DEMOGRAPHIC RESEARCH
A peer-reviewed, open-access journal of population sciences

DEMOGRAPHIC RESEARCH

VOLUME 54, ARTICLE 38, PAGES 1251–1278
PUBLISHED 11 JUNE 2026
https://www.demographic-research.org/Volumes/Vol54/38/
DOI: 10.4054/DemRes.2026.54.38

Research Article

Educational differences in fertility recuperation: The role of partnership trajectories in Spain

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Demographic Research: Volume 54, Article 38
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Cristina Suero[1]

Abstract

BACKGROUND
The postponement of first childbirth is a well-established trend across many high-income countries. While delayed childbearing often reduces the likelihood of having additional children, some women compensate by shortening the interval before a second birth. However, the capacity to recuperate fertility after a late start varies, particularly according to educational attainment, and the underlying mechanisms remain unclear.

OBJECTIVES
This study examines how partnership trajectories shape the timing and likelihood of first and second births, with a focus on educational differences. It explores whether stable partnerships are associated with earlier childbearing and whether they facilitate fertility recuperation after delayed motherhood, with particular attention to educational differences.

METHODS
Using data from the 2018 Spanish Fertility Survey, event-history analysis is applied to a subsample of 11,813 women to estimate the timing and likelihood of first and second births.

RESULTS
Women with more than one coresidential partner over their life course are less likely to have a first child and tend to postpone motherhood. However, they also experience shorter intervals between the first and second child, suggesting fertility recuperation. This pattern is more evident among university-educated women with multiple partnerships.

CONTRIBUTION
This study contributes to understanding fertility recuperation by linking partnership trajectories to fertility outcomes and highlighting the moderating role of education. The findings also provide new evidence from Spain, where very late fertility patterns may constrain fertility recuperation due to biological limits.

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1. Introduction

Traditionally, the educational gradient of fertility has been negative, with highly educated women tending to have fewer children than their less educated peers (Liefbroer and Corijn 1999). However, more recent research suggests that the relationship between education and fertility has become increasingly complex (Vasireddy et al. 2023). A growing number of studies report a U-shaped or even a positive association between education and fertility (Jalovaara et al. 2019; Klesment et al. 2014; Nisén et al. 2021; Wood, Neels, and Kil 2014). One key mechanism underlying the traditional negative gradient is the extended time highly educated women spend in education, which delays transitions to adulthood, including entry into motherhood (Ní Bhrolcháin and Beaujouan 2012; Wood, Neels, and Kil 2014). This postponement often results in smaller completed family sizes due to age-related declines in fecundity (Te Velde et al. 2012). In contrast, less educated women typically finish their studies earlier and reach life course milestones at younger ages, allowing for a longer reproductive window and potentially larger families. Among other factors, these differences have historically contributed to the negative educational gradient of fertility.

Nonetheless, recent studies show that highly educated women are increasingly likely to have a second or subsequent child (Jalovaara, Andersson, and Miettinen 2022; Mikolai, Berrington, and Perelli-Harris 2018; Nitsche et al. 2018; Wood, Neels, and Kil 2014). This suggests that women with higher education may be better positioned to recuperate fertility by shortening the interval between births (Klesment et al. 2014; Kreyenfeld 2002), even when they begin childbearing later than their less educated counterparts.

Yet the mechanisms behind this shift remain insufficiently understood. Women's education is associated with substantial differences across multiple life course domains, including partnership trajectories. Highly and less educated women tend to experience distinct patterns of partnership formation, dissolution, and repartnering (Kalmijn 2013; Perelli-Harris and Lyons-Amos 2016; Schwartz and Han 2014). Given the central role of partnership dynamics in shaping fertility behaviour (Perelli-Harris and Lyons-Amos 2016), these differences may substantially affect opportunities for fertility recuperation among highly educated women compared to the lower educated. This study explores how partnership trajectories, defined as the number of coresidential partnerships women experience over the life course, shape both the timing (tempo) and number (quantum) of first and second births across different educational groups.

Unlike research that primarily focuses on educational differences in transitions to first or second births (Greulich and Toulemon 2023; Nitsche et al. 2018; Nitsche, Trimarchi, and Jalovaara 2020), this study explicitly links educational disparities in fertility to women's cumulative partnership histories. Moreover, rather than analysing timing or quantum in isolation, it considers both dimensions jointly, providing a more

comprehensive account of fertility behaviour. By adopting a longitudinal perspective, the analysis further captures how conditions at each age influence subsequent fertility transitions. Finally, the study provides new empirical evidence from Spain – a context characterised by persistently late fertility timing, very low fertility rates, and a limited scope for fertility recuperation due to delayed life course transitions and biological constraints at older ages (Suero, Compans, and Beaujouan 2025). As fertility postponement continues to increase across Europe, the Spanish case offers a valuable lens for anticipating future fertility patterns and assessing the possibilities and limits of fertility recuperation in late-fertility societies.

2. Theoretical background

2.1 Major approaches on the relationship between women's educational attainment and fertility

Several theoretical approaches predict a negative relationship between women's educational attainment and fertility. According to the new home economics (NHE) framework, higher levels of education, particularly among women, are associated with increased labour market participation and higher opportunity costs of childbearing, making it more difficult to combine paid work and family responsibilities (Becker 1993). Similarly, the second demographic transition (SDT) theory links rising education to declining fertility through shifts in values, preferences, and family behaviours, including the postponement of marriage and parenthood and the diversification of family forms (Lesthaeghe 2010; van de Kaa 1998). The gender revolution theory (GRT) also predicts a decline in fertility as women's educational attainment and labour force participation increase. However, unlike NHE and SDT, GRT anticipates a potential reversal of fertility decline once gender equality advances and men increasingly participate in unpaid domestic and care work (Frejka, Goldscheider, and Lappegård 2018; Goldscheider, Bernhardt, and Lappegård 2015), thereby reducing women's "double burden" (McDonald 2013).

