



Wittgenstein Centre

FOR DEMOGRAPHY AND
GLOBAL HUMAN CAPITAL



The extension of compulsory education and fertility outcomes: evidence from two educational reforms in Spain

Valdés, M.T.¹; Suero, C.^{1,2}; Requena, M.³; Bernardi, F.³

1,University of Vienna.

2,Wittgenstein Centre for Demography and Global Human Capital.

3,National University of Distance Education (UNED).

RC-28 Spring Meeting
Seville, May20-22, 2026

1. Theoretical framework

- Progressive postponement of fertility and declining fertility rates across European countries, connected to the increasing level of education, particularly among women -> **negative relationship between education and fertility**, although changing during the last decades (Vasireddy et al., 2023).
- There are two ways in which education influence fertility:
 - Through the **time spent in education** -> educational enrollment usually discourages childbearing (Ní Bhrolcháin & Beaujouan, 2012) -> postponement (Mills et al., 2011; Neels et al., 2014; Berrington et al., 2015).
 - Through the **attainment effect of education** -> highly educated women tend to have different characteristics that influence their fertility behaviors (Lesthaeghe 2014; Rindfuss et al., 1980).
- Policies **extending compulsory schooling years** may shape fertility behaviors through two channels:
 - **Incarceration effect.** Extended time in a supervised environment limits engagement in behaviors associated with early pregnancy. This effect may be also prolonged in time (DeCicca & Krashinsky, 2020; Geruso & Royer, 2018).
 - **Human capital effect.** If extending years increases the level of education, highly educated women usually have different reproductive patterns (postponed fertility, higher childlessness, etc.) usually associated to a substitution effect. (Berrington et al., 2015).



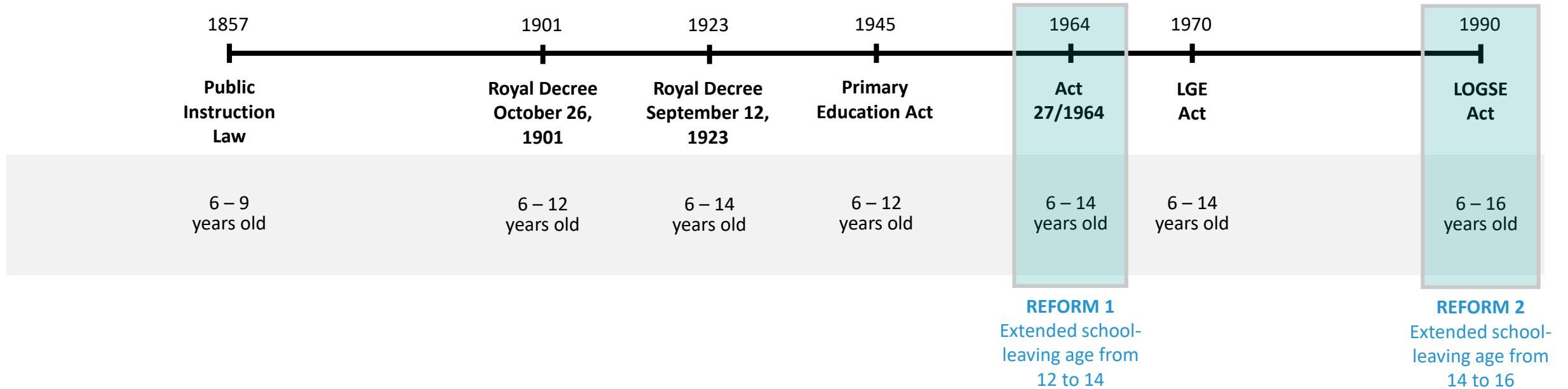
1. Theoretical framework

Table 1. Previous research using compulsory education laws as instruments to estimate the effect of education on fertility

