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Can countries reverse fertility decline? Evidence from France's marriage and baby bonuses, 1929–1981

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Abstract A number of countries have begun implementing tax incentives designed to reverse the decline in fertility. Whether such incentives are effective or equitable remains an open question. During the early twentieth century, France initiated an unusual tax policy to promote fertility and marriage: Household income was divided by family size to obtain a final tax bracket. The policy was regressive in that fertility incentives were so large and greatest among the rich. Similar policies whose fertility benefit increases with income are being implemented today. Using hand-collected archival data from aggregate tax returns and three natural experiments, I find mixed evidence that these kinds of tax incentives affect fertility and marriage.

Keywords Fertility · Tax policy · Natural experiment · Regressive tax

JEL Classification J13 · J11 · H20 · H31

1 Introduction

Can nations increase their citizens' reproductive rates? How can developed countries best alleviate the coming demographic crisis? Are economic incentives the best way to reverse the decline in fertility? Over the next 50 years, people over 65 will account for more than half the adult population and population will decline in many countries. Programs that support the elderly, like social security, will therefore become increasingly untenable and perhaps hamper economic growth or lead to political unrest. To prevent such consequences, some countries have begun implementing policies designed to increase fertility. For example, German courts ruled in April

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2001 that workers with children should pay lower premiums into compulsory insurance schemes than workers without children. In August 2000, Singapore introduced a $1.8 billion plan that included baby bonus and third child paid maternity leave schemes to encourage fertility. In November 2001, Australia announced a similar plan to boost fertility through tax refunds. Yet little is known about whether such policies actually work.

After World War II, France implemented a most unusual and regressive tax policy in order to reverse the decline in fertility. In most countries, the number of children is multiplied by a small, fixed deduction. In France, family incomes were divided by a factor, which increased with family size (the family quotient number), to obtain a final tax bracket—the tax advantage of having children thus increased with income. This policy is unique in that the monetary incentive for fertility was so large, greatest among the rich, and a potentially large transfer of income from the poor to the rich. If a dramatic policy such as this is found to have little effect, then less dramatic policies such as those currently being considered and implemented are likely to have little effect.

The primary challenge in estimating the effects of French pronatalist policy is to distinguish the effects of the intervention from secular time effects. Secular time effects may come from many sources. Eugenic interest in family allowances was growing over this period due to the fear of depopulation and relative increase in the number of poor and uneducated (Soloway 1990 and Schneider 1990), and the growth itself may have contributed to increased birth rates among high income groups. Recent observers suggest that placing the greatest tax burden on singles and childless couples and providing the greatest tax benefits for high income households, who were likely to spend more money on their children, was simply a way for the state to conduct distributive justice in a manner related to those in greatest financial need (Landais 2006). Regardless of the normative rationales put forward for the policy, the confounding effects of public debate emphasizing the need for population increases that accompanied the publicized tax incentives may affect behavior independent of the incentives themselves.

This paper uses the differential targeting of various populations with different economic incentives, provided by a series of policy changes from 1929 to 1981, to estimate the effect of tax policy on fertility. The identifying assumption is that secular time effects, such as those stemming from public debate about fertility, affects different population segments equally. Having several such policy changes and in different directions alleviates the identification problem: even if the assumption fails for one policy experiment, it is unlikely to fail for all three. My main identification strategy is a differences-in-differences approach that uses the differential incentives faced by families with different incomes. I focus on incentives faced by high-income families, since during the early part of the twentieth century, France only collected taxes on the top 5% of the income distribution. I analyze the following three policy changes: (1) the 1945 introduction of the family quotient system, (2) the 1950 removal of the tax penalty on childless couples, and (3) the 1959 removal of a tax penalty on singles. To conduct my analysis, I use archival data from Statistiques et Etudes Financieres for 1946–1981, Bulletin de Statistique du Ministere des Finances for 1938–1945, and Bulletin de Statistique et de Legislation Comparee for 1915–1937 to obtain data on the number of taxed households for each year, income bracket, and family quotient number.

