

Exploring the educational gradient on the timing of the transition to the first child: variation across 52 provinces in Spain

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Delayed Reproduction: Challenges and Prospects*

Theoretical framework: Space and fertility

The relationship between women's education and fertility has evolved over time (Vasireddy et al., 2023). While in the past it **used to be negative** (Liefbroer & Corijn, 1999), recent findings reveal significant differences across **space** and **time** (Jalovaara et al., 2019; Wood et al., 2014).

Numerous works report significant differences across countries in fertility rates (Sobotka, 2017), parity progression ratios (Zeman et al., 2018), period fertility (Greulich & Toulemon, 2023), cohort fertility and ultimate childlessness (Beaujouan & Berghammer, 2019), or **the educational gradient of fertility** (Wood et al., 2014).

Cross-country comparisons, although highly informative, implicitly assume that countries are homogeneous units of analysis, disregarding the complexity within their frontiers. However, **the specific local context where individuals are born and raised might be a crucial moderator of the impact of education on fertility behaviors.**

Theoretical framework: Cross-regional analyses

Several works have reported variation within countries in parity progression (Grey et al., 2017), total fertility rates (Campisi et al., 2010), and childlessness levels and timing of fertility (Goldstein et al., 2011), but **cross-regional studies on the educational gradient in fertility are uncommon.**

Nisén et al. (2021) is a notable exception. The authors examined subnational variation (NUTS2 level) in the educational differential in cohort fertility rates in 15 European countries. They not only reported a **high degree of variation within countries** but also showed that **regions with higher economic development presented lower educational gradients.**

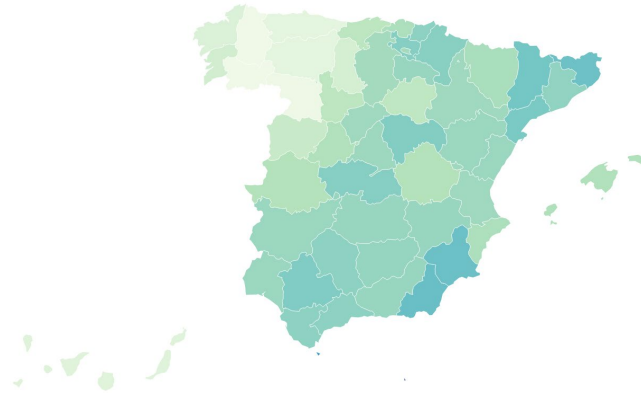
We join this line of research to examine **the cross-province (NUTS3) variation in the educational gradient in the occurrence and timing of the transition to the first child in Spain**, a country characterized by lowest-low and latest-late fertility.

The Spanish context

Spain is a highly decentralized country comprising two autonomous cities (Ceuta and Melilla) and 17 autonomous regions, which are further subdivided into 50 provinces.

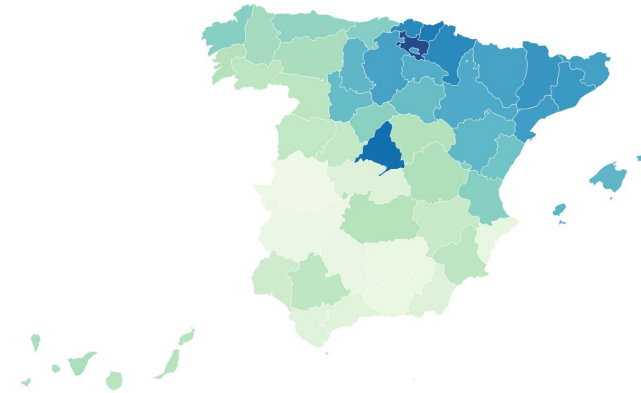
MIN Orense: 0.97
MAX Melilla: 2.49

Total Fertility Rate
1 2.5



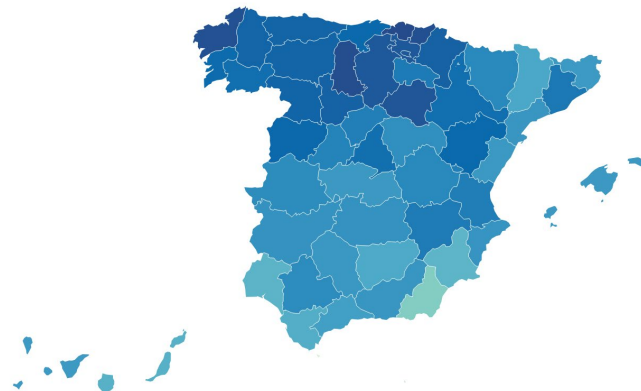
GDP per capita
15,850 34,200

MIN Cáceres: 15,853
MAX Álava: 34,200



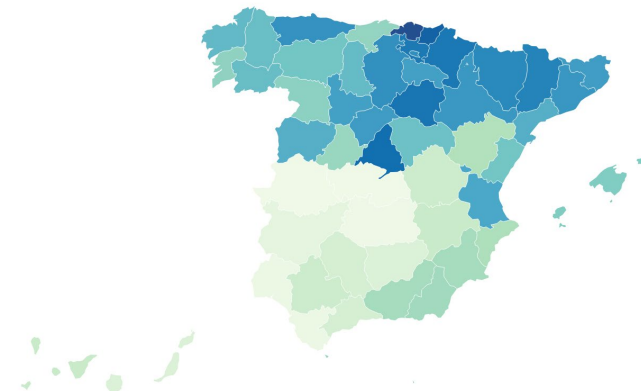
MIN Ceuta: 27.3
MAX Vizcaya: 31.5

Mean age at first birth
27 31.5



% university-educated women (18-50)
21 40

MIN Toledo: 21.0
MAX Vizcaya: 39.6



Data

We use data from the **2011 Spanish Population and Housing Census** (N = 4,107,465).

