	(-0.35)	(-4.42)
Age^3	0.00158***	0.000613	0.000697+	-0.000195	0.000860***
	(3.35)	(1.30)	(1.83)	(-0.16)	(3.59)
Constant	16.45***	9.477	8.568*	8.237	10.72***
	(3.42)	(1.86)	(2.28)	(0.70)	(4.40)
N	3,454	3,594	4,087	865	12,000
pseudo R-sq	0.041	0.060	0.053	0.084	0.048

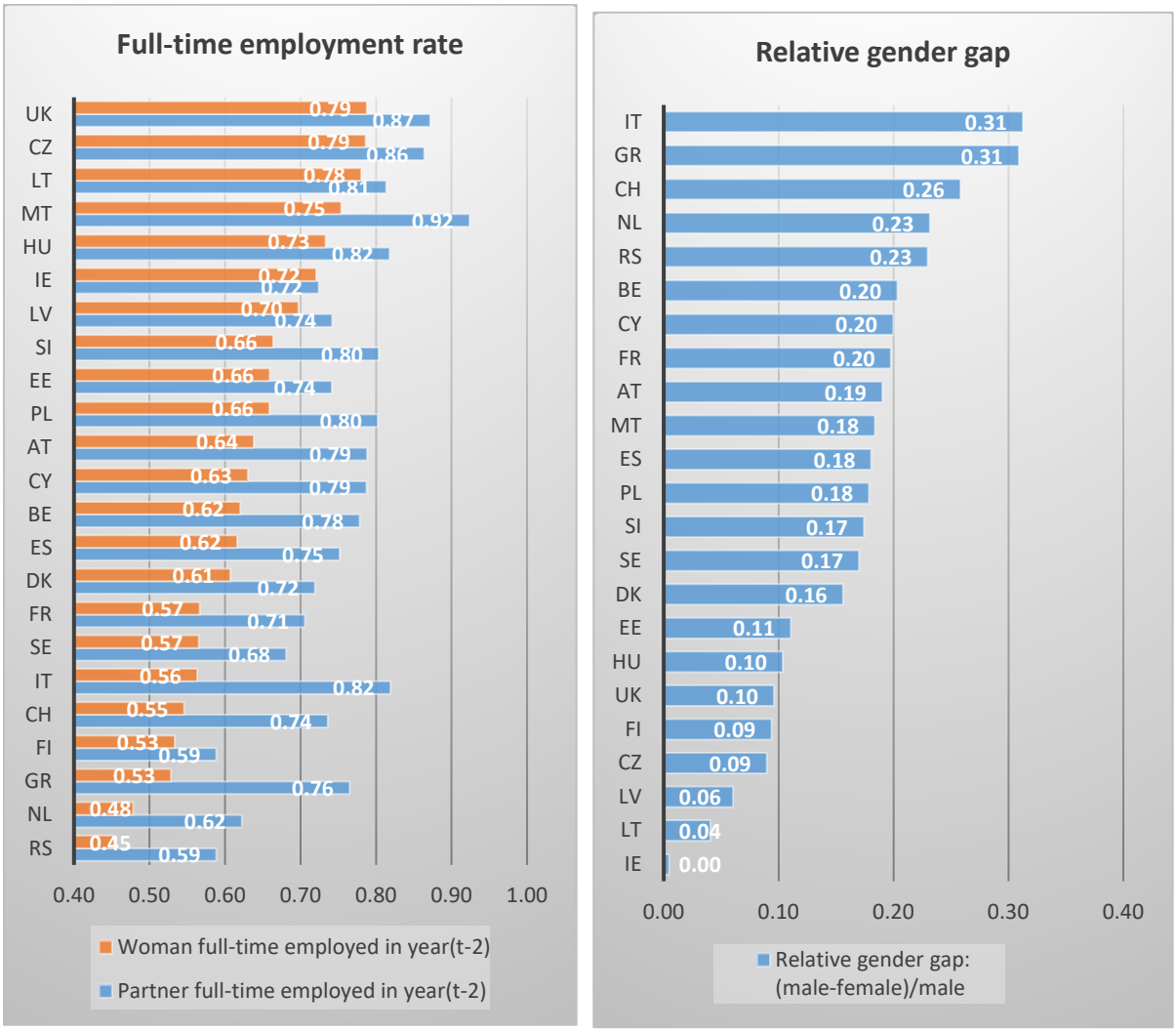
Data Source: EU-SILC, 24 European countries, 2004-2017.