These policy changes provide natural experiments for testing economic theories of fertility (Becker and Barro 1988). Standard microeconomic theory is not clear on how changing tax incentives impact fertility. On the one hand, the income-substitution theory predicts that, if children are normal goods, reducing the price of children and raising income should increase fertility. On the other hand, the quality-quantity theory predicts that higher incomes for those already with children induce an increase in the quality of children and a corresponding decrease in the quantity of children. Moreover, the subsidy for children works by lowering both the average and marginal tax rates. Lower marginal tax rates raise take-home wages, which measure the opportunity cost of time, may reduce the number of children because couples will prefer to spend the time making money. A similar logic applies for marriages. An income-substitution theory predicts that, if spouses are normal goods, reducing the price of spouses and raising income should increase the number of marriages. But the subsidy for spouses also lowers marginal tax rates. Lower marginal tax rates raise the opportunity cost of time, which may increase the separation rate of existing marriages.

This unusual tax and fertility policy may also explain the historical puzzle of why fertility has not fallen as far in France as it has in other European countries. Fertility by income (Fig. 1, which is from Perusse 1993) suggests that France's efforts at reversing the decline in fertility were somewhat successful relative to other countries. Cross-country evidence suggests that social policy, particularly the decline in government subsidies, is a leading explanation for the decline in fertility or lack thereof (Becker et al. 2001). This paper estimates in some specifications a large, statistically significant elasticity of fertility and marriage with respect to tax incentives, suggesting that the income-substitution mechanism outweighs the quality-quantity mechanism. If the incentive to have the first child increases by 1% of household income, the average number of dependents increases by 0.09 and the proportion of families with 1 or more children increases by 4 percentage points. If the marriage incentive

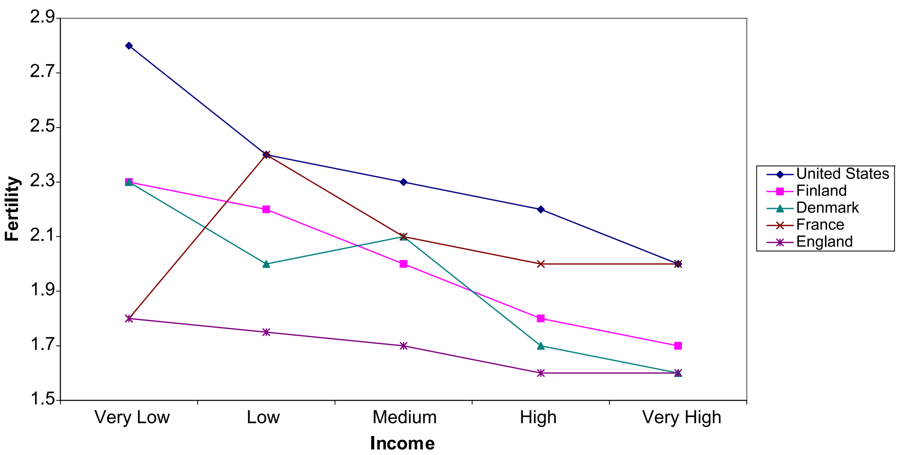

Fig. 1 Fertility and income in industrial societies

increases by 10% of household income, the proportion of married households rises by 3 percentage points. The typical tax incentive was a little under 0.1% of household income for each of these decisions.

A number of empirical studies have examined the elasticity of fertility with respect to tax policy. Studies employing time series data (see, for example, Whittington et al. 1990; Zhang et al. 1994; Buttner and Lutz 1990; Hyatt and Milne 1991, Goda and Munford 2009) or cross-country data (e.g., Gauthier and Hatzius 1997) find mixed evidence. Studies employing cross-sectional data to examine the effects of welfare policy find little or no relationship (see Hoynes 1997 and Moffitt 1998 for a literature survey and Baughman and Dickert-Conlin 2003 and Kearney 2004 for some examples; see Elwood 2000 and Sjoquist and Walker 1995 for studies of the effect of tax policy on marriage and Alm et al. 1999 for a literature review). However, the time-series approach suffers from an omission of trends in unobserved variables and many existing cross-sectional studies suffer from limited magnitude of the available policy variation. This paper is most related to Cohen et al. (2007), which examines the impact of variation in Israel's child subsidy in a panel data set of individual women; Milligan (2005), which uses a differences-in-differences strategy to examine the impact of a large but temporary child subsidy introduced during the 1990s in Quebec but not other Canadian provinces; Laroque and Salanie (2005), which estimates a structural model of fertility and finds a small effect of child subsidies on fertility in France, also during the 1990s; and Landais (2006) which focuses on post-1981 French tax reforms that capped the benefits received from the family quotient system and also finds a small effect of fertility incentives.

