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Do property taxes affect fertility? Quasi-experimental evidence from Portugal

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Abstract

This paper uses a property tax decrease to obtain causal estimates of the impact of taxes on household fertility decisions. We combine administrative data on all births occurred in Portugal between 2004 and 2011 with fiscal, demographic and political data on 278 municipalities in mainland Portugal. Through a Difference-in-Differences strategy, we found that muncipalities that were forced to decrease property tax faced an increase in fertility comparing to their counterfactual. Additionally, we show that these effects are larger in households in which the mother is either portuguese, less educated or unemployed. The result is driven by second and higher order births.

Keywords: Fertility, Property tax, Income

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1 Introduction

For the last few decades societies have been concerned about the evolution of fertility rates. The decrease in levels of fertility is seen as one of the most problematic demographic changes, specially in European countries. In Portugal, the fertililty rate was 2.6 children per women in fertile age in 1976 and it almost halved by 2016, reaching 1.4 child per woman.[1] The study conducted by Population Reference Bureau, in 2017, found that Portugal in 2050 will achieve the 9 million of residents, representing more than 1 million decrease in population comparing to 2017.

The fertility survey[2] conducted by Statistics Portugal, in 2013, found that Portuguese households desire to have a average number of children higher than the reference value for replacement of generations however the expexted final fertility (i.e. number of children that households already have and plan to have in the future) was 1.78 children per household. The main determinants of fertility decisions identified by couples were financial constraints, labor market restrictions and parental responsibility concerns.

The relationship between population growth and the economy has been a major concern for economists since Malthus (1888) pioneering work that predicted a positive relationship between economic factors and birth rates. In contrast with earlier findings, the modern view claims a negative relationship incorporating recent trends faced by developed countries: countries were growing and fertility rates falling [Becker (1960)].

We analyse a property tax reform that ocurred in Portugal in 2008 to implement a quasi-experiment analysis of fertility choices by households in the 278 mainland municipalities, between 2004 and 2011. The reform consisted on decreasing the upper bound of the range within which municipalities could set the property tax paid by municipals. Therefore treated municipalities are those that were forced to decrease the property tax. Peralta and Pereira dos Santos (2018) uses a similar design to evaluate the effects of a

[1] Fertility rates data was collected from OECD database and is defined as the "total number of children that would be born to each woman if she were to live to the end of her child-bearing years and give birth to children in alignment with the prevailing age-specific fertility rates".

[2] Statistics Portugal collected a sample of households living in Portugal that included womens among 18 and 49 years old to produce Statistics-Portugal (2013).

reduction in local autonomy on the probability of re-election of affected mayors. Also, Alvarez and Pereira dos Santos (2018) report an increase in real estate values in municipalities which were forced to decrease the property tax, in comparison with control group.[3]

This paper aims to answer the question on how households' decisions respond to changes in property tax levels. We implemented a Difference-in-Differences identification strategy and found that treated municipalities face a increase in fertilty when compared to counterfactual municipalities. This effect is stronger for households with either less educated, unemployed or portuguese mothers. The result is driven by second order births.

We offer a contribute to the literature on the economic determinants of childbearing by identifying a causal relationship between income and fertility decisions. The point estimate, for the effect of property tax decreases on fertility, was 3.4% in the preferred specification which is robust to several tests.

We use a quasi-natural variation in tax rates to identify the effect of family disposable income on fertility decisions, improving upon the usual approach in the literature which relies on endogenous variables.[4]

The remainder of the paper is organised as follows: Section 2 provides an overview of the literature. The reform in property tax, that allowed to follow a quasi-experimental design, is explained in detail in Chapter 3. The database and estimation method used in our model are presented, respectively, in Section 4 and Section 5. Further on the achieved results are discussed as well as the robustness regressions and the heterogeneous effects. Lastly, Section 10 provides a summary of our results, policy recommendations and possible further research.

[3]Lyytikäinen (2012) uses a similar reform to study property tax competition.

[4]Lindo (2010) uses husband's job displacement and its income shocks. Black et al. (2013) evaluated a exogenous change in energy world price that lead to increases in men's incomes in the "Appalachian coal-mining region" that occurred in 1970s.

2 Literature Review

While the more classical works followed the Malthusian tradition, it is only in 1960 that Gary Becker inaugurates the modern microeconomic analysis of households decisions. He suggested that richer parents prefer to invest in child quality instead of quantity, leading them to have less children.[5] Another hypothesis offered by Mincer (1963) or Becker (1965) suggests that fertility decisions are driven by the opportunity cost of time, and thus richer couples have less children.