Notes: t statistics in parentheses; + p<0.10, * p<0.05, ** p<0.01, *** p<0.001;
all models include country- and year-fixed effects.
Western Europe: Belgium, United Kingdom, Netherlands, France, Switzerland, Ireland, Austria;
Eastern Europe: Latvia, Hungary, Estonia, Poland, Lithuania, Slovenia, Czech Republic, Serbia;
Southern Europe: Greece, Italy, Spain, Portugal, Malta, Cyprus;
Northern Europe: Denmark, Finland, Sweden;

Education: low (pre-primary, primary, lower secondary); medium (upper-secondary, post-secondary non-tertiary); high (tertiary);
Regression with interaction between region and woman's labor market status yielded non-significant interaction terms.

Figures

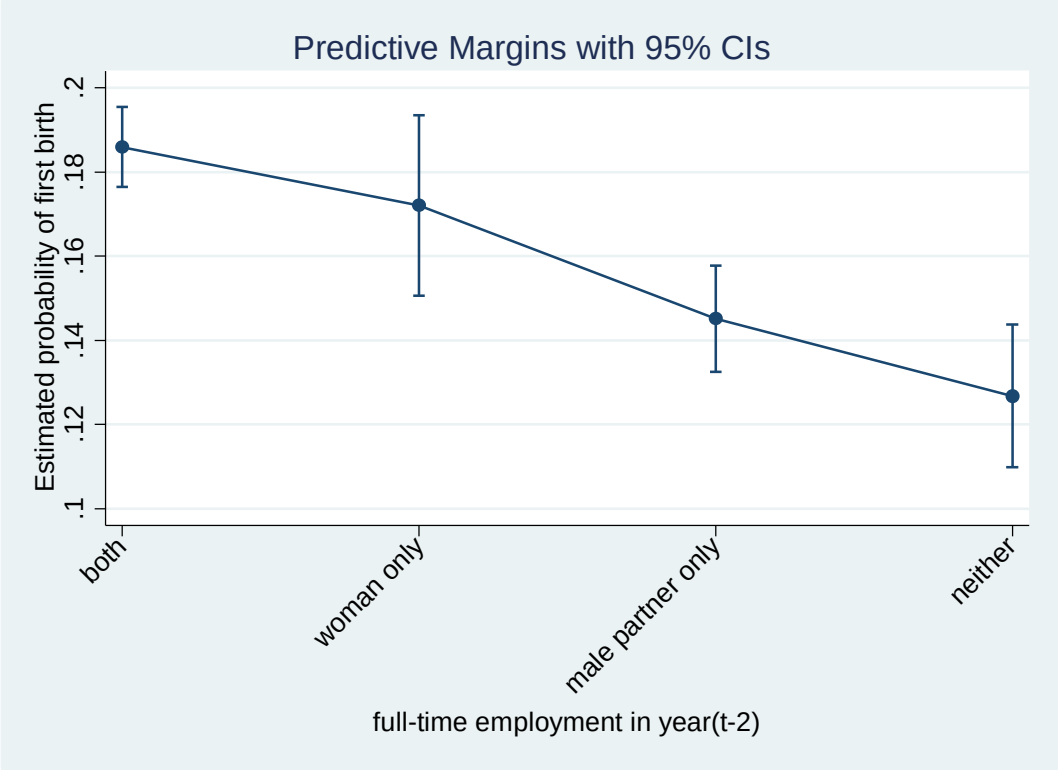
Figure 1: Proportions of women and their partners full-time employed during the calendar year previous to potential conception of a first child, and relative gender gap



Data Source: EU-SILC, 23 European countries, 2004-2017.