The rest of the paper proceeds as follows. Section 2 describes French tax policies regarding fertility, the archival data, and the empirical framework. Section 3 presents estimates of the fertility response to these tax policies. Section 4 presents estimates of the marriage response to these tax policies. Section 5 concludes.

2 Empirical strategy

The French government implemented many tax changes regarding the treatment of family size between 1929 and 1981. While my computation of the tax incentive includes all of these tax rules, I focus on the three major policy changes in the discussion below and leave the remaining tax law changes for the Appendix. I then explain in detail the archival data sources and the identification strategy.

2.1 Family quotient system

Beginning in 1920, the French government used the tax code to encourage fertility by penalizing unmarried taxpayers and childless couples. Unmarried taxpayers without children were taxed an extra 25%; married taxpayers without children at the end of two years of marriage were taxed an extra 10%; and taxpayers with children received a fixed deduction for each child, with larger deductions per dependent, the greater the number of dependents.

After 1945, the family quotient system, which divided household income by a family quotient (QF) number, a measure of family size, was implemented to calculate taxes. Household income divided by the QF resulted in a lower income bracket, the corresponding tax schedule was applied to the (roughly) per-capita household income, and then the tax liability was factored back up by the QF number. If a wealthy family had enough children, it would fall out of the tax system, which at times only taxed the top 5–8% of income. The QF number was not quite equal to family size: it assigned 1 unit for each adult and 0.5 unit for each child, but in single-parent households, the first child counted as 1 unit. The implementation of this dramatic tax change provides the first of three policy experiments.

I consider a second policy experiment with the 1950 removal of the tax penalty for couples without children. Between 1945 and 1950, if couples had no children after 3 years of marriage, they would be assigned a lower family quotient (QF) number of 1.5 rather than 2, and this lower QF typically led to a higher tax rate and, therefore, tax burden. After 1950, however, all married couples without children received a QF of 2. To consider the impact of this policy on fertility, I calculate the change in incentive for having the first child. Before 1950, married couples who remained childless after three years moved their QF number from 1.5 to 2.5 with the first child. After 1950, the first child only moved QF numbers from 2 to 2.5.

The third policy experiment involves a change in the tax incentive to marry. In 1959, France reduced marriage incentives by removing the tax penalty that singles had faced. Before 1959, the tax penalty was such that single-headed households without children had a surcharge on their top marginal tax rates. The top marginal tax rates were raised to 70, 55, 54, and 48.75, instead of the standard 60, 50, 48, and 45, which all other households faced. After 1959, single-headed households without children had the same marginal tax rate schedule as all other households. Removing this penalty on being single meant that singles without children had less of an incentive to be married.

2.2 Data

Three main sources of data are employed to follow fertility and marriage rates in France: Statistiques et Etudes Financieres for 1946–1981, Bulletin de Statistique du Ministere des Finances for 1938–1945, and Bulletin de Statistique et de Legislation Comparee for 1915–1937. I use these data sources to construct fertility and marriage rates for different percentiles of income.

Because these sources are aggregate tax return data recorded almost a century ago, there are several problems I need to overcome. First, the data before and after 1945 appear in different formats. Before 1945, the data records the number of deductions for dependent children in different income brackets and the number of married couples without children after 2 years of marriage. After 1945, taxpayers are listed according to the family quotient number and income. Second, the tax brackets change over time. Third, censoring bias occurs at the bottom of the income distribution: a family that does not need to pay taxes after the family quotient is computed will not appear in the tax record. This censoring would cause fertility to appear lower than it actually was for lower income ranges. Accordingly, the tax system, which at times only taxed the top 5–8% of income, did not collect data for persons with income beneath the top 5–8%, a relatively high threshold by modern standards.