The empirical determinants of fertility decisions include unemployment rates, taxes, government transfers, labor market conditions, education or economic uncertainty were all used. [Lee et al. (2018); Lavy and Zablotsky (2015); Kearney and Wilson (2018)]

For example, Schaller (2016) showed that overall unemployment rates are associated with decreasing fertility. This author also studies gender-specific labor market conditions and finds that improved labor market conditions for men increase birth rates but have the opposite effect for women. In Portugal, Lopes (2018) evaluated the effect of labour market flexibility on fertility decisions and discovered that fixed-term jobs delay fertility decisions because job security of permanent contracts might play a key role in young women's decisions. Also, Ahn and Mira (2002) and Orsal and Goldstein (2010) find that increases in women's unemployment rate and total unemployment rate are, respectively, determinant for childbearing decisions.

The house cost channel may impact fertility decisions via an income or a wealth effect. The former is driven by decreases in taxation while the latter is a consequence of greater property prices.

Lino et al. (2017) showed that housing costs are the greatest portion of the annual cost of raising a child among housing, food, transportation, clothing, health care and various goods and services. Housing expenses include mortgage payments, property taxes, rents, insurance and maintenance and repairs. Lovenheim and Mumford (2013) evaluated the effect of home price changes on the likelihood of giving birth, concluding that increases

[5]See Becker and Lewis (1973) or Willis (1973) for the detailed discussion.

in housing prices lead to increases in birth rates among current homeowners (*home equity* effect), however there is no evidence for renters. The results are confirmed by Dettling and Kearney (2014) who showed a negative effect for home seekers. In both papers, the overall effect will depend on the rate of home ownership, in this case it is positive since most Americans own a home.[6]

3 The property tax reform of 2008

Local governments sources of funding are transfers from the central governments and the following municipal taxes: (i) a property tax (IMI), which the municipalities may set freely within a range decided by the central government; (ii) a corporate income surtax of up to 2.5% of the taxable profit of firms in the municipality; (iii) a personal income surtax of up to 5%; (iv) tax on property transactions (IMT) that can achieve 8% of house values and (v) taxes on vehicles (IUC).

Table 1 shows that the property tax accounts for more than one half of total taxes.[7]

Municipal taxes	**Amount collected (Thousand of Euros)**
Total	2 247 772,64
Tax on vehicles	183 816,60
Tax on property transactions	50 189,14
Property tax	1 167 864,15

Table 1: Amount of taxes collected in 2011 by local governments

We now give a brief description of the Portuguese property tax system. The property tax exists since 1963. In 2003, a reform introduced its current form, the IMI[8]. This new tax changed the way in which the fiscal value of the properties was computed. Therefore, each dwelling had to be reassessed to start being taxed under the new propery tax rate and it would still pay taxes according to the old tax code before being reassessed. The

[6]Foundations of the previous studies can be found in the work of Mian and Sufi (2009) which suggest that increased expectations on future house prices are one of the drivers of credit expansion.

[7]This data was collected in *Pordata* yet this information was not available other municipal taxes.

[8]*Imposto Municipal sobre Imóveis*

assessed constructions are those built or whose owner changed after 2003, the non-assessed comprise the remain.

We will refer as **new** property tax to the value charged by the municipalities to assessed dwellings. On the other hand, the tax charged to non-assessed dwellings will be refered as **old** property tax.

In 2008 the porperty tax faced a unexpected shock when central government announced a decrease in the upper limit of the range that local municipalities could set. The evolution of this system is described in Table 2 for the different types of properties.[9] As expected the reform had no impacts on municipalities that were already setting a lower tax than the new maximum, however others were forced to decrease it.

Year	Rural properties	Old property tax	New property tax
2003-2007	0.8%	[0.5%,0.8%]	[0.2%,0.5%]
2008-2011	0.8%	[0.5%;0.7%]	[0.2%,0.4%]

Table 2: Property tax reform of 2008

Municipalities set two different tax ratex, t_{old} and t_{new}, for the old and new property tax, respectively. Therefore, the reform creates two treatment groups. On the one hand, T_{old} comprises all the municipalities with t_{old} above 0.7%; on the other hand, T_{new} includes municipalities with t_{new} above 0.4%.

The group T_{old} comprises 127 municipalities and the remain 151 were imposing a property tax lower than 0.7%. In the new property tax, 94 municipalities are included in the treatment group. Lastly, 82 were treated in both taxes and 139 were C_{both}.

It is important to notice that the two property taxes have different impacts in the household's budget constraint. Since all traded properties fall under the new tax rate, it is only this one that can have an effect in dwelling through a capitalisation effect. By contrast, both taxes have a direct impact on household's disposable income.

The importance of property tax become clear when the government stablished *Cláusula de Salvaguarda* that defined a maximum increase limit in property taxes in case the

[9]The distinction between rural and urban properties has to do with the existence of approved contructions in the land

property value had increased over 15000 Euros. The creation of this security condition gives us evidence that the magnitude of the effect is reasonable if one bears in mind the importance of property taxes on household budgets.