Note: Portugal is excluded, having < 30 observations

Figure 2: Predicted probability of first birth by woman's and male partner's employment status



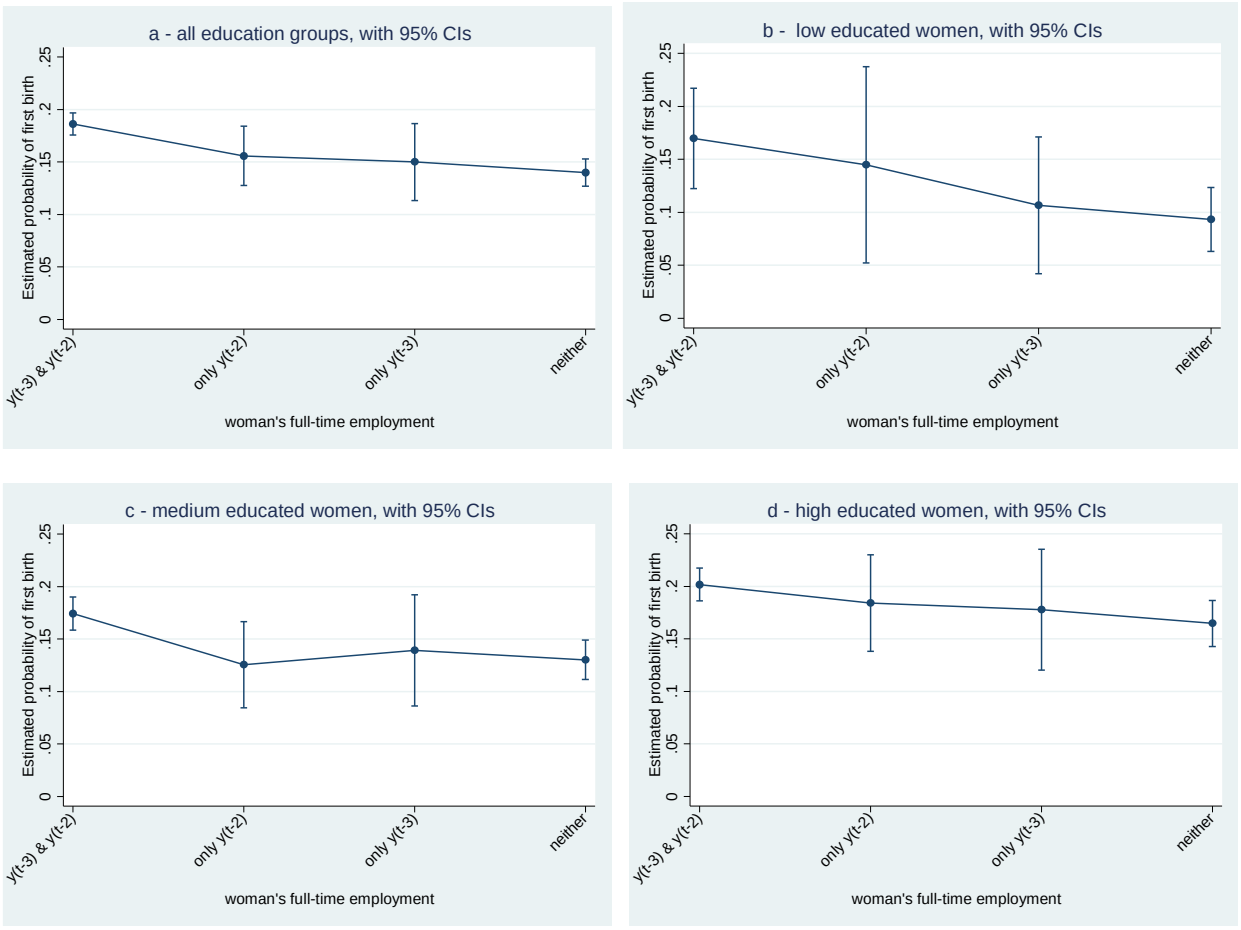
Data Source: EU-SILC, 24 European countries, 2004-2017.