Reference	Country	Year(s) of the reform	School-leaving age	Results
Black et al. (2008)	Norway	1960-72	14 → 16	Negative effect on early fertility (ages 15-20)
	US	-	-	Negative effect on early fertility (ages 15-20)
Cygan-Rhem and Maeder (2013)	West Germany	1946-69	14 → 15	Negative effect on completed fertility. Positive effect on childlessness. Negative effect on early fertility (ages 15-20). No effect at later ages
DeCicca and Krashinsky (2020)	Canada	-	-	Negative effect on fertility at ages 17-18
Fort (2006)	Italy	1963	11 → 14	Negative effect on fertility at ages 19, 20, 21. Positive effect on fertility at age 23
Fort et al. (2016)	Austria	1962-66	14 → 15	No effect on completed fertility in Continental Europe. Negative effect on completed fertility in England
	Denmark	1958	11 → 14	
	Denmark	1971	14 → 16	
	France	1936	13 → 14	
	France	1959-67	14 → 16	
	Italy	1963	11 → 14	
	The Netherlands	1950	13 → 14	
	The Netherlands	1971-75	14 → 16	
	England	1947	14 → 15	
Geruso and Royer (2018)	England and Wales	1972	15 → 16	Negative effect on fertility at ages 16-17. No effect on fertility at later ages. Negative effect on completed fertility. No effect on abortions
Güneş (2016)	Turkey	1997	12 → 15	Negative effect on fertility at ages 16, 17, 18, 19, 20, 21, and 22.
Kan and Lee (2018)	Taiwan	1968	12 → 15	No effect on completed fertility or the probability of childlessness
Liu et al. (2024)	China	1986-94	12 → 15	Negative effect on completed fertility
Monstad et al. (2008)	Norway	1960-1972	14 → 16	No effect on completed fertility or childlessness. Negative effect on early fertility (ages 15-20). Positive effect on late fertility (ages 35-40)
Silles (2010)	Great Britain	1947	14 → 15	Negative effect on teenage fertility
	Northern Ireland	1957	14 → 15	
	Great Britain	1972	15 → 16	
	Northern Ireland	1972	15 → 16	



2. The extension of compulsory education in Spain



REFORM 1. Compulsory education was declared mandatory until age 14 for all individuals born in 1954 and onwards.

REFORM 2. Basic education was defined as a compulsory educational stage, which implicitly implies that students must remain at school until the moment they turn 16.

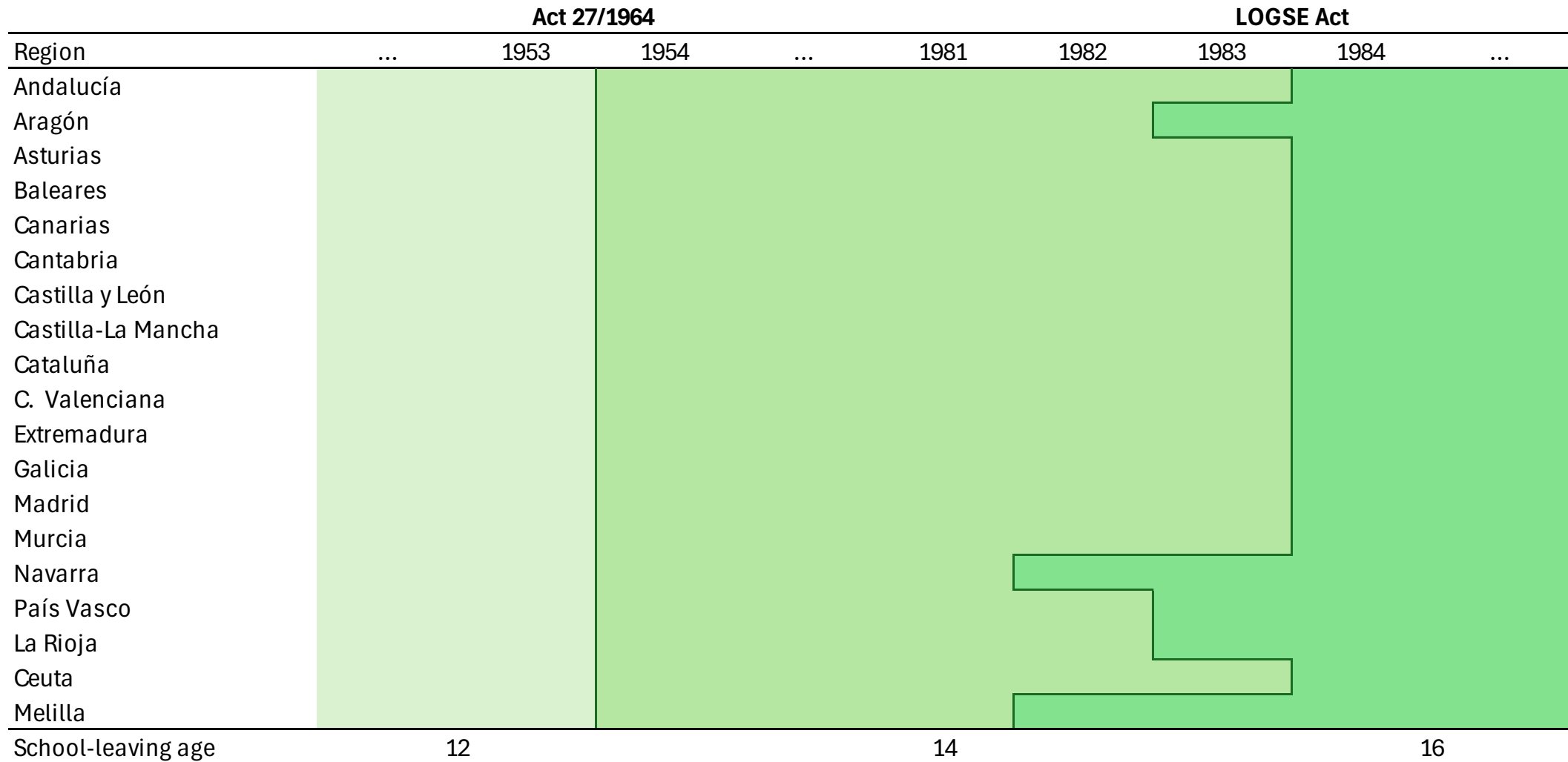
Implementation linked to the rollout of the new Lower Secondary Education stage (ESO). The first cohort affected was born in 1984, but there was regional variation:

Navarra and Melilla: 1982

Aragón, País Vasco, and La Rioja: 1983

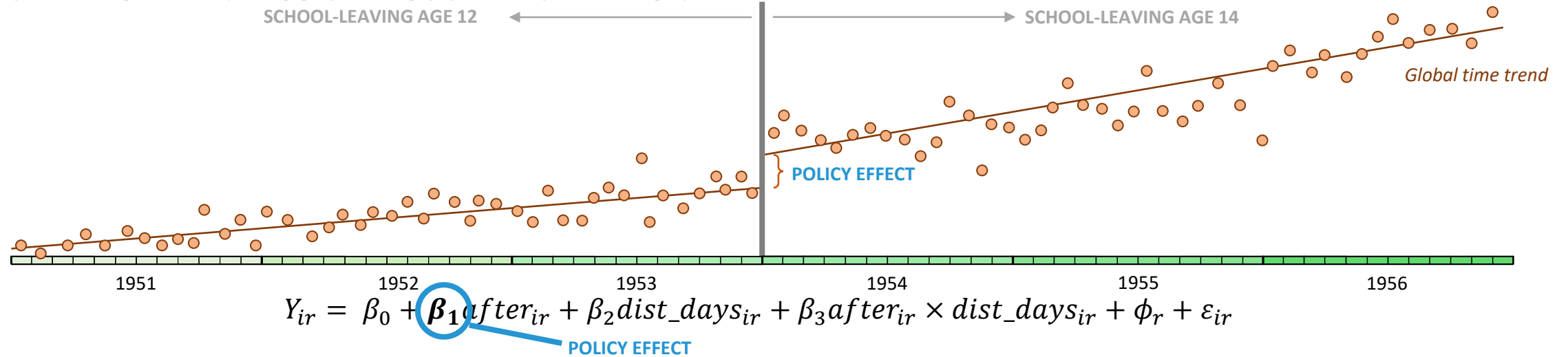


2. The extension of compulsory education in Spain

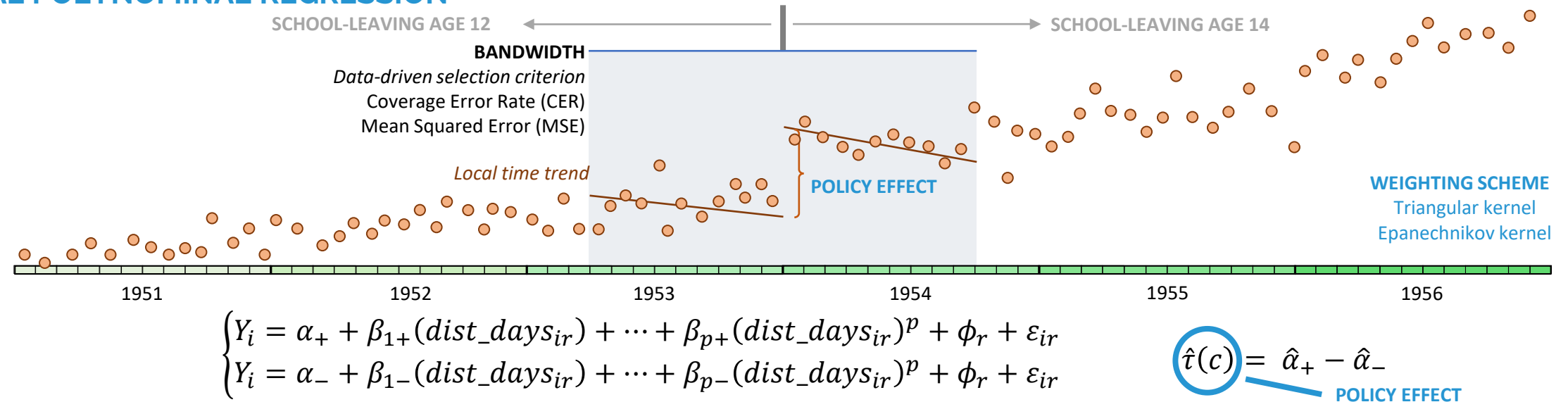


3. Methods

COHORT-BASED REGRESSION DISCONTINUITY DESIGN