The municipal revenue statistics are not detailed enough to allow us to measure the relative importance of the two taxes. However, some studies on the Portuguese housing market[10] suggest that population ranging from 30 to 50 years old are the group keen on buying a house. This leads us to study effects which are mostly concentrated on the new property tax rather than old one, because this is the share of population who will produce the effects that the paper captures.[11]

4 Database description

We use the administrative dataset of births that register all births ocurred in the country, together with rich information on the parents' education, country of birth, age and professional situation. Additionally, the dataset includes the indication of order of child birth for both parents and some characteristics about the new born such as birth weight. We concentrate on births ocurring in the 278 municipalities of mainland Portugal between 2004 and 2011 to focus on the effect of the 2008 reform.[12]

We aggregate births to the municipal level and combine this information with financial data from the government body for local institutions (DGAL) which gives the outcome variable – logarithm of the total of births per municipality. We sometimes also use subgroup totals along education, nationality or job status of the mother for robustness purposes.

[10] One example is *Observatório do mercado da habitação, Portugal* by Century 21 which evaluates the characterists of households demanding homes and the peculiar aspects of Portuguese housing market.

[11] Only between 2012 and 2013 all dwellings were assessed and therefore included in the new property tax system. This suggests that until 2011 (last year under analysis), the old property tax was still significant in terms of local government reveneus. https://www.jornaldenegocios.pt/economia/impostos/imi/detalhe/autoridade-tributaria-terminou-avaliacao-geral-de-49-milhoes-de-predios-urbanos

[12] Introducing a time range with years after 2011 may lead to misleading results because it would include the financial crisis period. Also, we exclude Azores and Madeira because they are significantly different of mainland Portugal with respect to form and range of taxes.

We used the Portuguese linked employee-employer dataset to compute the municipality immigrant share and educational level and the number of registered unemployed people in the municipality from the Local Employment Offices (*IEFP - Instituto do Emprego e Formação Profissional*). We obtained municipal fiscal and political information from *DGAI* (General Directorate for Internal Affairs'). Lastly, we have used data from *Quadros de Pessoal* to get information on each municipalities' municipality immigrant share and educational level.[13]

Table 3 provides the descriptive statistics of the outcome and control variables.

Variable	**Obs.**	**Mean**	**Standard deviation**	**Min**	**Max**
Dependent variable					
Number of births (log)	2224	4.97263	1.300139	1.609438	8.738094
Economic controls					
Unemployment rate	2224	6.573704	2.334364	1.439458	16.93281
Electricity Consumption PC	2224	4338.487	4812.513	1372.587	66560.67
Demographic controls					
Dependency ratio	2224	59.02198	12.10301	38.2387	108.7891
Graduates	2224	.0660788	.0322338	.0137672	.3024825
Population density	2224	.3115599	.8490376	.005	7.4112
Immigrant share	2224	.0805878	.0533251	.003268	.3374486
Sex ratio	2224	93.12891	3.367001	79.5	107.3
Share of fertile women	2224	43.21556	5.3695	25.2	55.6
Political controls					
Left-wing mandate	2224	.550953	.2537809	0	1
Public goods					
Hospital indicator	2224	.3133993	.4639795	0	1
Court indicator	2224	.743705	.4366848	0	1
Occupancy in pre-schooling	2224	92.6339	17.20888	36.1	225

Table 3: Descriptive statistics of the variables included in the analysis

We control for the economic conditions of the municipality, its demography and its political characteristics. The first has been shown to matter for childbearing decisions [Ahn and Mira (2002)].

[13] *Quadros de Pessoal* provides information with respect to working population of the municipality.

With respect to demographic conditions, we include population density, immigrant share, dependency ratio, sex ratio, percentage of fertile woman and education[14].

Ultimately, the main political control is the number of aldermen[15] seats controlled by list parties divided by the total number of alderman in the municipality. We also control for the provision of public goods with indicator variables for court and hospital and a rate of occupancy in the pre-schooling establishments.

5 Identification strategy

We implement a Difference-in-Differences estimation (DID) fixed-effects regression[16] where the treatment municipalities are the ones forced to decrease the property tax rate while the remaining ones as the comparison group.

$$\mathrm{y}_{it} = \alpha_i + \lambda_t + \gamma\, \mathrm{D}_i \times \mathrm{Y}_{it} + X'_{it}\beta + \epsilon_{it} \tag{1}$$

We use D_i to indicate the municipalities in the treatment group, i.e, those who had a tax rate above 0.7% in the old property tax or 0.4% in the new property tax. Y_t represents the treatment time – years after 2007 – and X_{it} all the covariates explained in previous section. The two other components that deserve consideration are α_i and λ_t which represents, respectively, municipality and year fixed effects.