To address the first issue, I compute the average fertility for each income bracket. For each year from 1945–1981, I have 9–14 income brackets. Within each income bracket, I have the total number of households categorized under each QF number, a rough proxy for family size. For each year from 1929–1944, I have 10–25 income brackets. For these years, however, information is not broken down by family size. Only the total number of dependents and the total number of households are available for each income bracket. I therefore concatenate the year-income bracket-family size data after 1945 into the year-income data format from before 1945. I create a weighted average fertility measure for each year-income cell after 1945 by first taking the product of family size and the number of households and add these across all family size possibilities within an income bracket. I then divide this sum by the total number of households per year and income bracket. I am left with 9–25 income brackets from 1929 to 1981, and each has its own number of households and average family size.

Lacking individual-level data, I must make inferences on the family composition and income representing various percentiles such as P99.99–P100, P99.98–P99.99, and so on. Based on the data regarding the number of households per income bracket, I construct synthetic cohorts representing each 0.01 percentile of income. I assign the average family size of that income bracket to each 0.01 percentile of income that falls within this bracket. Income brackets change over time, so I cannot directly make a comparison of family size for each income bracket across time. I therefore use the total number of households in a year to compute how many households are represented in each 0.01 percentile of income. In this way, I construct 500 synthetic cohorts representing each 0.01% of income from 0.01 to 5 percent. Limiting to the top 5% of population is necessary to address censoring bias that occurs at the bottom of the income distribution: a family that does not need to pay taxes after dividing income by family size will not appear in the tax record. This censoring would cause fertility to appear lower than it actually was for lower income brackets. This censoring is the reason why the 5% income percentile shows 0 average dependants in Fig. 2.

Figure 2 displays the average number of dependents per taxable household by income percentile from 1929 to 1981 for households representing the 5th, 1st, 0.1, and 0.01 percentiles. For most years, a synthetic cohort is likely drawn from the same income bracket over time, but in some years the synthetic cohort will be drawn from

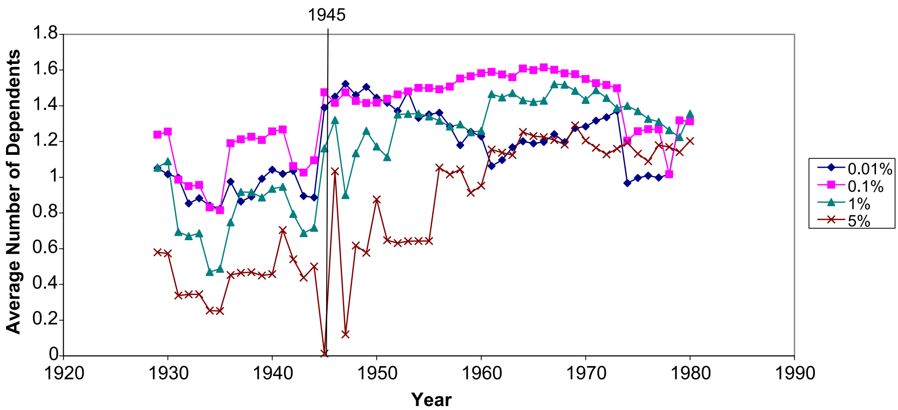

Fig. 2 Average number of dependents per taxable household by income percentile 1929–1981

a different income bracket, so sharp jumps in the time series can likely be attributed to, say, a 0.1 percentile household being drawn from the second income bracket in one year and then being drawn from the third income bracket in the following year. Moreover, since some of these income brackets are quite large, average family size can differ greatly between neighboring income brackets.

In order to compute the effect of tax incentives on having children or being married, I also need to account for all other tax rules that might affect what a family in any particular year-income-size cell pays in taxes. Tax rules have small variations every year and are recorded in Piketty (2001). I summarize in detail the year-to-year variation in tax law in the Appendix. For example, to calculate the incentive to have the first child, I compute the taxes any household in an income-year would have paid if the household consisted of a married couple with no children and compute the taxes the same household would have to pay if it consisted of a married couple with 1 child. The difference is the tax incentive for having the first child. I construct similar tax incentive measures for having the second child, having the third child, and getting married. All incentives are computed as a percentage of income. Because there are many small tax changes all the time, my strategy for estimating the effect of tax policy on fertility when I use the continuous treatment specification as described below, in essence, employs many small differences-in-differences as well as the three large policy changes.