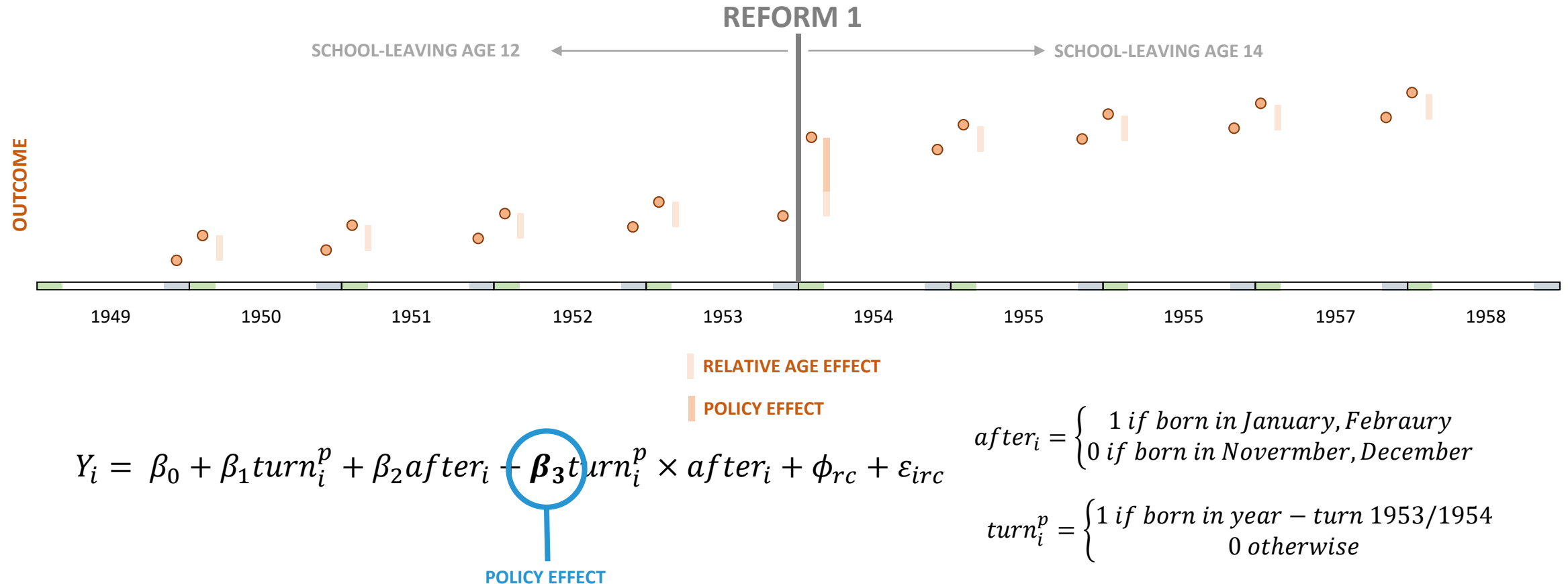


LOCAL POLYNOMIAL REGRESSION



3. Methods

DIFFERENCE-IN-DIFFERENCE APPROACH



Robustness checks: Alternative bandwidths around the cutoff: ± 1 month and ± 4 months. Using an additional dataset.