The estimation of the average treatment on treated effect (γ) is given by the interaction between the variable that identifies treatment groups and the one characterising the time period.

The crucial assumption in this method is that the unobserved heterogeneity, the unobserved difference in the outcome between municipalities which were forced to decrease the property tax and the remaining, is time-invariant and cancelled out when estimating

[14]Percentage of employed with terciary education achievement. In line with Osili and Long (2008) and Lavy and Zablotsky (2015)

[15]Aldermen are the elected indivuals in each local government beyond the mayor. Their number will depend on the size of the population.

[16]The main supports of the identification strategy used here is the work by Angrist and Pischke (2008) and Khandker et al. (2009).

by DID. The first way to test the validity of this assumption is by checking pre-treatment trends in outcome between the two groups. We should expect them to stand parallel during the period under analysis. The second step is to run a placebo test using pre-treatment periods only and simulate a false treatment period. The latter will be presented in section 7 and it embodies a robustness assessment to the results here presented.

The assumptions of this estimation strategy will be evaluated in Section 6.1 by presenting the pre-treatment trends and the balanced tests, where mean differences of the two groups in the variables are incorporated in the study.

An extension of DID estimation strategy is an "event study" design which studies the dynamic effects of random shocks. This estimation allows to see the variation of average treatment effects across time by creating a setting where the panel receive treatment at all units of time.

We follow the same identification strategy adopted by Kleven et al. (2018) and Autor (2003) and implement an event study in the following form:

$$\mathrm{y}_{it} = \sum_{i=-3}^{4} \beta_j \, \mathrm{D}_i \times \mathrm{Y}_{it} + \rho X'_{it} + \alpha_i + \lambda_t + \epsilon_{it} \tag{2}$$

Where j= -3,..,4 and 0 equals the reform year. We omit the year before the reform (j= -1) which gives coefficients that estimate the reform impact relatively to this year.

6 Results

6.1 Assumptions

We begin by checking the "parallel trends" assumption. For this assumption to hold, the two groups (treatment and control) should evolve identically to the absence of treatment.

Figure 1 shows that trends on the log of the number of births are parallel before the reform. Firstly, we consider both, and later, for robustness purposes, we split the analysis between the two existing property taxes: old and new property tax that differ on

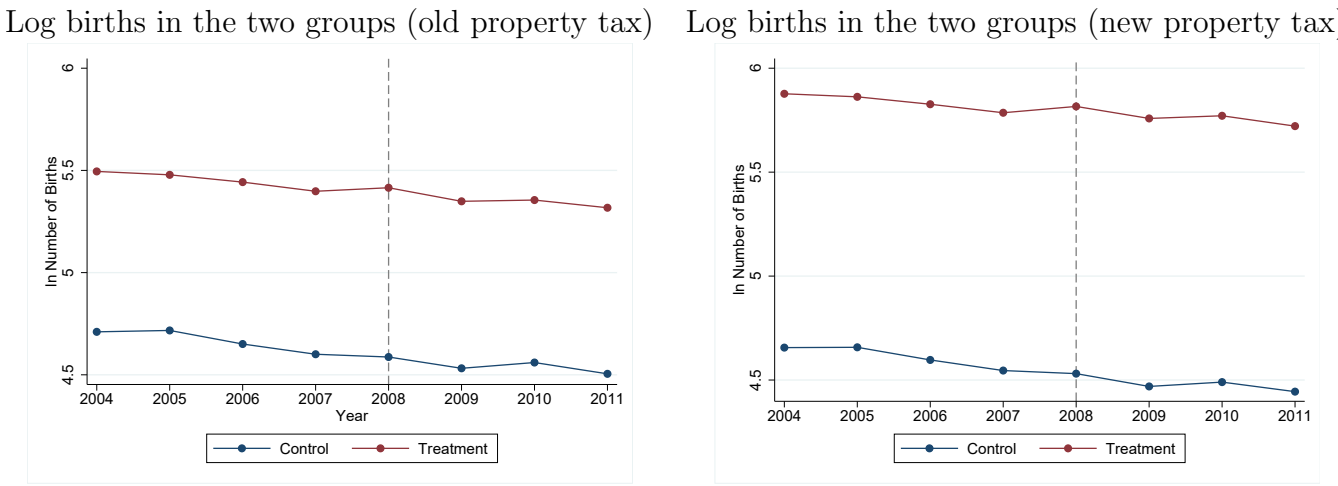

Figure 1: Common trends

assessment of dwellings after 2003.

Actually, until the year of the reform the two groups follow equal trends which suggest that unobserved heterogeneity is time invariant, thus not unfavourable to estimation results.