Several caveats are worth mentioning. The data is limited in its aggregate nature. Therefore, there may be unobserved household level characteristics, such as age and educational attainment, that vary within these synthetic cohorts, so the P95–P95.01 cohort is not comparable across years. The idea behind using three policy changes is that tax incentives may vary more discontinuously for a particular cohort than demographic characteristics such as age and educational attainment would. Further, my focus on the top part of the income distribution is limited by the tax experiments and data sources. Whether the fertility behavior of the wealthiest households during 1950 is similar to middle-income households today is an open question. Moreover, the data format changes during the first policy experiment, so it is important to not rely on the 1945 QF introduction alone in making inferences. Finally, all of the relevant tax rules are considered in the calculations and described in the Appendix. If, however, other laws relevant to the fertility decisions of the wealthy had changed in some way during the policy experiments under investigation the estimates could be biased. Having several such policy changes and in different directions alleviates the identification problem: Even if the assumption fails for one policy experiment, it is unlikely to fail for all three.

2.3 Identification strategy and specifications

To identify the causal effect of tax incentives on fertility, the ideal experiment would be to randomly assign individuals different tax incentives for having children. In the absence of such an experiment, I use the differential impact of tax law changes across income percentiles. In particular, I estimate the following reduced form equations, which estimate how fertility rates and tax incentives change after major policy changes:

$$F_{it} = \beta_0 + \beta_1 \cdot 1(year_t > year_{\text{policy}}) + \beta_2 \cdot 1(i \in Treatment) + \beta_3 \cdot 1(year_t > year_{\text{policy}}) \times 1(i \in Treatment) + \varepsilon_{it},$$

$$I_{it} = \beta_0 + \beta_1 \cdot 1(year_t > year_{\text{policy}}) + \beta_2 \cdot 1(i \in Treatment) + \beta_3 \cdot 1(year_t > year_{\text{policy}}) \times 1(i \in Treatment) + \varepsilon_{it},$$

where i denotes income percentile rank, t denotes time, F_{it} denotes a measure of fertility for income percentile i in time t, and I_{it} denotes the tax incentive as percentage of income for income percentile i in time t. The independent variables are simply a treatment dummy, pre-post dummy, and interaction. I will refer to these as the differences-in-differences specification. In the following discussion, F_{it} refers to different measures of fertility so different estimates of β_3 will be obtained, but its interpretation should be clear in the context of each policy change. The treatment group T is the top 0.01 income percentile, representing the top two to three thousand individuals during this time for all policy experiments as this group has the largest change in fertility incentive as percentage of income.

To account for the possibility that the treatment group may have been on a different trend from that of the non-treatment group before and after the policy change, which would bias the estimates of β_3, I also estimate models with cohort-specific linear time trends.

$$F_{it} = \beta_0 + \beta_1 \cdot 1(year_t > year_{\text{policy}}) + \beta_2 \cdot 1(i \in Treatment) + \beta_3 \cdot 1(year_t > year_{\text{policy}}) \times 1(i \in Treatment) + \beta_4 \cdot 1(i \in Treatment) \cdot year_t + \varepsilon_{it},$$

$$I_{it} = \beta_0 + \beta_1 \cdot 1(year_t > year_{\text{policy}}) + \beta_2 \cdot 1(i \in Treatment) + \beta_3 \cdot 1(year_t > year_{\text{policy}}) \times 1(i \in Treatment) + \beta_4 \cdot 1(i \in Treatment) \cdot year_t + \varepsilon_{it},$$

Since behavioral changes coming from the top 0.01% income percentile might not be representative of the entire population, I estimate a continuous treatment specification with the following equation:

$$F_{it} = \beta_0 + \beta_1 I_{it} + \beta_2 P_i + \beta_3 year_t + \varepsilon_{it},$$

where I include fixed effects for income percentile rank, P_i, to control for unobservables associated with income rank and fixed effects for year, $year_t$, to remove the time trend. This model uses only time-series variation within income percentile and cross-sectional variation within years to estimate the effect of tax incentives on fertility. These fixed effects address the concern that unobservables for particular income percentiles may affect fertility behavior and the concern that period effects influence both tax incentives and fertility behavior. To account for the possibility that different income percentiles may be on different time trends regarding their fertility behavior, I also estimate a model that includes income percentile-specific linear time trends:

$$F_{it} = \beta_0 + \beta_1 I_{it} + \beta_2 P_i + \beta_3 year_t + \beta_4 P_i \cdot year_t + \varepsilon_{it}.$$