Spain has traditionally collected **the total number of children of each woman** in the census operation, but not children's birthdates

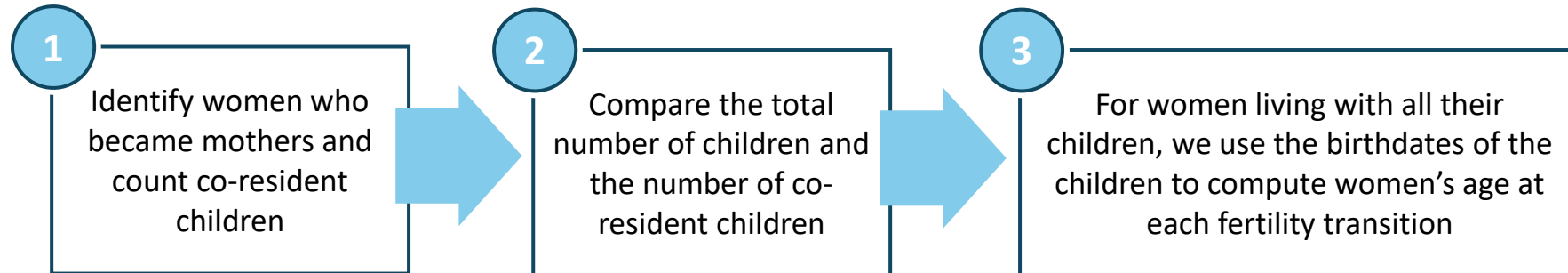


QUANTUM OF FERTILITY



TEMPO OF FERTILITY

Data on the timing of fertility can be retrieved from **co-resident children**:



It is not possible to reconstruct the reproductive history of women that do not co-reside with all their children

Data

It is possible to greatly limit this bias by considering women **below a certain age**:

Percentage of mothers that live with all their children for different age thresholds

	All mothers	<65	<60	<55	<50	<45
Original sample	1,218,454	822,599	713,188	600,301	470,715	335,181
Analytical sample	546,117	516,461	503,916	475,859	408,500	302,241
% retained	44.8%	62.8%	70.7%	79.3%	86.8%	90.2%

Total sample of **797,742 women aged 18-50** (born between 1961 and 1993): 408,500 mothers and 389,218 childless women.

Province samples range from **1,123 women born in Melilla** to **86,214 women born in Madrid**.

Method

We follow recent works on fertility behaviour (Beaujouan & Solaz, 2013; Cukrowska-Torzewska & Grabowska, 2023; Gray et al., 2010; Kreyenfeld et al., 2023) and employ **mixture cure models** to model the proportion of **university and non-university-educated women** born in each province who do not complete the transition to the first child (**cure fraction**) and the age at which 50% of those who completed that transition did so (**median age at first birth**):

$$S(t; x, y, z) = \pi(x) - (1 - \pi(x)) S_b(t; y, z)$$

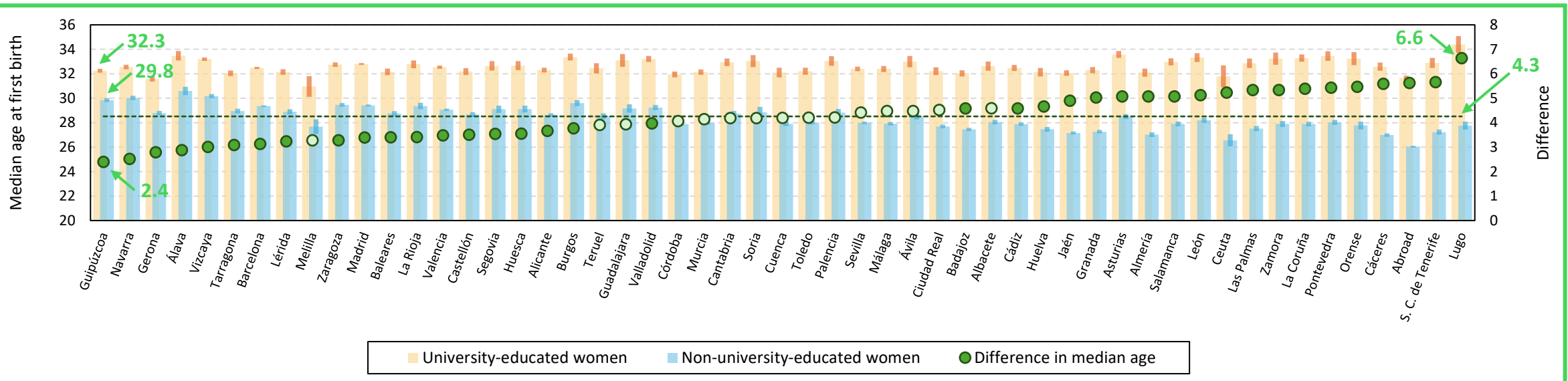
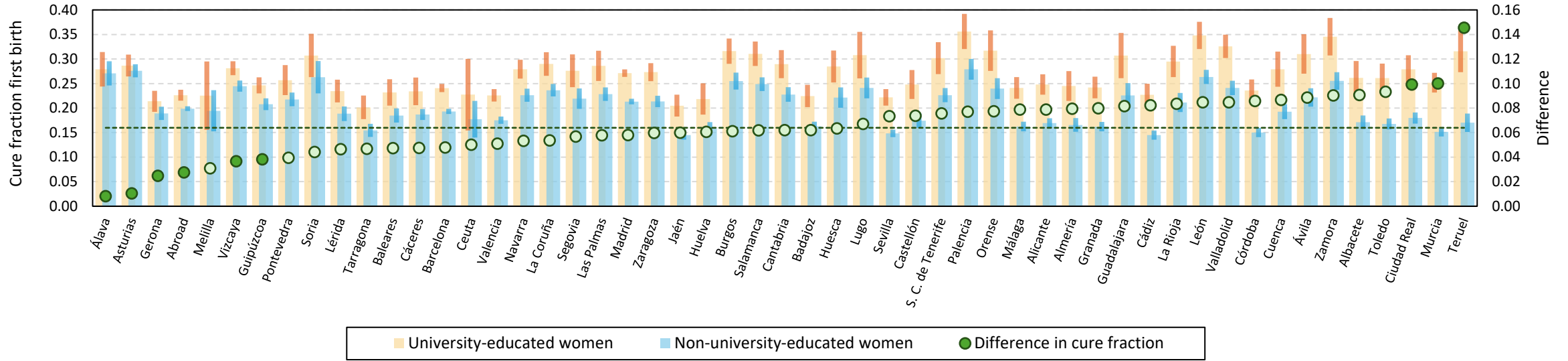
$$\pi(x) = \alpha + \beta x$$