Another way to confirm the validity of the results is by testing the mean differences of variables of interest among the two groups in the year before the reform adoption, because the main challenge of impact evaluation is to ensure that the control group is similar to treated units in terms of observable characteristics. The results are shown in Table 4 for the reform that affected old property tax and in Table 5 for new property tax. In those tables, one can see that the differences among groups are larger when we study the reform that affected the old property tax.

It is shown that treated municipalities (T_{old} or T_{new}) present a higher mean in variables like population density, electricity consumption or share of fertile woman. In fact, the treatment group is composed mostly by urban municipalities. In order to control for this, we test the effect of reform in a sample without metropolitan areas (Lisbon and Oporto) and in a sample without each district's[17] main municipality. Also, in the next sections, there exists a specification that includes the interaction of population quintiles dummies and year dummies, to better control for differences through the two groups.

[17]District is the first level of administrative subdivision of Portuguese territory.

Variable	Treatment (T_{old})	Control	Difference
Economic controls			
Unemployment rate	6.950	6.571	0.379***
Electricity Consumption PC	4780.495	3955.460	825.035***
Demographic controls			
Dependency ratio	55.271	62.226	- 6,995***
Graduates	0.069	0.064	0.006***
Population density	0.443	0.201	0.243 ***
Immigrant share	0.081	0.084	- 0.002
Sex ratio	93.102	93.081	0.021
Share of fertile women	44.827	41.796	3.031***
Political controls			
Left-wing mandate	0.556	0.548	0.008
Public goods			
Hospital dummy	0.526	0.210	0.316***
Court dummy	0.795	0.693	0.102***
Occupancy in pre-schooling	89.884	95.249	0.202 ***

Table 4: Mean differences with respect to non-assessed properties

Variable	Treatment (T_{new})	Control	Difference
Economic controls			
Unemployment rate	7.075	6.575	0.500***
Electricity Consumption PC	5145.935	3916.736	1229.199***
Demographic controls			
Dependency ratio	53.404	61.932	-8.528***
Graduates	0.075	0.061	0.014***
Population density	0.644	0.141	0.503***
Immigrant share	0.094	0.077	0.017***
Sex ratio	94.029	92.907	0.543***
Share of fertile women	45.754	41.866	3.888***
Political controls			
Left-wing mandate	0.582	0.536	0.046***
Public goods			
Hospital dummy	0.526	0.210	0.316***
Court dummy	0.783	0.718	0.065***
Occupancy in pre-schooling	87.694	95.405	-7.711***

Table 5: Mean differences with respect to assessed properties

6.2 Baseline Results

Table 6 and 7 show the estimates of equation 1. Column (1) presents the simple regression with no controls, in column (2) are included the controls, Column (3) includes controls and the interaction between unemployment rate quartiles with year dummies, Column (4) adds to the controls a interaction between year dummies and nuts II dummies. Lastly, we present the main result in column (5) which combines controls with the interaction of population quintiles and year dummies.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Treat	0.029**	0.029**	0.027*	0.029**	0.013
	(0.014)	(0.014)	(0.014)	(0.013)	(0.013)
Controls	No	Yes	Yes	Yes	Yes
Unemployment Rate Quartiles x Year	No	No	Yes	No	No
NUTS II x Year	No	No	No	Yes	No
Population Quintiles x Year	No	No	No	No	Yes
Adjusted R2	0.2266	0.2432	0.2468	0.2630	0.25682

Notes: Standard errors in parenthesis are clusteres at municipal level and are robust to heretocedasticity. Stars indicate significance levels of 10% (*), 5% (**) and 1% (***).

Table 6: Baseline results for old property tax system (includes non-assessed properties)

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Treat	0.059***	0.055***	0.053***	0.039***	0.034**
	(0.013)	(0.014)	(0.014)	(0.013)	(0.015)
Controls	No	Yes	Yes	Yes	Yes
Unemployment Rate Quartiles x Year	No	No	Yes	No	No
NUTS II x Year	No	No	No	Yes	No
Population Quintiles x Year	No	No	No	No	Yes
Adjusted R2	0.2339	0.2490	0.2523	0.2642	0.2606

Notes: Standard errors in parenthesis are clusteres at municipal level and are robust to heretocedasticity. Stars indicate significance levels of 10% (*), 5% (**) and 1% (***).

Table 7: Baseline results for new property tax system (includes assessed properties)

The results show a positive impact for the new property tax reform on births. When the treatment group is defined by T_{old}, however, the significance of the result does not survive the inclusion of all controls. The magnitude of the effect estimated (in our preferred specification) represents an average yearly increase of 3.86 more children per municipality

using as reference the pre-treatment births.

We evaluate the treatment effect yearly, following equation (2), and found an effect in 2010, two years after the initial annoucement for assessed properties yet none for non-assessed as Figure 2 shows. This event study suggests that people take some time to make their decisions and as time goes by the reform becomes insignificant.