Together, these perspectives are consistent with the long-term decline in period fertility rates observed across Europe, which has unfolded alongside substantial educational expansion, particularly among women (Lesthaeghe 2020). Yet recent evidence suggests that this relationship is changing. In several contexts, studies document a U-shaped or even positive association between education and fertility (Vasireddy et al. 2023). These emerging patterns challenge traditional theoretical expectations and underscore the need for further research into the mechanisms linking women's education and fertility behaviour.

2.2 Late entry into motherhood and fertility recuperation

Alongside declining fertility levels, European countries have experienced substantial delays in both partnership formation and childbearing over recent decades (Kohler, Billari, and Ortega 2002). Importantly, the postponement of childbearing is especially pronounced among highly educated women. Extended participation in formal education (Neels et al. 2017) tends to delay life course transitions and ultimately parenthood (Baizán, Aassve, and Billari 2003; Billari, Liefbroer, and Philipov 2006; Brons, Liefbroer, and Ganzeboom 2017; Ferraretto and Vitali 2023). In addition, highly educated women tend to invest more time in building their professional careers prior to parenthood (Gustafsson and Kalwij 2006; Kreyenfeld, Andersson, and Pailhé 2012). By contrast, women with lower levels of education generally complete schooling earlier and transition into adulthood, and motherhood, earlier (James and Vujić 2019). But they are more exposed to income volatility and economic shocks, which can negatively affect their fertility (Adsera 2011a).

Given the biological constraints associated with age (Beaujouan et al. 2019), delaying childbearing often results in lower completed fertility (Habbema et al. 2015; Leridon and Slama 2008). However, some women may manage to have children later in life, partially recuperating their fertility. Such fertility recuperation has been documented in France (Compans 2021), Western Europe (Castro 2015), Germany (Kreyenfeld 2002), the Nordic countries (Andersson et al. 2009), and elsewhere and appears to be more prevalent among highly educated women. Despite this evidence, the pathways that enable such compensatory fertility behaviour remain insufficiently understood.

2.3 Education, partnership trajectories, and fertility

Partnership trajectories are a key determinant of fertility behaviours (Nishikido, Cui, and Esteve 2022). Unstable partnership trajectories have been associated with childlessness across Europe (Jalovaara and Fasang 2017), in Poland and Italy (Mynarska et al. 2015), and in Germany (Raab and Struffolino 2020). Usually, individuals who do not find a suitable or desired partner tend to postpone childbearing until they do (Mills et al. 2011), which shapes their reproductive behaviours. Consequently, *women who experience multiple partnerships, as well as those who never enter a coresidential partnership – both conceptualised here as unstable partnership trajectories – are expected to transition into motherhood later than women who experience a single partnership* (Hypothesis 1).

Unstable partnership trajectories may also reduce the likelihood of achieving intended family size (Nishikido, Cui, and Esteve 2022) because of the fecundity decline associated with age (Habbema et al. 2015; Leridon and Slama 2008). Spending a longer

period searching for an appropriate partner may hinder not only the transition to first birth but also the progression to subsequent births. Consequently, *women with multiple partnerships or no partnerships are expected to be less likely to have a second child than women with more stable partnership trajectories* (Hypothesis 2).

Importantly, partnership dynamics vary systematically by women's educational attainment. Despite some contextual complexity (Perelli-Harris and Lyons-Amos 2016), prior research generally identifies a positive educational gradient in union stability (Boertien and Härkönen 2018), using indicators such as marriage and divorce rates (Kalmijn 2013; Perelli-Harris and Lyons-Amos 2016; Schwartz and Han 2014) and union entries and dissolutions (Jalovaara and Andersson 2023). Highly educated women tend to form partnerships at older ages (Smock and Schwartz 2020), but they are more likely to establish egalitarian relationships with lower divorce risks (Sigle-Rushton 2010). In contrast, women with lower levels of education are more exposed to adverse life conditions, including economic hardship and labour market instability, which are associated with higher risks of union dissolution (Hogendoorn, Kalmijn, and Leopold 2022).

Beyond differences in partnership stability, highly educated women often have access to greater social and economic resources (Bueno and García-Román 2021), which may facilitate childbearing even under less favourable partnership conditions. These resources may enable them to better cope with partnership instability and mitigate its negative consequences for fertility. Thus *highly educated women are expected to be better able to offset the negative effects of unstable partnerships on the transition to the first child than women with lower educational attainment* (Hypothesis 3). Furthermore, *they may be more likely to compensate for delayed entry into motherhood and overcome the constraints posed by partnership instability when progressing to a second birth* (Hypothesis 4).

3. The Spanish case

Spain is characterised by particularly late transitions to adulthood (del Rey, Stanek, and García-Gómez 2023), largely influenced by persistent labour market instability among young adults (Adsera 2011b; Bueno and Brinton 2019). The mean age at first birth reached 31 in 2018[2] (Eurostat 2018a), and 9.8% of births were to mothers aged 40 or older, almost double the EU average of 5.2% (INE 2018a).

In parallel, Spain exhibits one of the lowest fertility levels. In 2018, the total fertility rate (TFR) was 1.26 (HFD 2018). This combination of low and late fertility is closely

[2] The year when the survey was conducted.

associated with the rising educational attainment of the population, particularly among women. In 2018, 44.3% of the population aged 25 to 34 held tertiary education qualifications, rising to 50.1% among women (Eurostat 2018b). By educational attainment, there is a persistent negative educational gradient, with the highest fertility rates among the least educated (Requena 2021). It has been estimated that around one-third of women will remain childless at the end of their reproductive years, despite the enduring ideal of a two-child family (Lozano et al. 2024). Although fertility ideals are largely homogeneous across educational groups, childlessness remains more prevalent among highly educated women (Esteve, Devolder, and Domingo 2016).