$$S_m(t; y, z) = 1 - \theta \left(\frac{\ln(t) - \mu}{\sigma} \right) = 1 - \theta \left(\frac{\ln(t) - y\beta_y}{z\beta_z} \right)$$

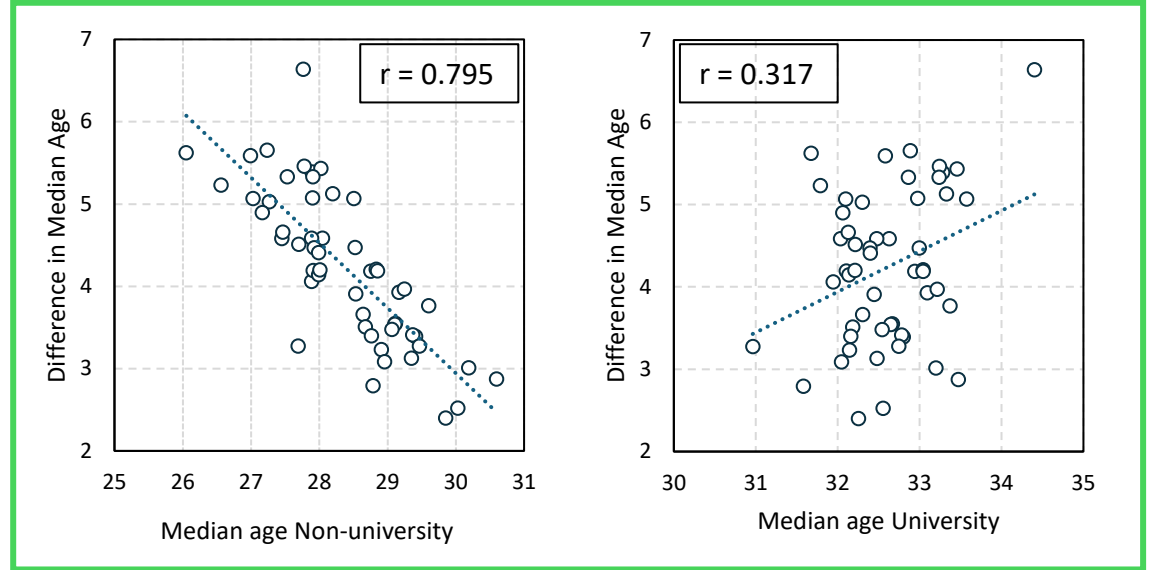
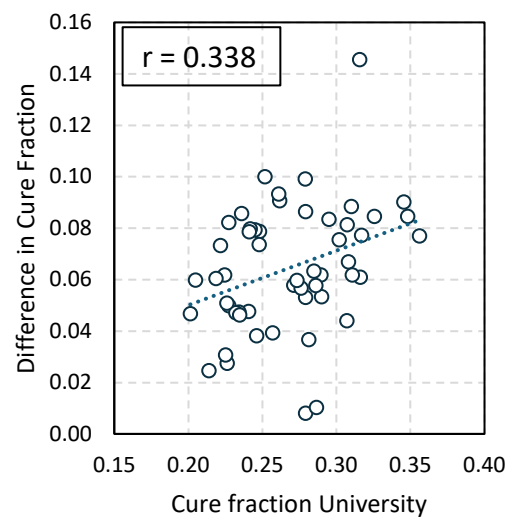
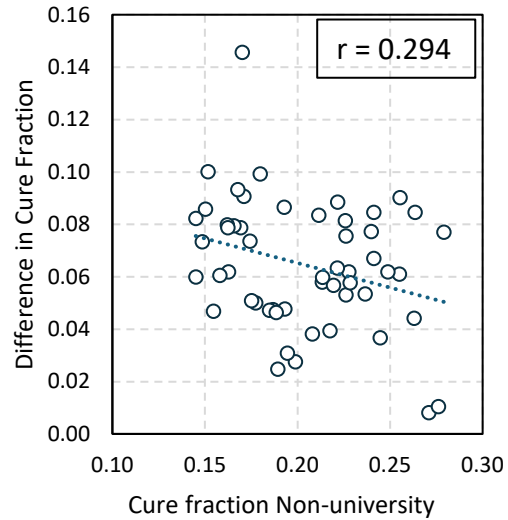
We use women's education (either **university- or non-university-educated**) as the sole predictor.