Notes:

Confidence intervals can overlap even though coefficients are statistically different from each other. 'Male partner only' is statistically different from all other combinations (10% significance level). 'Woman only' is statistically different from 'male partner only' and 'neither', but not from 'both'.

Graph based on regression results presented in Table 2, Model 2.

Figure 3: Predicted probability of first birth by woman's educational attainment and her two years of full-time employment previous to potential conception of a first child



Data Source: EU-SILC, 24 European countries, 2004-2017.

Notes:

Confidence intervals can overlap even though coefficients are statistically different from each other.

Graphs based on regression results presented in Table 3.

Data Appendix

To analyze the impact of women's employment on the probability of having a first child, we mobilize the longitudinal sample of EU-SILC (Eurostat 2012). The longitudinal dataset used in the present study covers the majority of European countries and the years 2004 to 2017. Our study is unique in measuring employment as a duration variable, of not only full-time but also full-year status. We modeled up to two consecutive years of full-time, full-year employment. The standard longitudinal implementation of the EU-SILC consists of a rotational panel in which individuals are observed annually for a period of four years, with four rotation groups present in each year. Selection into the sample occurs annually, beginning in 2004, and each new sample after 2004 is followed for four waves. France and Portugal have longer follow-ups. For those countries, we use only the first four waves in order to obtain an international panel data set which is as much harmonized and as least attrition-affected as possible.

Each year, Eurostat disseminates a series of separate datasets covering up to 4 years of follow-up. We used a script provided by Borst (2018) in order to merge these data sets into one cumulative dataset (containing years 2004 to 2017). This corrects for inconsistencies caused by the fact that not all countries follow exactly the integrated design as suggested by Eurostat. The automated approach developed by Borst (2018) allows obtaining unique identifiers for each individual and household in the international panel. Individuals with a discontinuous follow-up are dropped from the sample, which only concerns a very small minority of the sample (below 1%). For France, Portugal and Ireland, the limitation to only those households and individuals for which unique identifiers could be created, combined with the limitation to only the first four panel-years for France and Portugal, led to a considerable reduction of sample size. For Iceland, Norway and Luxembourg, the automated approach was not possible as these countries change

their sample design across different releases (see Borst, 2018 for more details). This is why we dropped those three countries from our sample. Germany is not covered by the longitudinal EU-SILC module because it does not release its panel data due to data confidentiality reasons. Another four countries have been dropped from our analytic sample because of biased fertility measures: Romania, Bulgaria, Croatia and Slovakia (see below).

In the EU-SILC, the sampling and the weighting procedures are not directly designed to ensure unbiased fertility estimates. Estimates of period fertility obtained with EU-SILC can be biased due to several reasons: the observation of non-biological children, double counts (in the case of shared custody, for example), errors in identifying birth orders (in the case of siblings living outside the parental household), sample selection (under- or over-representation of childless individuals, for example), and fertility-linked attrition in the panel (if households are likely to move around the event of a birth). Greulich and Dasré (2017) propose a systematic analysis of period fertility measures in EU-SILC. They find that EU-SILC underreports first childbirth only to a negligible extent in comparison to unbiased measures coming from the Human Fertility Database (n.d.) for the majority of countries covered by EU-SILC. They also find no evidence for significant socioeconomic differences in attrition. Sample selection bias and fertility-linked attrition leads, however, to a considerable underestimation (by over 10%) of the probability of first birth for women aged 20 to 30 in Romania, Bulgaria, Croatia and Slovakia.

We therefore omit these four countries from our sample. Our analytic sample consequently covers 24 European countries[3].