Partnership dynamics constitute an additional challenge to fertility. Among childless women aged 35 to 40, 23% cite not having found a suitable partner as the main reason for remaining childless, with little variation across educational levels (INE 2018b).

Overall, in this context of "latest late fertility," the transition to parenthood is particularly challenging. Both biological and social constraints limit the feasibility of childbearing at advanced ages, suggesting that in Spain the scope for fertility recuperation is more restricted than in contexts where transitions to adulthood occur earlier in the life course.

4. Data and methods

4.1 Data

This research uses data from the 2018 Spanish Fertility Survey (SFS), a retrospective survey conducted by the Spanish National Statistics Institute. The survey collected information from a sample of 14,556 women aged 18 to 55 residing in Spain, gathering detailed partnership, labour, and reproductive histories. This rich life course data allows for the reconstruction of women's trajectories and facilitates the analysis of how partnership experiences influence both the timing and the quantum of fertility.

The survey has two main advantages over other data sources. First, its retrospective design provides complete partnership histories up to the time of the interview. Specifically, it includes information about the last five partners with whom the respondent coresided. Second, the comparatively large sample size enables stratified analyses. The analytical sample includes 11,813 women for the analysis of the transition to the first child and 7,852 women for the analysis of the transition to the second child. Women born after 1989 are excluded, as they may be too young and their inclusion could bias the results. This restriction yields a sample of women aged 29 and older, ensuring sufficient time to complete education, given that university education in Spain is typically completed around age 23.

Partnership trajectories are captured through a time-varying variable derived from women's partnership histories. This variable records the number of coresident partners a woman has had at each age up to: (1) the birth of the first child (in the analysis of the transition to the first child) or the second child (in the analysis of the transition to the second child) or (2) the time of the survey, if the transition had not occurred by then. Since the variable is time varying, it considers the age at which the number of partners changes for women. Because the transition to parenthood may itself trigger changes in partnership arrangements, and to assess whether such changes alone drive the transition to the second child, an additional robustness analysis is presented in Table A-3. This analysis considers only partnership trajectories up to the first birth and excludes partnership changes occurring thereafter.

Educational attainment is classified into two categories: non-university education (ISCED levels 0–5) and university education (ISCED levels 6–8). In addition to these main variables, the models include several controls. A time-varying variable captures whether a woman has *completed her education at each age*, accounting for the fact that women who are still enrolled in education are less likely to have children (Ní Bhrolcháin and Beaujouan 2012). The *country of birth* variable distinguishes between women born in Spain and those born abroad, as migrant women tend to have earlier first births. Lastly, in the models examining the transition to the second child, the *age at first birth* variable is included to account for the potential impact of a late first birth on both the timing and likelihood of a second birth given the biological constraints associated with age-related fertility decline.

4.2 Methods

The analysis employs event-history analysis (EHA) techniques to examine the effect of partnership trajectories on the timing and incidence of the transitions to the first and second child. These models allow observation of the transitions across different life states based on a clock, which in this case is the age of the woman (in years with decimals). The aim is to assess how the different partnerships women had over their lives contributed to the timing and quantum of the transition to first and second births. A key advantage of EHA is its ability to account for right-censoring, as it incorporates the status of each individual at each age, ensuring that women who have not yet completed their fertility by the time of the survey are still properly considered in the analysis. All analyses were conducted in Stata 17 using data obtained from the Spanish National Statistics Institute (INE; www.ine.es).

To model the occurrence of the transition to first and second births, Cox proportional hazards (PH) regression models are applied. The hazard function is specified as:

$$h(t|X) = h_0(t)\exp(X\beta),$$

where $h(t|X)$ is the hazard at time t for covariates X, $h_0(t)$ is the baseline hazard function, and $(X\beta)$ represents the linear predictor based on the covariates. Cox models do not require the specification of the underlying distribution of survival times and yield hazard ratios. These models rely on the proportional hazards assumption and are conceptually similar to incidence rate ratios in Poisson regression (Abd ElHafeez et al. 2021).

To ensure robustness, two additional analyses were conducted. First, linear probability models were applied to women aged 45 or older, under the assumption that they had completed their reproductive span, thereby removing the influence of timing (Table A-4). Second, piece-wise exponential models were estimated as an alternative approach that provides greater flexibility regarding the baseline hazard function (results available upon request). The findings from these models are consistent with those obtained from the Cox models.

To analyse the timing of the transitions, log-normal duration models were applied. The hazard function is defined as:

$$\mathrm{h(t)} = \log(T) \sim N(\mu, \sigma^2),$$

where $\mu = X\beta$ represents the mean of the log-transformed survival time and is modelled as a function of the covariates and σ^2 is the variance. This parametric model is particularly suited in situations where the risk of an event (e.g., childbirth) is initially low, increases rapidly to a peak (typically in the 20s–30s), and then declines – characteristics that match fertility patterns. A Wald test was conducted to confirm the appropriateness of this distribution. For these timing models, the sample was restricted to women who had experienced the event: 7,915 women for the transition to the first child and 4,979 women for the transition to the second child.

Both the occurrence and timing analyses follow the same modelling strategy. Model 1 includes partnership alongside controls: a time-varying indicator of whether the woman had completed her education and the country of birth. Model 2 adds educational attainment (and the age at first birth in analyses of the transition to the second child). Model 3 incorporates interaction terms between partnership trajectories and educational attainment.