The model is estimated separately for each **province of birth**, with immigrants treated as an additional geographical unit.

Results



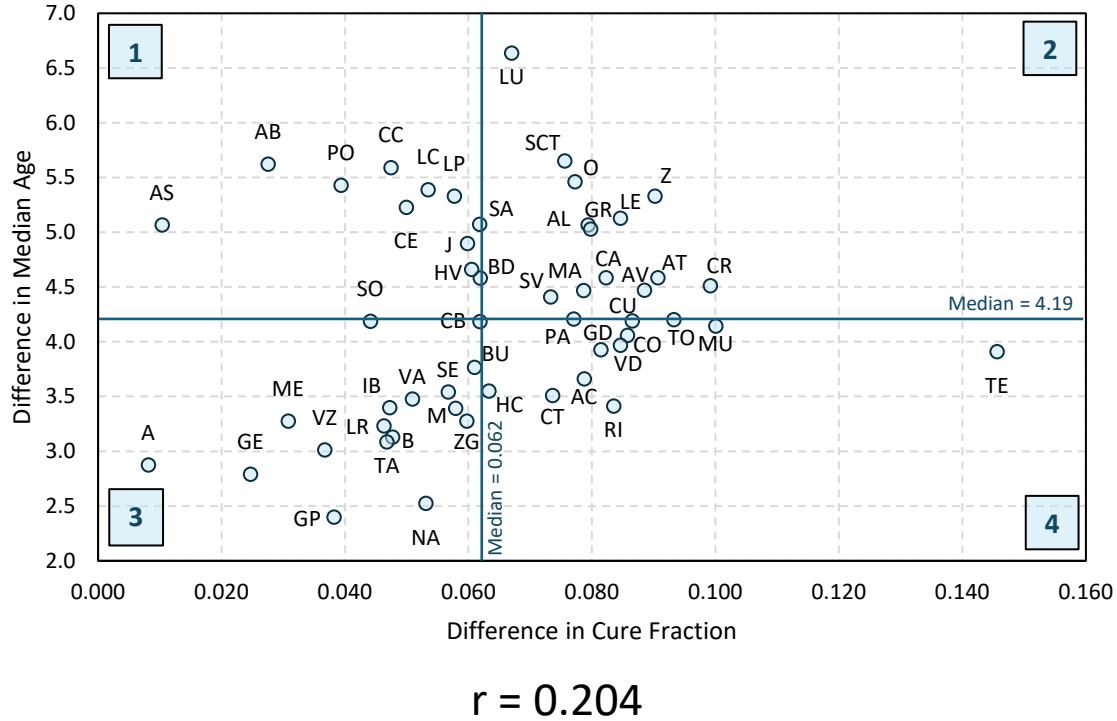
Results



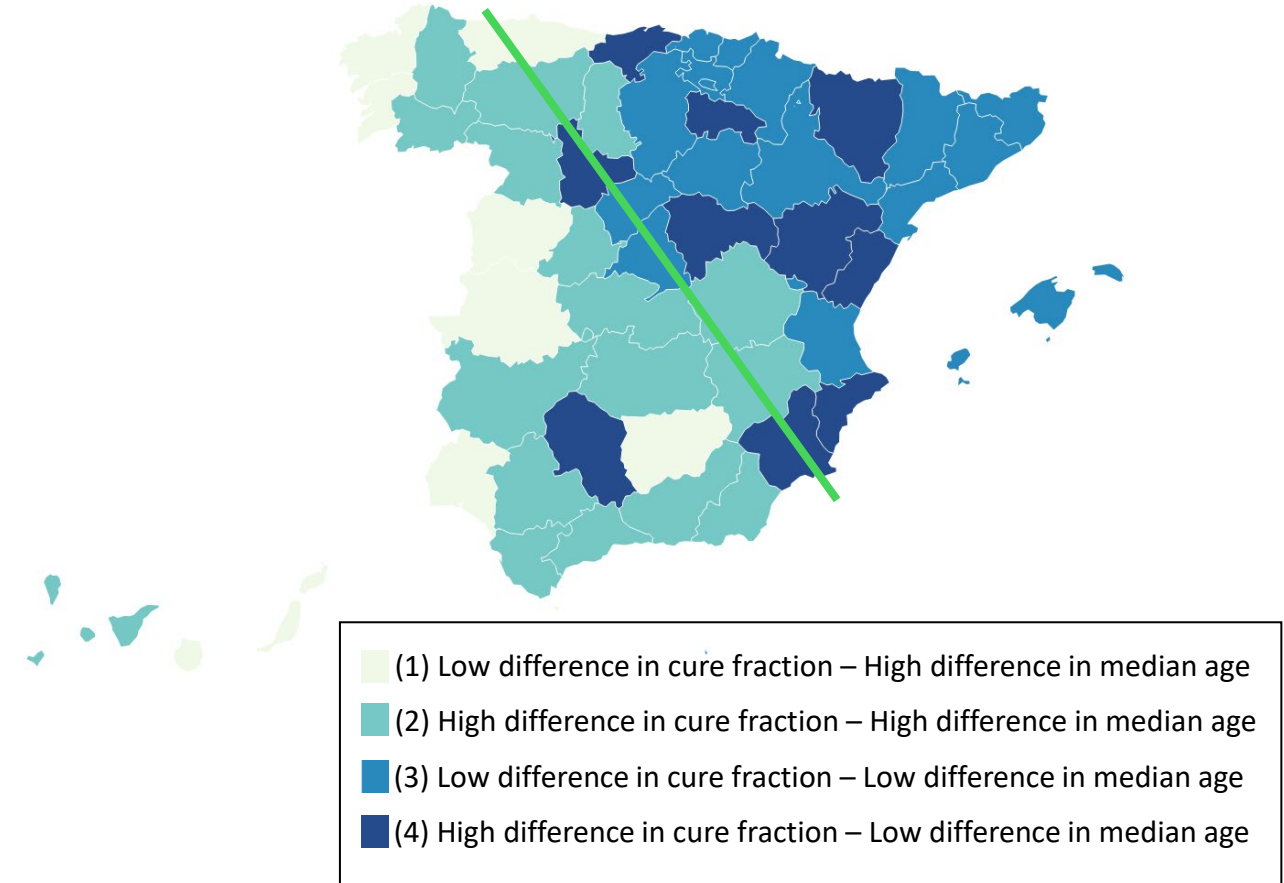
The cross-province variation in the impact of women's education on the timing of the transition to the first child has much more to do with **the variation across provinces among non-university-educated women** ($r = -0.79$) than with the behaviour of university-educated women ($r = 0.32$).