Placebo tests: turn takes value 1 for any other year-turn, faking a reform. Expected null effects for all those fake reforms.

4. Data

- 2011 Spanish Population and Housing Census (microdata consisting of around 10% of the universe).
- **FIRST ANALYTICAL SAMPLE – REFORM 1**
 - Sample definition: all women born in Spain around 1954 (57 years old).
 - RDD: 148,724 women born between 1951 and 1956 (three cohorts at each side of the cutoff, excluding Jan 1st).
 - DiD: 119,076 women born between 1947 and 1960 (seven cohorts at each side of the cutoff, born in the first and the last two months of the year, excluding Jan 1st).
 - Outcomes:
 1. Average **number of children**: Average number of children per women in the cohort RDD and DiD samples: 1.94 and 1.95, respectively.
 2. **Childlessness**: Proportion of childless women in the cohort RDD and DiD samples: 14,78% and 14,97%, respectively.



4. Data

- 2011 Spanish Population and Housing Census (microdata consisting of around 10% of the universe).
- **SECOND ANALYTICAL SAMPLE – REFORM 2**
 - Sample definition: all women born in Spain in the last cohorts required to stay in school until age 14 and the first ones required to stay until age 16 (around 27 years old), Mothers not living with all their children are excluded.
 - RDD: 111,411 women born between 1979 and 1986 (three cohorts at each side of the cutoff, excluding Jan 1st).
 - DiD: 87,013 women born between 1975 and 1990 (seven cohorts at each side of the cutoff, born in the first and the last two months of the year, excluding Jan 1st).
 - Outcomes:
 - 1. Entered motherhood at ages 15-16:** Observed among 0.28% of the cohort RDD sample and 0.27% of the DiD sample.
 - 2. Entered motherhood at ages 17-20:** Observed among 2.74% of the cohort RDD sample and 2.73% of the DiD sample.



5. Results

5.1. REGRESSION DISCONTINUITY DESIGN

Table 1. RDD estimates for the effect of educational reforms extending compulsory education on fertility

		Cohort RDD			Local polynomial regression RDD			
		(1)	(2)		(3)	(4)	(5)	(6)
Reform 1	Number of children	-0.017 (0.006) [0.019] **	-0.012 (0.014) [0.401]	-0.026 (0.011) [0.050] ** {222 days}	-0.033 (0.009) [0.013] ** {257 days}	-0.022 (0.013) [0.157] {187 days}	-0.023 (0.013) [0.164] {274 days}	-0.021 (0.013) [0.092] * {312 days}
	Childlessness	0.005 (0.002) [0.036] **	0.008 (0.005) [0.088] *	0.012 (0.006) [0.058] * {246 days}	0.012 (0.007) [0.086] * {401 days}	0.011 (0.006) [0.070] * {233 days}	0.011 (0.006) [0.058] * {305 days}	0.011 (0.004) [0.012] ** {454 days}
Reform 2	Child 15-16	-0.0004 (0.001) [0.567]	-0.0012 (0.001) [0.157]	-0.0024 (0.001) [0.004] *** {208 days}	-0.0025 (0.001) [0.015] ** {266 days}	-0.0022 (0.001) [0.017] ** {201 days}	-0.0026 (0.001) [0.001] *** {265 days}	-0.0027 (0.001) [0.009] *** {303 days}
	Child 17-20	-0.0002 (0.002) [0.909]	0.0029 (0.002) [0.247]	0.0040 (0.003) [0.316] {181 days}	0.0051 (0.005) [0.286] {271 days}	0.0040 (0.004) [0.320] {167 days}	0.0046 (0.003) [0.228] {230 days}	0.0033 (0.002) [0.160] {303 days}
Observation window		±3 years	±3 years	±3 year	±3 year	±3 year	±3 year	±5 year
Time trend		Linear	Quadratic	-	-	-	-	-
Polynomial		-	-	Order 1	Order 2	Order 1	Order 1	Order 1
Kernel		-	-	Triangular	Triangular	Epanechnikov	Triangular	Triangular
Bandwidth selection		-	-	CEERD	CEERD	CEERD	MSERD	CEERD
Region-fixed effects		Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: *** p-value ≤ 0.01; ** p-value ≤ 0.05; * p-value ≤ 0.10. Standard errors are in parentheses, p-values are in square brackets, and selected bandwidths are in curly brackets.