Results are presented graphically as predicted hazards (from Cox regressions) and predicted survival times (from log-normal regressions). Full tables of hazard ratios and coefficients are provided in Tables A-1 and A-2. An additional analysis using age at first birth as the main predictor to assess the transition to the second child is included in Table A-5.

Regarding the period of exposure, for the transition to the first child, the time at risk begins at age 18 and ends at: (1) the birth of the first child, (2) the time of the survey, or (3) age 45 for women older than that. For the transition to the second child, the risk period begins with the birth of the first child and ends at: (1) the birth of the second child, (2) the time of the survey, or (3) age 45 for women older than that. The analysis of the transition to the second child excludes 162 cases of multiple births.

5. Results

5.1 Descriptive analysis

Table 1 displays the basic statistics of the variables included in the models. University-educated women are less likely to have a first child (58.5%) compared to women without university education (71.3%). In addition, university-educated women tend to enter motherhood significantly later, with a mean age at first birth of 32.0 years, compared to 27.4 years for less educated women.

However, among those who became mothers, educational differences in the likelihood of having a second child are minimal: 63.3% of university-educated mothers had a second child compared to 61.4% of mothers without a university education. Nonetheless, the spacing between the first and second births differs: University-educated mothers have a shorter average interval between the first and second birth (3.5 years) compared to their less educated counterparts (4.7 years).

Regarding partnership trajectories prior to the first birth, there are no substantial differences by educational level in the overall sample. Approximately 21% of women had never coresided with a partner, 74% had lived with one partner, and around 5% had lived with two or more partners. Yet within the subset of mothers, educational differences emerge: 15.4% of non-university-educated women had their first child without ever having coresided with a partner, compared to only 5.9% of university-educated women. Conversely, 89.3% of university-educated mothers had their first child after coresiding with only one partner, compared to 81% among the less educated. The proportion of mothers who had their first child after living with multiple partners is relatively low but is slightly higher among university-educated women (4.9%) than among non-university-educated women (3.6%). These figures provide preliminary insights into patterns of unpartnered motherhood, which is more common among women without university education – potentially reflecting a higher incidence of unintended pregnancies during adolescence within this group.

As expected, university-educated women attain their highest level of education later (mean age 24.8) than women with lower educational levels (mean age 19.3). These

patterns hold within the subsample of one-child mothers. Additionally, the proportion of women with university education has increased substantially across successive cohorts. Finally, the proportion of foreign-born women is higher among those without university education (21.4%) than among university-educated women (14.3%).

Table 1: Basic statistics of the variables included in the models

	Transition to parity 1		Transition to parity 2	
	Non-university education (%)	University education (%)	Non-university education (%)	University education (%)
Transition to child				
Yes	71.3	58.5	63.3	61.4
No	28.7	41.5	36.7	38.6
Duration to transition (mean, years)	27.4	32.0	4.7	3.5
Partnership trajectories				
No partners	21.2	20.5	15.5	5.9
One partner	74.0	73.7	80.8	89.2
Two or more partners	4.8	5.8	3.7	4.9
Age at achieving highest level of education (mean)	19.3	24.8	19.0	24.6
Cohort				
Before 1970	32.8	20.6	34.8	24.5
1970–1979	39.1	42.8	41.7	51.5
1980–1989	28.2	36.7	23.5	24
Country of birth				
Native	78.6	85.7	78	84.8
Foreign	21.4	14.3	22	15.2
N	7772	4041	5519	2333

Note: Author's own calculations based on the 2018 SFS. Women were aged 28–55. Percentages are weighted; Ns are unweighted.

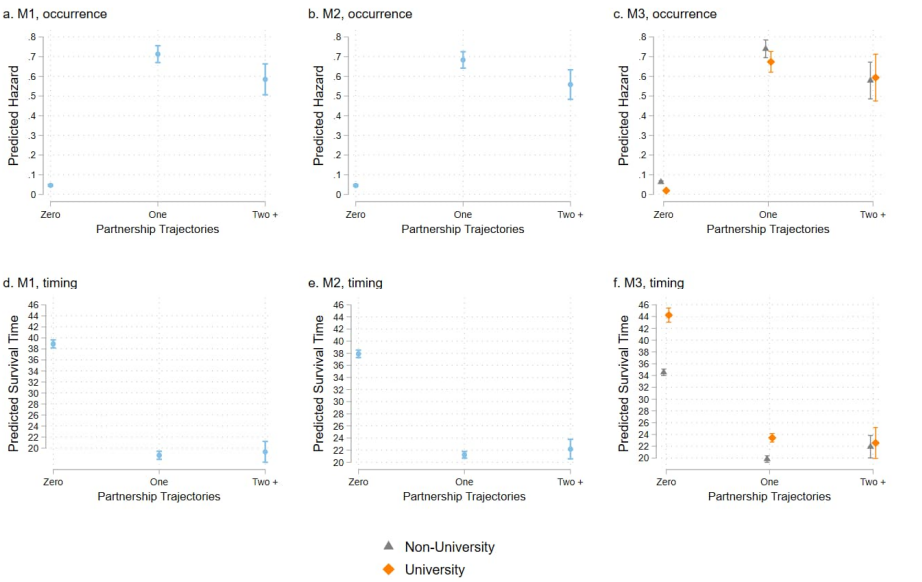
5.2 Partnership trajectories and the transition to the first child

The top panels of Figure 1 present the results of the Cox regression models, represented as predicted hazards of transitioning to the first child by partnership trajectory. Model 1 includes the variables of partnership trajectories and controls, Model 2 adds the level of education, and Model 3 includes the interaction between partnership trajectories and education.