No such thing happens for the quantum of fertility, as the association between the difference by educational attainment in the cure fraction and the behaviour of university ($r = 0.34$) and non-university-educated women ($r = -0.29$) is moderate in both cases.

Results

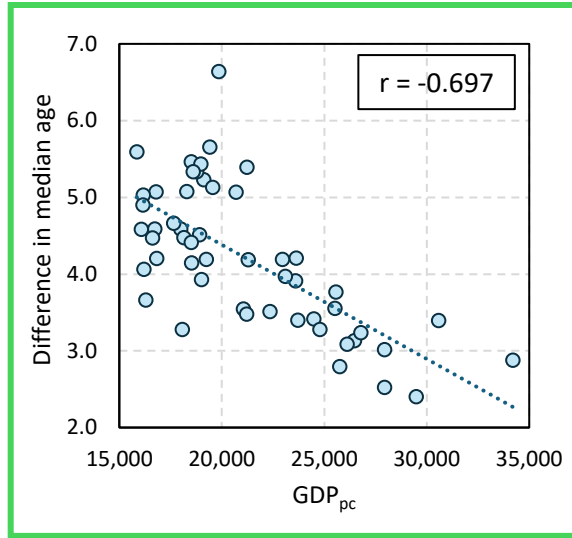
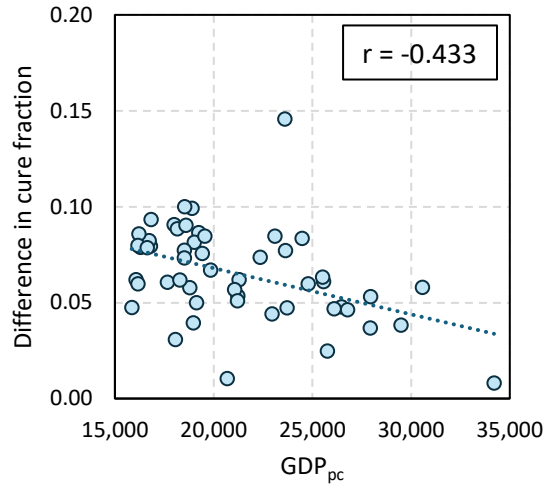


The cross-province correlation between the educational gradient in the cure fraction and the median age at first birth is **low**.

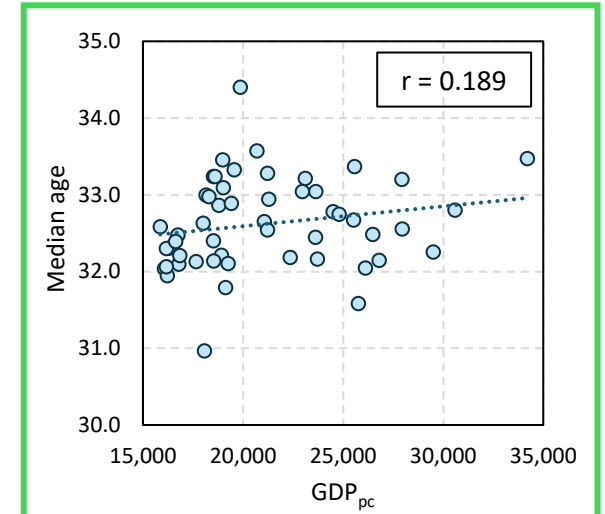
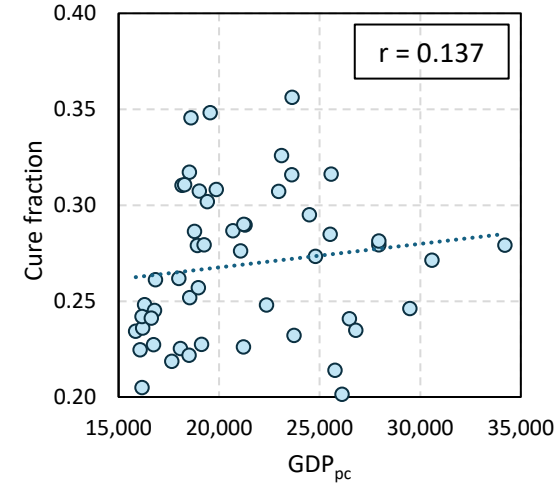


There is a geographical pattern in the educational gradient in age at first birth. Lower differences by educational attainment are observed in the **north-east and center of the country**, while higher differences concentrate in the west and the south.