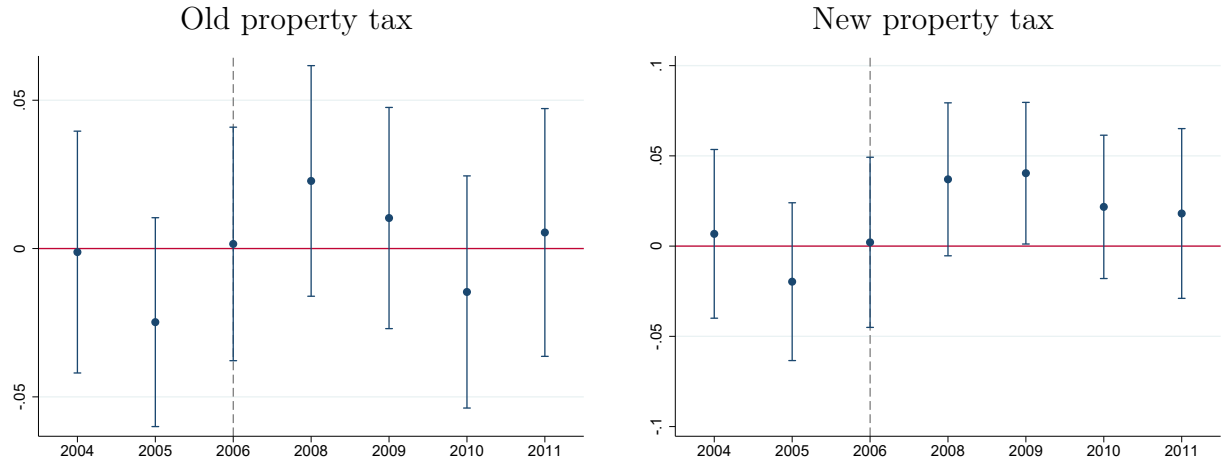

Figure 2: Event study

In the next sections, the analysis will be narrowed to the reform that ocurred on new property tax system (the one that includes assessed properties) not only because we believe that it is the most significant for the study but also due to its baseline results.

7 Robustness

We implement the following robustness checks: (1) exclude municipality that were setting a property tax lower than 0.3% to approximate control and treatment groups; (2) exclusion of metropolitan areas and each district's main municipality to exclude the more urban areas; (3) exclude year of 2011 to make sure that our results are out of the crisis period; (4) intensity of treatment to attribute importance to the amount of tax that each municipality decrease and lastly (5) placebo test. In all robustness checks, we include a simple specification with no controls and specification (2) includes population quintiles fixed effects with controls – our preferred specification.

We start by reducing the control group size by excluding those municipalities that set a property tax lower than 0.3% in the year before the reform. This way the analysis gives more homogenous groups. In Table 8 one can see that the coefficient of interest remains positive and significant, and the effect kept a similar dimension.

	(1)	**(2)**
Treat	0.059***	0.037**
	(0.014)	(0.014)
Controls	No	Yes
Population Quintiles x Year	No	Yes
Observations	2048	2048

Table 8: Restricted sample: exclude municipalities that were setting a property tax lower than 0.3%

Still adressing sample concerns, the estimations left out metropolitan areas and each district's main municipality in order to exclude more urbanized areas, this way the sample becomes more homogeneous without hurting the results. This allows to compare more similar municipalities by reducing the differences among treatment and control groups in terms of population and other economic variables. We show the results in Table 9 and 10, respectively. It can be seen that the coefficients are, consistently, positive and significant.

	(1)	**(2)**
Treat	0.052***	0.035**
	(0.014)	(0.015)
Controls	No	Yes
Population Quintiles x Year	No	Yes
Observations	2152	2152

Table 9: Exclusion of metropolitan areas

One major drawback of the approach is that it covers the financial crisis period. In Table 11 it is conducted a robustness check where 2011 is hidden of analysis, allowing for estimate the effects without IMF intervention on Portuguese economy. The estimated regression still presents a positive and significant effects in the strictest specification.

Until this point, we used municipalities forced to decrease their property taxes as treated units, however some of them experienced a higher decrease. So to get more reliable

	(1)	(2)
Treat	0.063***	0.039**
	(0.015)	(0.016)
Controls	No	Yes
Population Quintiles x Year	No	Yes
Observations	2080	2080

Table 10: Exclusion of each district's main municipality

	(1)	(2)
Treat	0.061***	0.035**
	(0.013)	(0.014)
Controls	No	Yes
Population Quintiles x Year	No	Yes
Observations	1946	1946

Table 11: Excluding 2011 of the analysis

results we allow for an "intensity of treatment" formulation through which the treatment variable is given by the amount of tax that municipalities were forced to decrease. As Table 12 shows the coefficient remains positive and significant.