The results indicate that the likelihood of having a first child is substantially lower for women who have never coresided with a partner (PH = 0.05) compared to partnered women. Those who had more than one coresident partner are also less likely to transition to motherhood (PH = 0.58) compared to those who had only one partner (PH = 0.71). The inclusion of education in Model 2 does not significantly alter these associations. When interaction effects with education are introduced in Model 3, some educational

differences emerge. Among women without a coresident partner, those without university education are slightly more likely to have a first child than their university-educated counterparts (PH = 0.06 vs. 0.02). Similarly, among women who had only one partner, the likelihood of entering motherhood is slightly higher for the less educated, although the difference is not large (PH = 0.74 vs. 0.67). For women who had more than one partner, there are no notable educational differences; the predicted hazards remain around 0.58. This indicates that the decline in the likelihood of having a first child among non-university-educated women is stronger than for university-educated women.

Figure 1: Results of the Cox regression models representing the occurrence (top panels) and log-normal duration models representing the timing (bottom panels) of the first child by partnership trajectories



Notes: Results presented as predicted hazards and predicted survival times. Confidence intervals are 95%. Controls: completing education and country of birth.

The analysis of timing, presented in the bottom panel of Figure 1 as predicted survival time (PST), complements this picture. Women who had no coresident partner but nevertheless had a child did so at much later ages (PST = 38.91), suggesting that these cases are likely the result of a prolonged partner search followed by a decision to pursue motherhood alone.

Women with more than one partner transitioned to the first birth slightly later (PST = 19.3) than those with only one partner (PST = 18.71), indicating that having multiple partnerships may introduce some delay in motherhood. However, the difference is small. Adding education in Model 2 slightly reduces these differences.

The interaction effects in Model 3 reveal that university-educated women tend to have their first child later than less educated women across most partnership trajectories, except for those who have had more than one partner. In this case, the timing gap by education narrows (PST = 23.43 for university-educated women vs. 22.56 for non-university-educated women), suggesting that multiple partnerships delay the transition to motherhood more for less educated women than for the highly educated.

5.3 Partnership trajectories and the transition to the second child

Figure 2 depicts the results for the transition to the second child by partnership trajectories. The top panel displays the predicted hazards of having a second child, while the bottom panel shows the predicted timing of the transition.

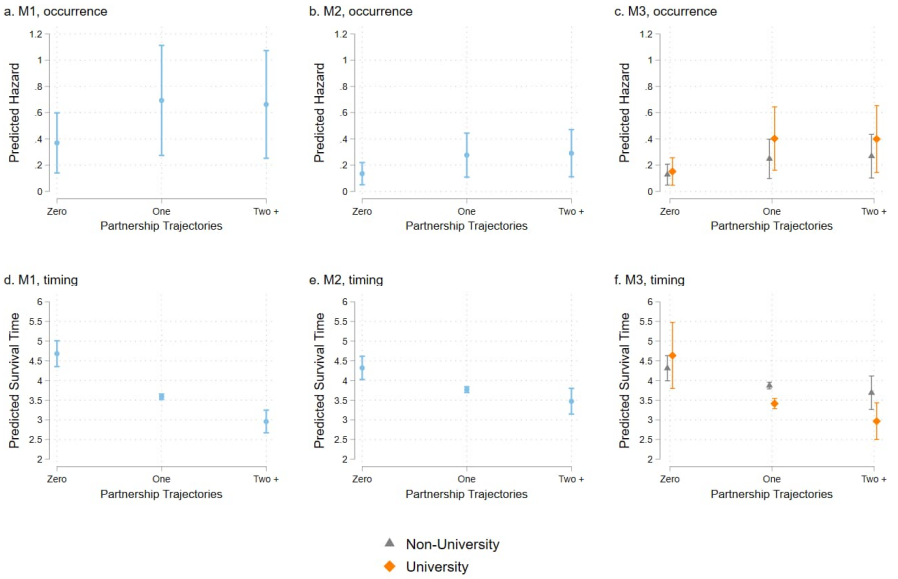
Women who have had no coresident partners are significantly less likely to have a second child (PH = 0.37). However, among partnered women, the number of coresident partners does not substantially affect the likelihood of progressing to a second birth: The predicted hazard is 0.69 for those with one partner and 0.66 for those with more than one.

Educational attainment does not appear to strongly moderate the relationship between partnership trajectories and the occurrence of second births. Nonetheless, university-educated women exhibit a slightly higher likelihood of having a second child when they have had one or more partners (PH = 0.40) compared to their non-university-educated counterparts (PH = 0.27).

Regarding timing, partnership trajectories do shape the interval between the first and second child. Women who have had more than one partner tend to accelerate the transition to a second child (PST = 2.96 years), while those who remained with a single partner space their births more (PST = 3.59 years), even after controlling for age at first birth. These results remain consistent when partnership trajectories are considered only up to the first birth (see Table A-3).

Interestingly, women who had no coresident partner take the longest to transition to a second child (PST = 4.68 years), which may reflect either greater constraints or a more deliberate delay in expanding their family.

Figure 2: Results of the Cox regression models representing the occurrence (top panels) and log-normal duration models representing the timing (bottom panels) of the second child by partnership trajectories



Notes: Results are presented as predicted hazards and predicted survival time. Confidence intervals are 95%. Controls: completing education, country of birth, and age at first birth.

The examination of educational differences shows that university-educated women tend to shorten the spacing between births more than less educated women as the number of partners increases. The additional analysis in Table A-5, focusing on the age at the first birth as the main variable, also shows a shortening time in the transition to the second child among highly educated women who have had more than one partner; this is not visible among less educated women with similar partnership trajectories. This suggests that highly educated women may be more capable of compensating for partnership instability by accelerating childbearing once they are in a stable partnership.