Results



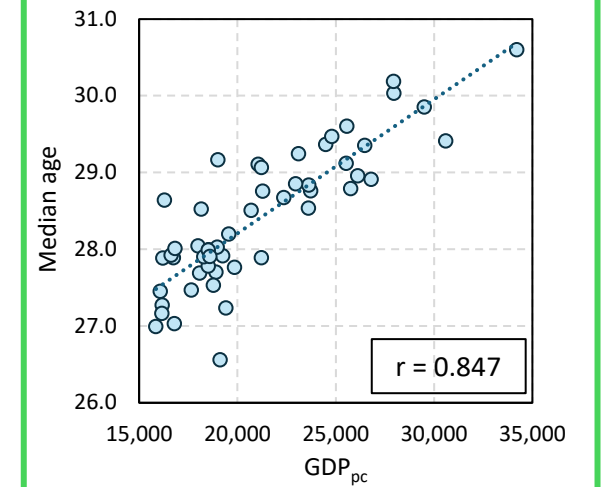
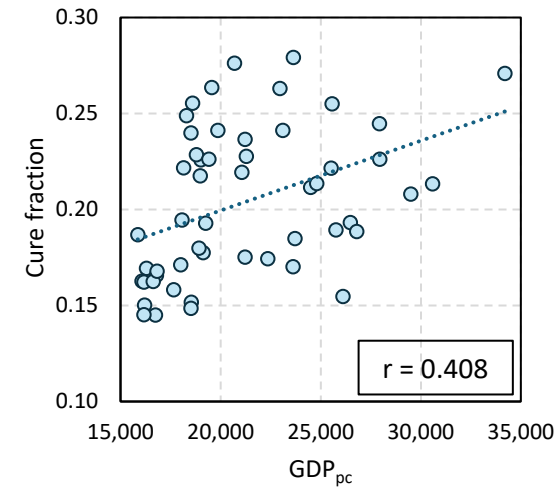
UNIVERSITY



There is a **strong negative correlation** between the educational gradient in the median age at first birth and the economic development of each province ($r = -0.697$).

The relationship between the median age at first birth and the GDP per capita fully disappears for university-educated women ($r = 0.189$), while is **extremely strong for non-university-educated women** ($r = 0.847$).

NON-UNIVERSITY



Robustness checks

Is selection into living with all children affecting our results?

NO

Is the composition of the non-university-educated group driving our findings?

NO

Are the results any different if we use women's province of residence instead of their province of birth?

NO

Are the results similar for the transition to the second child?

NO

Conclusions

1) Cross-country comparisons on the educational gradient in fertility, while insightful, disregard a substantial degree of **within-country heterogeneity**, treating countries as units more homogeneous than they really are.

2) It is in the **tempo of fertility** and not so much in the quantum where regional disparities in the educational gradient are clearer and where the relationship with the province's wealth is stronger. Simply using the number of children instead of our approach **would have obscured** this finding.

3) Controlling for all shared characteristics across Spanish provinces (legal framework, educational system, cultural traits...), the **wealth of the province (NUTS3) of birth** is a crucial moderator of the impact of attaining university education on the occurrence and, particularly, the timing of the progression to the first child.

As Spain is a latest-late fertility country, **university-educated women might have not margin for further delay in the transition to the first child**, hence their uniformity across the country irrespectively of the province's wealth.

THANK YOU!!

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Take-away messages

- 1) There is substantial variation across provinces in the educational gradient in the occurrence and, particularly, the timing of the transition to the first child.
- 2) The cross-province variation in the educational gradient in the timing of the transition to the first child has much more to do with behavior of non-university-educated women than with university-educated women, who behave much more uniformly across the country.
- 3) The educational gradient in the occurrence of the transition to the first child does not go hand in hand with the educational gradient in the timing of the transition.
- 4) Provinces in the North-East and Center of the country exhibit lower educational differences in the timing of the transition to the first child, while higher differences are observed in the West and the South.
- 5) There is a strong negative correlation between the educational gradient in the median age at first birth and the economic development of each province.
- 6) University-educated women behave quite similarly across provinces regardless of the wealth of the province of birth, while non-university-educated women became mothers significantly later if they were born in wealthier provinces.

Robustness check: Selection bias

Descriptive information for women aged below 50

	Original dataset	Restricted dataset
	(1)	(2)
<i>Number of children</i>		
Zero children	46.1%	48.8%
One child	19.5%	19.8%
Two children	27.7%	26.7%
Three children	5.3%	4.1%
Four children or more	1.3%	0.6%
<i>Age</i>		
18-25 years old	16.7%	17.9%
26-35 years old	27.8%	28.8%
36-45 years old	36.5%	36.5%
46-50 years old	19.0%	16.7%
<i>Educational attainment</i>		
Non-university	71.7%	70.3%
University	28.3%	29.7%
<i>Occupational status</i>		
Directors and managers	1.9%	2.0%
Professionals (STEM)	3.5%	3.9%
Professionals (non-STEM)	17.0%	18.3%
Employed - others	55.6%	54.7%
Unemployed	22.1%	21.2%
N	873,751	797,742