Coding first-birth exposure and first birth

The EU-SILC has not been designed to directly measure fertility. It is, however, possible to compile fertility measures indirectly, by using a variant of the 'own children method' (Grabill and Cho 1965; Desplanques 1993). This consists of merging children to their parents and identifying parity (in our case, nulliparous couples) by considering children who are living in the observed household at the time of the survey, and identifying births to couples from infant children who are new to the household since the previous survey wave. The EU-SILC's variable for year and quarter of birth allows us to make this identification. The couple is defined as nulliparous if there is no child in their household observed before the quarter of the interview of year *t* (designated as w_t). Our first-birth event variable is coded 1 if a linked child was born in one of the quarters between w_t and w_{t+1} (see Figures A1 and A2).

Figure A1 about here

Figure A1 illustrates how the data are compiled for the three-wave cases. The three interview waves are designated w_{t-1}, w_t, and w_{t+1} , occurring in calendar years that we designate

[3] Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Lithuania, Latvia, Malta, Netherlands, Poland, Portugal, Serbia, Spain, Switzerland, Sweden, Slovenia, United Kingdom.

as *t-1*, *t*, and *t+1*. The example is for those women who remain childless until w_t. 'Exposure to first birth' is observed between w_t and w_{t+1}. In this example, both the interviews at waves w_t and w_{t+1} take place in the second quarter of each year, i.e., in April, May, or June. The interviews of waves w_{t+1} and w_t identify births that occurred between these two interview waves. The observed period of exposure to first birth in Figure A1 is from quarter *2* (*q2*) of calendar year *t* up to but excluding the interview occurring in quarter 2 (*q2*) of calendar year *t+1*.

The EU-SILC database also includes a variable for the quarter of the interview. For 48% of individuals in our analytical sample of 12,060 observations, interviews take place in the second quarter of the year, followed by the first quarter as the next most frequent quarter (24%) For 13%, interviews take place in the third quarter and for 15% in the fourth quarter. For most individuals (68%), interviews take place in the same quarter of each survey year, implying that the "year of first-birth exposure" between the consecutive annual survey waves w_t and w_{t+1} covers four quarters, or 12 months. An additional 17% have shorter durations (one to three quarters) and 15% have longer durations (five to seven quarters). Our regression results are robust to controls for number of quarters of duration of exposure to birth in the "year of first-birth exposure."

Employment during one whole calendar year before potential conception of a first child: during year t-2

Labor force status is reported on a monthly basis during the whole calendar year preceding the interview wave. In order to observe labor force status during at least one whole calendar year before potential conception of a first child, we may see that women need to be observed for a minimum of three waves (see again Figure A1). Labor force status is observed on

a monthly basis during the whole calendar year *t-2*, as reported in the wave w_{t-1}. The time between the last month of observed labor force status and the beginning of exposure to birth is therefore between 12 and 21 months (defined in quarters, as we only know the time of interview to the quarter). In our EU-SILC analytical sample, this time is distributed as follows: 24%, 12 months; 48.5%, 15 months; 13%, 18 months; and 14.5%, 21 months. We thereby exclude the possibility that a woman is already pregnant with her first child by the most recent month of observation of her labor force status.

Note that regression results are robust to controls for technical components of our data associated with the compilation method, including duration between observed labor force status and beginning of exposure to birth and number of observed waves per individual. We excluded these technical components from the regression specifications presented in the paper's main findings after finding that none were statistically significant nor had a substantive impact on the regression estimates.

Employment during two whole calendar years before potential conception of a first child: during year t-2 and year t-3

In order to observe labor force status during *two* whole calendar years before potential conception of a first child, women need to be observed for four annual waves. There are 4,431 'fully-observed cases', i.e., partnered women aged 18 to 39 for whom we can observe the labor force status during *two* full calendar years before potential conception of the first child. As shown in Figure A2, women need to be followed up for three waves and still be at risk of first birth at the wave w_t, and then be observed again at wave w_{t+1}.