6. Conclusion and discussion

Previous research has highlighted that some women who postpone entry into motherhood may compensate for this delay by subsequently reducing the spacing between births, a phenomenon known as fertility recuperation. This behaviour is particularly common among highly educated women (Klesment et al. 2014; Kreyenfeld 2002; Kreyenfeld and Andersson 2014) and has been observed in different contexts, including France (Compans 2021), Western Europe (Castro 2015), Germany (Kreyenfeld 2002), and the Nordic countries (Andersson et al. 2009). While partnership trajectories are known to influence fertility behaviours (Baizán, Aassve, and Billari 2003), this relationship may vary by women's educational attainment due to their differing social, economic, and cultural characteristics. This study examines the role of partnership trajectories in shaping the timing and quantum of the transitions to first and second child by women's educational attainment in Spain, a country characterized by the postponement of parenthood and persistently low fertility rates (Lozano et al. 2024), where opportunities for fertility recuperation may therefore be more limited than in other contexts.

The findings reveal that partnership trajectories play a notable role in the likelihood of having a first child, consistent with previous research highlighting the importance of partnership formation for childbearing (Nishikido, Cui, and Esteve 2022). First, women who had more than one coresident partner were less likely to become mothers than those who had only one partner over their lives, and when they did, they tended to do it slightly later compared to those with only one partner. This supports Hypothesis 1, which posits a deterring effect of unstable partnership trajectories on the transition to motherhood, and aligns with prior evidence linking partnership instability to fertility postponement and higher levels of childlessness (Jalovaara and Fasang 2017; Mills et al. 2011; Raab and Struffolino 2020).

Second, while the number of partners is not strongly associated with the likelihood of having a second child, women who had two or more partners usually accelerated the transition to the second child once they had entered motherhood. This is consistent with Hypothesis 2, aligned with the notion of fertility recuperation after a delayed first birth or after more unstable life trajectories. It also reinforces existing evidence on the birth spacing compression and recuperation processes (Kreyenfeld 2002), including recent findings for Spain (Compans, Beaujouan, and Suero García 2023).

Third, as expected, there are notable differences by women's educational attainment, which moderates the relationship between partnership trajectories and fertility outcomes. In general, university-educated women are less likely to transition to first childbirth compared to less educated women, and when they do, they tend to do so later. However, among women who have had more than one partner, those with less education tend to follow trajectories similar to those of the university-educated, suggesting that highly

educated women seem to be better able to offset the negative effects of unstable partnership trajectories on the likelihood of having a first child than women with lower levels of education, confirming Hypothesis 3. Moreover, university-educated women who experience unstable partnership trajectories are more likely to transition to a second child and have shorter intervals between births than their lower-educated counterparts. This finding supports Hypothesis 4 and indicates that highly educated women are more capable of compensating for delayed entry into motherhood and overcoming the constraints posed by unstable partnerships. This fact also aligns with previous research showing that highly educated women have more control over their fertility and are more likely to meet their fertility desires and intentions (Beaujouan and Berghammer 2019).

An additional noteworthy finding concerns women who become mothers without ever having coresided with a partner. Although this situation is more common among women with lower educational levels (Garriga and Cortina 2017), likely reflecting unintended pregnancies, university-educated women who become mothers without a partner tend to do so at much older ages, likely facilitated by assisted reproductive technologies (ART) and reflecting a more deliberate transition to single motherhood. These findings call for further research on educational inequalities in access to and outcomes of ART (Suero, Compans, and Beaujouan 2025), as well as on the role of regulations allowing access to certain social groups, such as single women. Furthermore, the findings also raise questions about the real chances of raising a child as a single mother in Spain for women with different levels of education. An alternative or complementary explanation is that highly educated women may persist longer in the search for an ideal partner, driven by higher expectations, eventually transitioning to motherhood alone at later ages.

Overall, these results suggest that partnership situations remain one of the most important predictors of reproductive behaviours (Nishikido, Cui, and Esteve 2022), at least in the Spanish context. More specifically, partnership trajectories across the life course emerge as a key factor in understanding fertility postponement and the potential for fertility recuperation. Furthermore, the findings show how this relationship is moderated by women's level of education.

Methodologically, the study relies on event-history analysis techniques, employing Cox proportional hazard models and log-normal duration models to capture both the occurrence and timing of transitions to the first and second child. While these methods have some limitations – particularly regarding the influence of timing on the likelihood of transitions – the additional robustness checks strengthen the validity of the findings.

Despite the limitations, this study contributes significantly to the understanding of fertility postponement and recuperation by incorporating a new element: partnership trajectories. Additionally, the moderating role of education highlights relevant

inequalities that help explain recent shifts in the educational gradient of fertility (Vasireddy et al. 2023).

Spain represents a particularly informative case, as its extremely late fertility patterns may constrain the potential for fertility recuperation due to biological limits. While fertility recuperation among highly educated women has been documented in other European contexts, these countries have not yet experienced the same combination of very low and very late fertility. As postponement continues to spread across Europe, the Spanish case offers valuable insights into the future limits of fertility recuperation and the demographic consequences of sustained delays in family formation.

Overall, the research provides further evidence that the different partnership trajectories associated with the level of education are among the explanations for the higher likelihood of having a second child among highly educated women, despite delayed entry into motherhood. They thus help explain the evolving relationship between women's educational attainment and fertility.

7. Acknowledgements

This work was supported by grant PRE2018-086566, funded by MCIN/AEI/ 10.13039/501100011033 and ESF Investing in Your Future. I would like to acknowledge Teresa Castro, Teresa Martin, Alberto del Rey, Clara Cortina, and Marta Domínguez-Folgueras, as well as the three anonymous reviewers who reviewed the previous version of this manuscript, for their constructive feedback during the elaboration of the final manuscript.