	Original dataset	Restricted dataset
	(1)	(2)
<i>Country of birth</i>		
Born abroad	10.8%	9.6%
Born in Spain	89.2%	90.4%
<i>Civil Status</i>		
Single	43.2%	45.9%
Married	50.0%	48.3%
Widowed	1.0%	0.8%
Separated	1.6%	1.3%
Divorced	4.2%	3.7%
<i>Region</i>		
Northeast	37.6%	37.8%
Northwest	16.8%	16.7%
Centre	18.9%	19.0%
South	26.8%	26.5%
N	873,751	797,742

Mothers living with all their children have a **lower average number of children**, are **slightly younger**, rather **better educated**, and marginally more likely to **work as non-STEM professionals**, be **born in Spain**, and **stay single**.

Robustness check: Selection bias

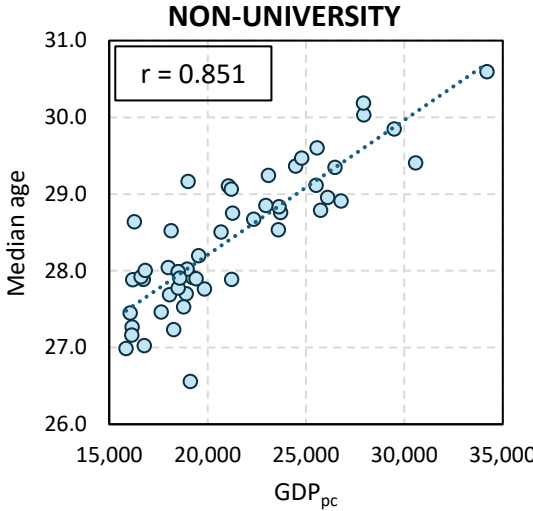
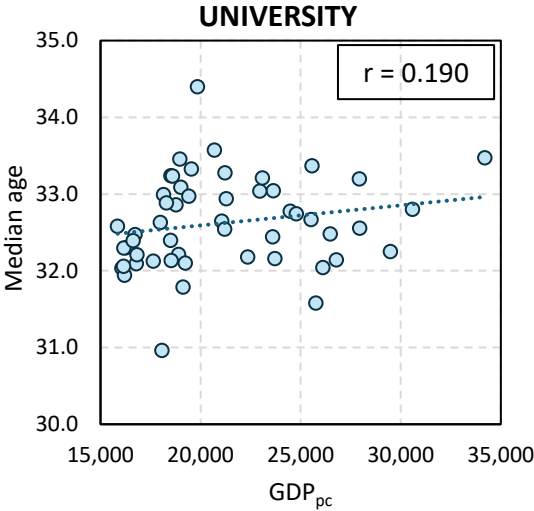
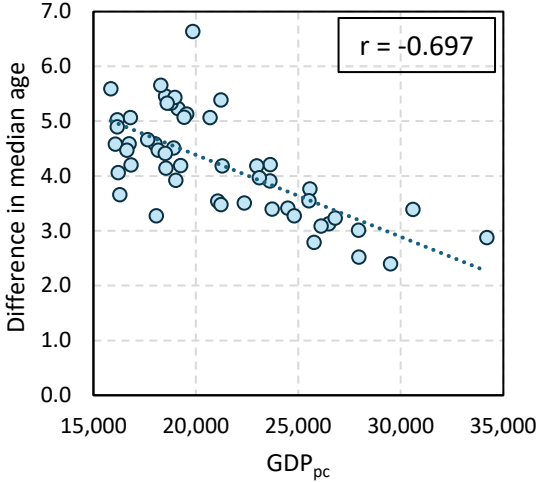
Descriptives for women aged below 50

	Original dataset	Restricted dataset	Restricted dataset (weighted)
	(1)	(2)	(3)
<i>Number of children</i>			
Zero children	46.1%	48.8%	46.1%
One child	19.5%	19.8%	19.6%
Two children	27.7%	26.7%	27.7%
Three children	5.3%	4.1%	5.3%
Four children or more	1.3%	0.6%	1.3%
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N	873,751	797,742	797,742

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N	873,751	797,742	797,742

We use **Entropy Balancing** to produce a **set of weights** that **balances** the distribution of key covariates to mimic their distribution in the original sample.

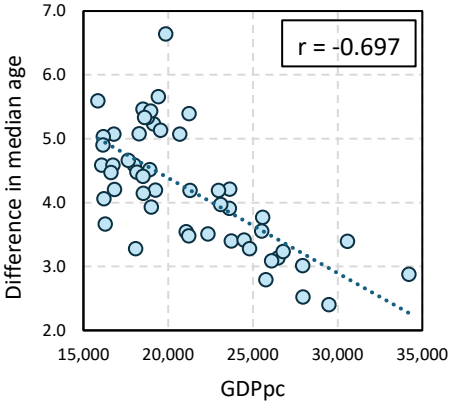
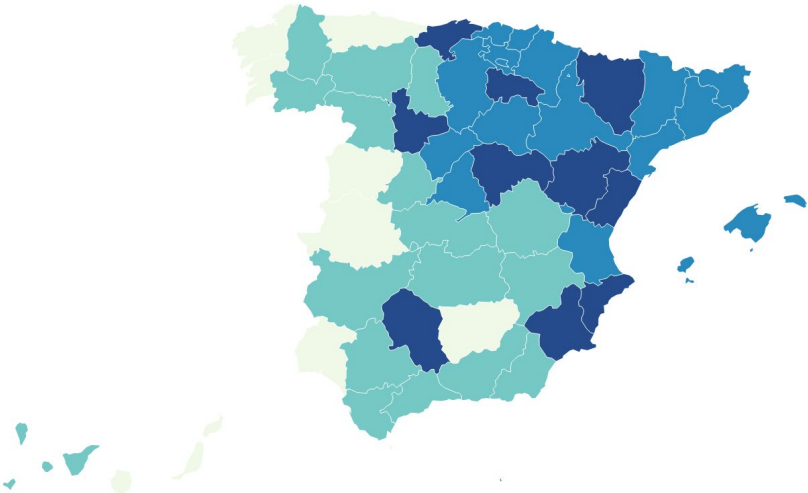
Robustness check : Selection bias