REFORM 1:

Negative impact of the extension of compulsory education from age 12 to 14 on completed fertility: lower number of children per woman and higher probability of childlessness.

REFORM 2:

Negative impact of the extension of compulsory education from age 14 to 16 on very early fertility: decrease probability of birth at ages 15-16, and a small positive effect on ages 17-20.

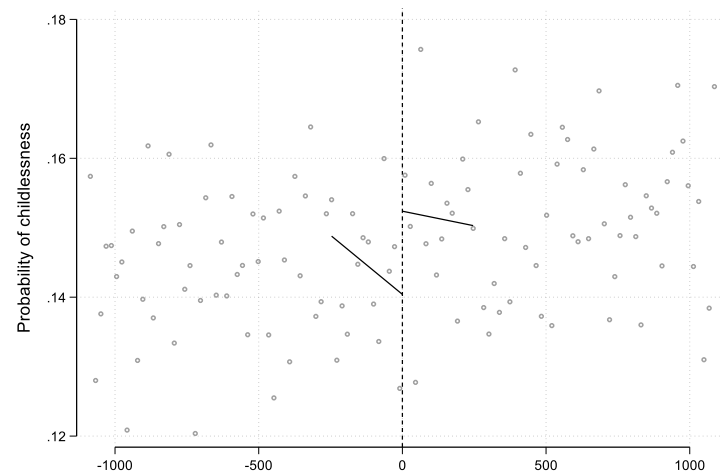
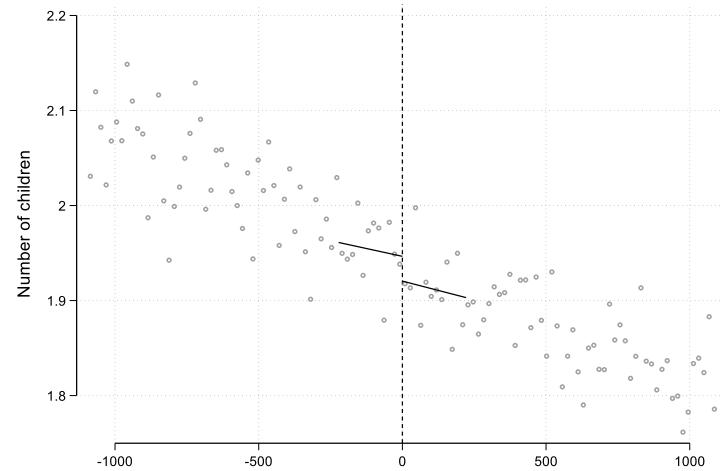


5. Results

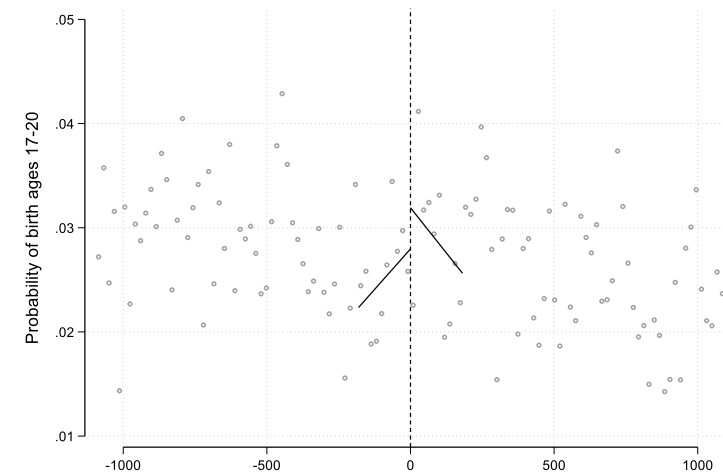
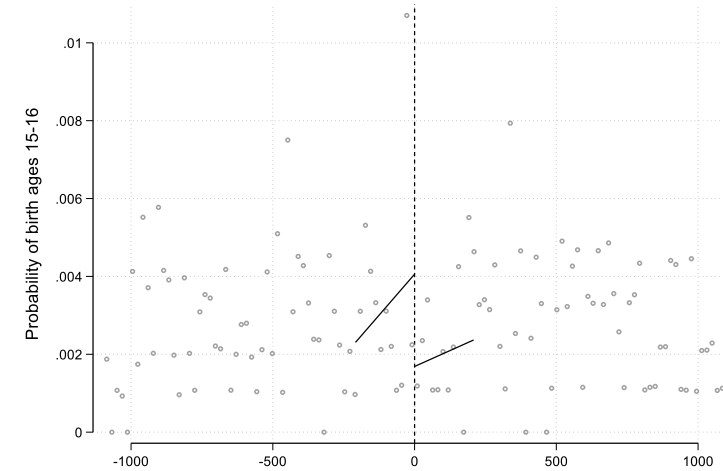
REGRESSION DISCONTINUITY DESIGN