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Appendix

Table A-1: Results of event-history analysis models predicting the occurrence and timing of transitions to first births by partnership trajectories

	Transition to first child																	
	Occurrence									Timing								
	Model 1			Model 2			Model 3			Model 1			Model 2			Model 3		
	HR	SE	p-value	HR	SE	p-value	HR	SE	p-value	Coeff.	SE	p-value	Coeff.	SE	p-value	Coeff.	SE	p-value
Partnership trajectories																		
No partners	0.064	0.003	0	0.066	0.003	0	0.085	0.004	0	0.732	0.027	0	0.579	0.019	0	0.555	0.019	0
One partner	1	.	.	1	.	.	1	.	.	0	.	.	0	.	.	0	.	.
Two or more partners	0.82	0.049	0.001	0.817	0.049	0.001	0.782	0.059	0.001	0.033	0.045	0.466	0.043	0.035	0.21	0.1	0.043	0.018
Country of birth																		
Native	0.794	0.027	0	0.803	0.027	0	0.804	0.027	0	0.249	0.015	0	0.195	0.012	0	0.195	0.012	0
Foreigner	1	.	.	1	.	.	1	.	.	0	.	.	0	.	.	0	.	.
Completed education																		
No	0.515	0.025	0	0.547	0.027	0	0.602	0.029	0	0.101	0.014	0	0.015	0.012	0.193	0.01	0.012	0.385
Yes	1	.	.	1	.	.	1	.	.	0	.	.	0	.	.	0	.	.
Educational attainment																		
Non-university education				1	.	.	1	.	.				0	.	.	0	.	.
University education				0.832	0.021	0	0.911	0.025	0.001				0.203	0.009	0	0.167	0.013	0
Partnership * Education																		
No partners * Non-university							1	.	.							0	.	.
No partners * University							0.333	0.033	0							0.081	0.019	0
One partner * Non-university							1	.	.							0	.	.
One partner * University							1	.	.							0	.	.
Two+ partners * Non-university							1	.	.							0	.	.
Two+ partners * University							1.127	0.139	0.334							–0.138	0.072	0.054
Constant										2.672	0.029	0	2.792	0.021	0	2.807	0.021	0

Note: Results are presented as hazard ratios in the Cox regression models and as coefficients in the log-normal duration models.

Table A-2: Results of event-history analysis models predicting the occurrence and timing of the transitions to second births by partnership trajectories

	Transition to second child																	
	Occurrence									Timing								
	Model 1			Model 2			Model 3			Model 1			Model 2			Model 3		
	HR	SE	p-value	HR	SE	p-value	HR	SE	p-value	Coeff.	SE	p-value	Coeff.	SE	p-value	Coeff.	SE	p-value
Partnership trajectories																		
No partners	0.533	0.035	0	0.488	0.032	0	0.514	0.037	0	0.491	0.052	0	0.529	0.052	0	0.491	0.057	0
One partner	1	.	.	1	.	.	1	.	.	0	.	.	0	.	.	0	.	.
Two or more partners	0.956	0.064	0.503	1.052	0.071	0.453	1.08	0.087	0.338	0.054	0.064	0.397	-0.019	0.064	0.769	-0.02	0.078	0.793
Country of birth																		
Native	0.961	0.04	0.339	1.071	0.045	0.105	1.072	0.045	0.099	0.05	0.038	0.191	-0.005	0.039	0.896	-0.005	0.039	0.897
Foreigner	1	.	.	1	.	.	1	.	.	0	.	.	0	.	.	0	.	.
Completed education																		
No	0.697	0.236	0.286	0.658	0.221	0.214	0.659	0.221	0.214	-2.824	0.143	0	-2.877	0.145	0	-2.877	0.145	0
Yes	1	.	.	1	.	.	1	.	.	0	.	.	0	.	.	0	.	.
Educational attainment																		
Non-university education				1	.	.	1	.	.				0	.	.	0	.	.
University education				1.6	0.054	0	1.623	0.057	0				-0.396	0.031	0	-0.406	0.032	0
Age at first birth				0.961	0.003	0	0.961	0.003	0				0.027	0.003	0	0.027	0.003	0
Partnership * Education																		
No partners * Non-university							1	.	.							0	.	.
No partners * University							0.734	0.138	0.099							0.249	0.144	0.083
One partner * Non-university							1	.	.							0	.	.
One partner * University							1	.	.							0	.	.
Two+ partners * Non-university							1	.	.							0	.	.
Two+ partners * University							0.917	0.135	0.556							0.006	0.137	0.962
Constant										4.634	0.146	0	4.078	0.156	0	4.083	0.156	0

Notes: Results are presented as hazard ratios in the Cox regression models and as coefficients in the log-normal duration models.

Table A-3: Results of event-history analysis analysing the transition to the second child using trajectories up to the first child instead of trajectories up to the second child