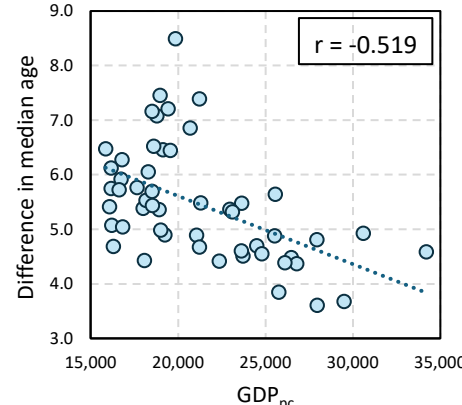
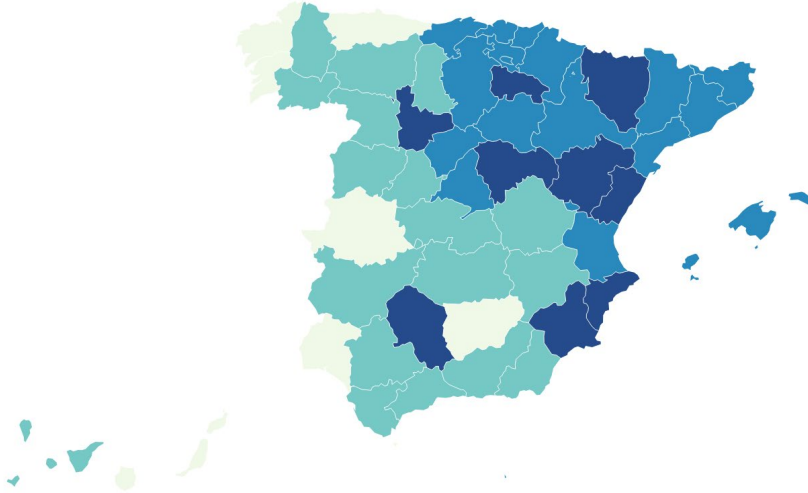
Robustness check: educational groups

We replicate the analysis comparing university-educated women with those who attained **compulsory education or less**(excluding women with intermediate education).

UNIVERSITY VS NON-UNIVERSITY

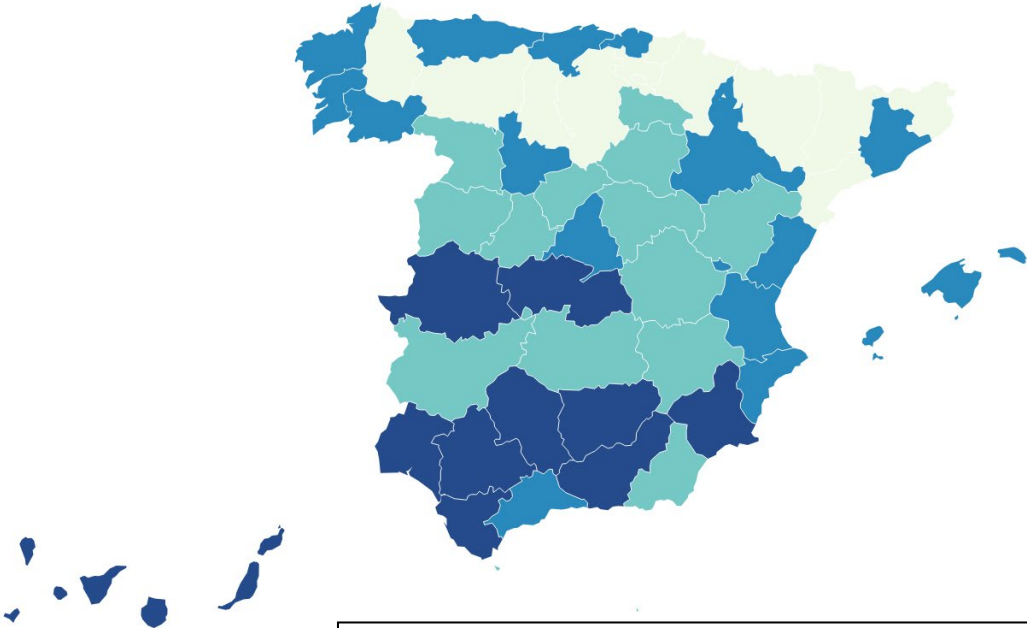


UNIVERSITY VS LOWER SECONDARY OR LESS



Robustness check: transition to the second child

TRANSITION TO THE SECOND CHILD



- (1) Low difference in cure fraction – High difference in median age
- (2) High difference in cure fraction – High difference in median age
- (3) Low difference in cure fraction – Low difference in median age
- (4) High difference in cure fraction – Low difference in median age