RD PLOTS – Preferred specification

REFORM 1



REFORM 2



5. Results

5.2. DIFFERENCE IN DIFFERENCES

Table 2. DiD estimates for the effect of educational reforms extending compulsory education on fertility.

		(1)			(2)	(3)
		After	Turn ^P	After x Turn ^P	After x Turn ^P	After x Turn ^P
Reform 1	Number of children	0.037 (0.008) [0.000] ***	0.034 (0.022) [0.116]	-0.062 (0.032) [0.050] **	-0.023 (0.047) [0.628]	-0.014 (0.029) [0.625]
	Childlessness	-0.0004 (0.002) [0.858]	-0.0117 (0.008) [0.131]	0.019 (0.011) [0.101]	0.032 (0.016) [0.047] **	0.007 (0.007) [0.383]
Reform 2	Child 15-16	-0.0002 (0.0004) [0.686]	0.0022 (0.002) [0.032] **	-0.0038 (0.002) [0.050] **	-0.0070 (0.003) [0.006] ***	-0.0022 (0.001) [0.107]
	Child 17-20	-0.0004 (0.001) [0.763]	0.002 (0.006) [0.783]	0.0017 (0.006) [0.781]	-0.0017 (0.008) [0.828]	0.0037 (0.004) [0.408]
Bandwidth around the cutoff		+- 2 months			+- 1 months	+- 4 months

Note: *** p-value ≤ 0.01; ** p-value ≤ 0.05; * p-value ≤ 0.10. Standard errors are in parentheses and p-values are in square brackets.

REFORM 1:

Negative impact of the extension of compulsory education from age 12 to 14 on completed fertility: lower number of children per woman and higher probability of childlessness.

REFORM 2:

Negative impact of the extension of compulsory education from age 14 to 16 on very early fertility: decrease probability of birth at ages 15-16, and no effect on ages 17-20.



6. Conclusions

1. Extending compulsory education from ages 12 to 14 had a negative impact on fertility, **reducing the total number of children and increasing the probability of childlessness**.
2. Extending compulsory education from ages 14 to 16 significantly **reduced the probability of births at ages 15 to 16 but not beyond**; this is consistent with an **incarceration** effect.

WARNING! This is not to say that raising the school-leaving age reduces total fertility and the probability of teen births.

For the **well-defined population of compliers affected by the 1964 RD** and under the specific circumstances of the Spanish context of 1960s (i.e., high very early dropout and high and early fertility), prolonged compulsory schooling decreased final family size.

For the **well-defined population of compliers affected by the LOGSE Act** and under the specific circumstances of the Spanish context of the 1990s (i.e., high tertiary education completion, very low teen birth rate, and late fertility), prolonged compulsory schooling almost eliminated births at ages 15 to 16.

Currently low and late fertility levels in Spain are partly due to subsequent reforms extending mandatory schooling in the country -> long-term effects.

Implementing a policy may generate **externalities across different dimensions of individuals' lives**, highlighting the importance of education in shaping a wide range of life outcomes.



Thank you!

Cristina Suero

cristina.suero.garcia@univie.ac.at

Acknowledgements.

BIC.LATE receives funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant Agreement No 101001410).