	Transition to second child using trajectories up to first child																	
	Occurrence									Timing								
	Model 1			Model 2			Model 3			Model 1			Model 2			Model 3		
	HR	SE	p-value	HR	SE	p-value	HR	SE	p-value	Coeff.	SE	p-value	Coeff.	SE	p-value	Coeff.	SE	p-value
Partnership trajectories																		
No partners	0.729	0.033	0	0.642	0.031	0	0.672	0.034	0	0.265	0.029	0	0.122	0.029	0	0.092	0.032	0.004
One partner	1	.	.	1	.	.	1	.	.	0	.	.	0	.	.	0	.	.
Two or more partners	0.843	0.075	0.053	1.012	0.091	0.896	0.906	0.107	0.403	-0.334	0.056	0	-0.196	0.055	0	-0.205	0.072	0.005
Country of birth																		
Native	0.963	0.04	0.369	1.064	0.045	0.143	1.061	0.045	0.165	0.014	0.026	0.601	0.102	0.026	0	0.102	0.026	0
Foreigner	1	.	.	1	.	.	1	.	.	0	.	.	0	.	.	0	.	.
Completed education																		
No	0.698	0.236	0.286	0.663	0.222	0.22	0.666	0.223	0.226	1.261	0.71	0.076	1.274	0.67	0.057	1.263	0.669	0.059
Yes	1	.	.	1	.	.	1	.	.	0	.	.	0	.	.	0	.	.
Educational attainment																		
Non-university education				1	.	.	1	.	.				0	.	.	0	.	.
University education				1.605	0.054	0	1.623	0.057	0				-0.124	0.021	0	-0.137	0.022	0
Age at first birth				0.959	0.003	0	0.959	0.003	0				-0.026	0.002	0	-0.026	0.002	0
Partnership * Education																		
No partners * Non-university							1	.	.							0	.	.
No partners * University							0.747	0.098	0.026							0.208	0.08	0.009
One partner * Non-university							1	.	.							0	.	.
One partner * University							1	.	.							0	.	.
Two+ partners * Non-university							1	.	.							0	.	.
Two+ partners * University							1.316	0.235	0.125							0.024	0.109	0.826
Constant										-0.003	0.71	0.997	0.66	0.671	0.326	0.677	0.671	0.313

Notes: Results are presented as hazard ratios in the Cox regression models and as coefficients in the log-normal duration model.

Table A-4: Results of linear probability models predicting the occurrence of the transitions to first and second births by partnership trajectories

	Transition to first child									Transition to second child								
	Model 1			Model 2			Model 3			Model 1			Model 2			Model 3		
	Coeff.	SE	p-value	Coeff.	SE	p-value	Coeff.	SE	p-value	Coeff.	SE	p-value	Coeff.	SE	p-value	Coeff.	SE	p-value
Partnership trajectories																		
No partners	-0.292	-0.016	0	-0.293	-0.016	0	-0.226	-0.018	0	-0.056	-0.024	0.019	-0.146	-0.023	0	-0.145	-0.025	0
One partner	0	(.)	.	0	(.)	.	0	(.)	.	0	(.)	.	0	(.)	.	0	(.)	.
Two or more partners	-0.327	-0.03	0	-0.328	-0.03	0	-0.369	-0.036	0	-0.196	-0.048	0	-0.025	-0.047	0.59	-0.041	-0.059	0.484
Age at completing education	-0.006	-0.001	0	-0.004	-0.001	0	-0.004	-0.001	0	-0.001	-0.001	0.497	0.002	-0.001	0.19	0.002	-0.001	0.185
Country of birth																		
Native	-0.048	-0.02	0.014	-0.046	-0.02	0.02	-0.044	-0.02	0.024	0.016	-0.025	0.535	0.064	-0.024	0.008	0.064	-0.024	0.009
Foreigner	0	(.)	.	0	(.)	.	0	(.)	.	0	(.)	.	0	(.)	.	0	(.)	.
Educational attainment																		
Non-university education				0	(.)	.	0	(.)	.				0	(.)	.	0	(.)	.
University education				-0.046	-0.014	0.001	-0.011	-0.016	0.483				0.122	-0.019	0	0.121	-0.02	0
Age at first birth													-0.027	-0.001	0	-0.027	-0.001	0
Partnership * Education																		
No partners * Non-university							0	(.)	.							0	(.)	.
No partners * University							-0.256	-0.035	0							-0.009	-0.062	0.883
One partner * Non-university							0	(.)	.							0	(.)	.
One partner * University							0	(.)	.							0	(.)	.
Two+ partners * Non-university							0	(.)	.							0	(.)	.
Two+ partners * University							0.121	-0.064	0.059							0.042	-0.096	0.658
Constant	0.966	-0.028	0	0.943	-0.029	0	0.931	-0.029	0	0.697	-0.037	0	1.354	-0.049	0	1.354	-0.049	0

Note: Results are presented as coefficients.

Table A-5: Results of linear probability models predicting the occurrence and timing of the second child based on age at the first child

	Occurrence						Timing					
	Non-university educated			University educated			Non-university educated			University educated		
	Coeff.	Std. err.	P>|t|	Coeff.	Std. err.	P>|t|	Coeff.	Std. err.	P>|t|	Coeff.	Std. err.	P>|t|
Age at first child	-0.025	-0.002	0	-0.036	-0.003	0	-0.108	-0.015	0	-0.202	-0.022	0
Partnership trajectories												
No partners	-0.052	-0.107	0.625	-0.681	-0.266	0.01	2.042	-0.977	0.037	7.251	-1.764	0
One partner	0	(.)	.	0	(.)	.	0	(.)	.	0	(.)	.
Two or more partners	0.63	-0.47	0.18	0.788	-0.687	0.252	1.096	-4.707	0.816	-6.026	-5.546	0.278
Partnership * Age at first child												
No partners * Age	-0.004	-0.004	0.385	0.018	-0.009	0.038	-0.057	-0.042	0.172	-0.2	-0.06	0.001
One partner * Age	0	(.)	.	0	(.)	.	0	(.)	.	0	(.)	.
Two or more partners * Age	-0.02	-0.013	0.137	-0.02	-0.019	0.275	-0.07	-0.142	0.62	0.176	-0.156	0.259
Age at completing education	0.003	-0.002	0.095	-0.001	-0.003	0.756						
Country of birth							-0.003	-0.012	0.782	0.003	-0.017	0.837
Native	0.024	-0.028	0.391	0.198	-0.05	0	0.268	-0.217	0.216	-0.936	-0.326	0.004
Foreigner	0	(.)	.	0	(.)	.	0	(.)	.	0	(.)	.
Constant	1.302	-0.058	0	1.692	-0.128	0	7.412	-0.461	0	10.7	-0.807	0

Note: Results are presented as coefficients.