	(1)	(2)
Treat	0.706***	0.447***
	(0.15)	(0.16)
Controls	No	Yes
Population Quintiles x Year	No	Yes
Observations	2224	2224

Table 12: Intensity of Treatment regression

Finally , we provide a Placebo test using the 2005 year as the treatment one and the sample is reduced to the pre-treatment period. Table 13, presents the results and, as expected, no significant effects were found by simulating a reform.

8 Heterogeneity

We now look for heterogeneous effects depending on mother's education, professional situation or nationality. We also evaluate the different dynamics depending on child

	(1)	(2)
Treat	0.022	0.003
	(0.016)	(0.018)
Controls	No	Yes
Population Quintiles x Year	No	Yes
Observations	1112	1112

Table 13: Placebo test

order and restricting the sample to womens between 20 and 40 years old.

In this chapter, we also provide a simple version of the model with no controls and a specification where we include the controls already discussed and population quintiles fixed effects.

It has been shown by reference that educational level matters for childbearing decisions as in Black et al. (2013) and in Table 14 we find a positive effect for less educated women. Also education may contribute as a *proxy* for wealth.

	High school		**Without high school**	
	(1)	(2)	(1)	(2)
Treat	0.015	-0.004	0.085***	0.054***
	(0.018)	(0.020)	(0.020)	(0.021)
Controls	No	Yes	No	Yes
Population Quintiles x Year	No	Yes	No	Yes
Observations	2224	2224	2224	2224

Table 14: With or without high school

The same analysis can be brought up for individual's current professional situation, this characteristic may affect fertility decisions since it somehow represents the individual's economic condition. Divinding the sample according to mother's profissional situation, by the time of the birth, we estimate an insignificant effect for employed mothers yet positive and significant for the rest (both inactive and unemployed mothers). The coefficientes estimates shown in Table 15 suggest stronger wealth effects for households in worse economic conditions, hence the same reasoning as education.

Also, dividing the sample by household's nationality delivers heterogenous effects. In Table 16 the effects are only significant when the mother is Portuguese, ehich may be

	Employed		Unemployed/Inactive	
	(1)	(2)	(1)	(2)
Treat	-0.065	0.018	0.062***	0.037***
	(0.044)	(0.043)	(0.013)	(0.014)
Controls	No	Yes	No	Yes
Population Quintiles x Year	No	Yes	No	Yes
Observations	2224	2224	2224	2224

Table 15: Heterogenous effects across mother's professional situation

explained through the rate of ownership among Portuguese and non-Portuguese since the property tax will influence wealth of households that currently own a house.

	Portuguese		Non-portuguese	
	(1)	(2)	(1)	(2)
Treat	0.056***	0.035**	0.034	-0.004
	(0.013)	(0.014)	(0.047)	(0.055)
Controls	No	Yes	No	Yes
Population Quintiles x Year	No	Yes	No	Yes
Observations	2224	2224	2224	2224

Table 16: Portuguese vs non-portuguese mother

Following Dettling and Kearney (2014), we test for heterogenous effects along order of birth and confirm their finding that higher order births are marginal and in the sense that they respond more to economic incentives.

	First order		High order	
	(1)	(2)	(1)	(2)
Treat	0.041**	0.012	0.080***	0.058***
	(0.016)	(0.017)	(0.018)	(0.020)
Controls	No	Yes	No	Yes
Population Quintiles x Year	No	Yes	No	Yes
Observations	2224	2224	2224	2224

Table 17: Child order

Restraining our sample to women in the age range where births are usually planned, and this respond to economic determinants, we confirm our results as Table 18 shows.

	(1)	(2)
Treat	0.051***	0.030*
	(0.014)	(0.015)
Controls	No	Yes
Population Quintiles x Year	No	Yes
Observations	2224	2224

Table 18: Sample restriction to womens within 20 and 40 years old

9 Evaluating income effect: narrowing the sample

The evidence in Section 6.2 can be confounded by the fact that some municipalities in C_{old} belong to T_{new}, and the other way around. We now implement our preferred specification in a subsample of municipalities that does not suffer from this caveat. More specifically, we exclude the municipalities that were control in one tax system while in the other treated (57 municipalities).

By doing this, we make sure that all households in treated units faced a disposable income increase while none household in control group was affected. These results, contrary to previous sections, do not need any assumption about which type of taxation the group of interest bears.

Table 19 shows positive and significant coefficients which gives extra support and relevance to the current argument.

	(1)	(2)
Treat	0.053***	0.027*
	(0.015)	(0.016)
Controls	No	Yes
Population Quintiles x Year	No	Yes
Observations	1768	1768

Table 19: Municipalities in which both property taxes decreased or remained constant

Together with the evidence found in Tables 6 and 7, this suggests that our result is driven by liquidity effects since all households faced an increase in disposable income and therefore they are comparable.