Figure A2 about here

For those who remain childless until w_t, we are able to observe the labor force status throughout all 12 months of calendar year *t-2* and calendar year *t-3*. Information of the monthly labor force status of year *t-2* is reported at w_{t-1} and information of the monthly labor force status of year *t-3* is reported at w_{t-2}. This is considered the 'fully-observed case' because 24 consecutive months of labor force status before potential conception of a first child are observed.

Employment observed at immediately before exposure to first birth: at w_t

To understand the sensitivity of estimates of the first birth probability to the lag between labor force status and birth exposure, we also coded labor force status for the woman and her male partner as reported at the time of the survey interview immediately before exposure to first childbirth starts. This option has the advantage that it brings us the largest possible number of observations, as we only need two consecutive waves here. We observe 28,410 partnered women aged 18 to 39 with information on labor force status observed immediately before exposure to first birth. This information is from a variable for self-reported labor force status at the time of the interview. Here, 72% of women were full-time employed (or full-time self-employed) at w_t, as were 88% of their partners (results not shown). The other possible labor force status response categories are part-time employed (including part-time self-employed), unemployed, or inactive (fulfilling domestic tasks and care responsibilities, permanently disabled and/or unfit to work, in early retirement or any other form of professional inactivity). Students and those in further training are dropped from this analytic sample. To ensure that the observation of self-reported employment status precedes exposure to first birth, for this analysis (Model 3 in Table 2 of the

main text), we truncated the period of first-birth exposure to the three quarters immediately after the quarter of the survey interview, thereby excluding the possibility that a first birth in the quarter of the survey interview precedes the report of labor force status.

The problem with this w_t measure of full-time employment is that, for a woman who gives birth to a first child during the exposure period, her labor force status may have been observed when she is already pregnant. Regression results may in this case suffer from an endogeneity bias if becoming pregnant affects employment status. Endogeneity bias may also result if planning soon to become pregnant affects employment status (e.g., if conception occurs in the quarter of the interview, but after the report of labor force status). Besides endogeneity, another issue to consider is that labor force status observed at a given point in time (i.e., at the time of the survey) might not be a good indicator of the continuity and stability of full-time employment which we hypothesize to be a predictor of first birth. The EU-SILC provides information about the type of contract (fixed term vs. permanent), for example. However, this kind of information does not provide an indicator for employment security that is reliable for all European countries, as having a temporary job does not provide the same level of precariousness in all European countries (ILO, 2018).

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Figure A1: Data compilation for women observed for three waves

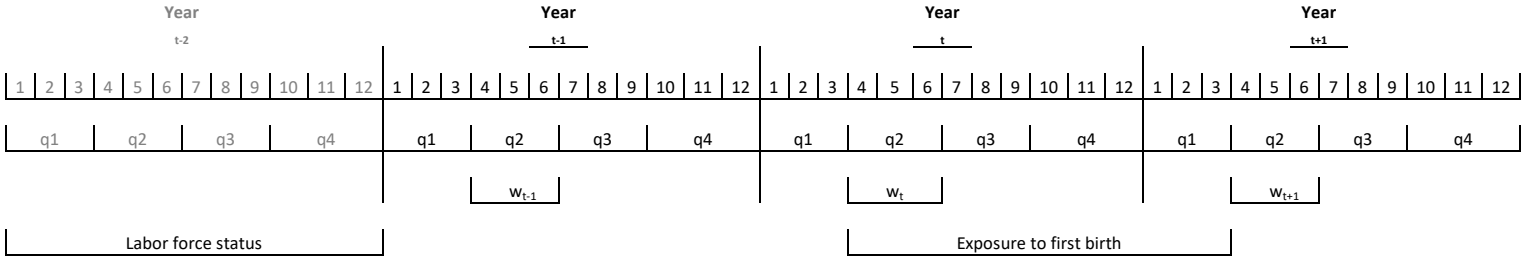

Figure A2: Data compilation for women observed for four waves