10 Conclusion

This paper estimates the causal effect of property taxes on household fertility decisions by exploiting quasi-experimental evidence for Portugal, using a reform of 2008 that decreased the upper bound of the range within which municipalities can set their tax rates.

Reducing the upper bound of the municipal tax rate upon properties - for both assessed and non-assessed properties - granted a quasi-natural experiment which allowed to exogenously divide the sample into control and treatment groups. Treated municipalities' governments experienced a decrease in reveneus yet, through lower taxation, population's disposable income rose.

The estimated effect between property tax and fertility is positive and it challenges convectional literature by offering a positive relationship between income and birth rates. Such estimate effect was significant at 95% significance level in different model specifications: sample excluding municipalities that were setting a property tax lower than 0.3%; excluding metropolitan areas and each district's main municipality; excluding 2011; a intensity of treatment formulation; and, lastly, a placebo test using only pre-treatment periods and simulate a false treatment period. This suggests that our results are not being driven by selection of households across municipalities. In terms of effect size, our estimation represents more 3.86 births, approximately, per municipality using as reference the pre-treatment births.

The effect was concentrated mainly on households that were composed by portuguese mothers, less educated and that were currently out of the job market. Additionally, the effect was larger for second order births.

Using education and professional situation as *proxies* for income, the effect is larger for households with higher financial constraints, as expected.

The main caveats of our research are due to data limitations. Ideally one would like to have data on the proportion of individuals that pursue a home in fertile ages or a direct measure on how many households are in each type of property tax (new and old property tax).

Our results might contibute to the discussion about how to tackle the decline in birth rates however we cannot neglect the limited effect estimated.

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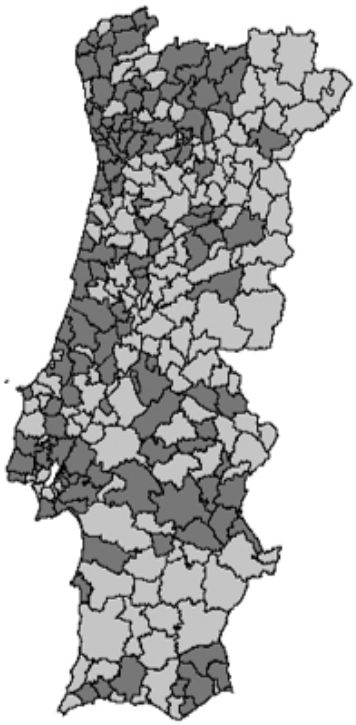
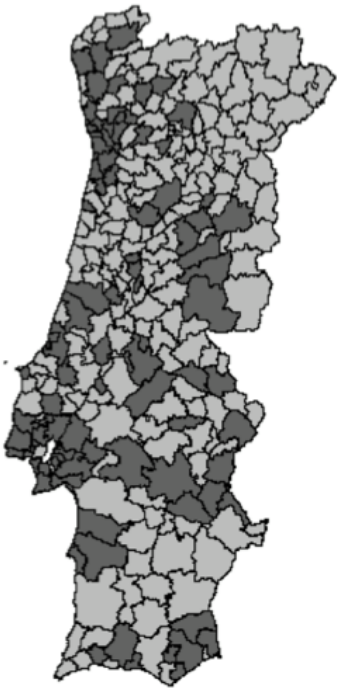
Annex



Dark: Treated municipalities
Light: Control municipalities

Figure 3: Treated and control muncipalities in reform on old property tax system: geographical distribution



Dark: Treated municipalities
Light: Control municipalities

Figure 4: Treated and control muncipalities in reform on new property tax system: geographical distribution

	Both parents portuguese		**At least one is not portuese**	
	(1)	(2)	(1)	(2)
Treat	0.049***	0,032**	0.103*	0.029
	(0.013)	(0.014)	(0.046)	(0.052)
Controls	No	Yes	No	Yes
Population Quintiles x Year	No	Yes	No	Yes

Table 20: Heterogenous effects across nationality of parents

	One parent have high school		**None have**	
	(1)	(2)	(1)	(2)
Treat	0.015	0.001	0.085***	0.05**
	(0.017)	(0.019)	(0.022)	(0.023)
Controls	No	Yes	No	Yes
Population Quintiles x Year	No	Yes	No	Yes

Table 21: Comparing subsamples with respect to high school achievement

	Both parents employed		**At least one unemployed**	
	(1)	(2)	(1)	(2)
Treat	-0,114***	-0.043	0.059***	0.034**
	(0.040)	(0.035)	(0.014)	(0.015)
Controls	No	Yes	No	Yes
Population Quintiles x Year	No	Yes	No	Yes

Table 22: Heterogeneous effects across professional situation