The weakness of the continuous treatment approach as compared to the differences-in-differences approach is that the source of identification is less clear and may, in part, be driven by the censoring problems that occurs at the bottom of the income distribution (a family that does not need to pay taxes after dividing income by family size will not appear in the tax record). This censoring problem is lessened after 1945 as can be seen in Fig. 2, since a quickly growing proportion of the population were required to pay taxes. Nevertheless, because of issue regarding the representativeness of the difference-in-differences estimate and the potential censoring issues in the continuous treatment estimate, an important check is to compare the magnitude of the estimates derived from these two approaches. Standard errors are clustered at the income cell level to take into account the fact that the 500 synthetic cohort observations per year are drawn from 9–25 income cells in the aggregate tax return data per year.

3 The fertility response to tax

3.1 Introduction of the family quotient system

The implementation of the Family Quotient System appears to have had a positive effect on fertility. Figure 3 focuses on the years 1935 to 1952 and displays the average number of dependents for households representing the 1st, 0.1, and 0.01 percentiles. A visual examination of the trends for the 0.1 and 0.01 percentiles suggests a similar trend in the average number of dependents before 1945. The average number of dependents diverged after 1945 with the fertility of the top 0.01% increasing relative to

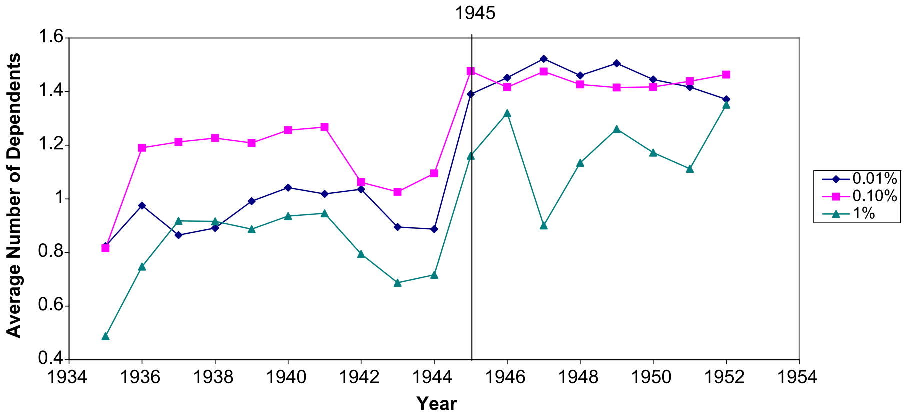

Fig. 3 Average number of dependents per taxable household by income percentile 1935–1952

Table 1 1945 Introduction of family quotient system

Panel A: Tax Incentive for 1st child as percent of income			
	1936–1945	1946–1951	Difference
Top 0.01%	0.058	0.094	0.036
	(0.006)	(0.029)	(0.011)
0.02–5%	0.008	0.042	0.033
	(0.006)	(0.020)	(0.004)
Difference	−0.049	−0.052	0.003
	(0.003)	(0.011)	(0.011)
Panel B: Tax Incentive for 2nd child as percent of income			
	1936–1945	1946–1951	Difference
Top 0.01%	0.002	0.030	0.028
	(0.002)	(0.005)	(0.002)
0.02–5%	0.004	0.011	0.007
	(0.004)	(0.008)	(0.002)
Difference	0.002	−0.019	0.021
	(0.001)	(0.003)	(0.003)
Panel C: Tax Incentive for 3rd child as percent of income			
	1936–1945	1946–1951	Difference
Top 0.01%	0.002	0.025	0.023
	(0.001)	(0.002)	(0.001)
0.02–5%	0.004	0.008	0.004
	(0.004)	(0.007)	(0.002)
Difference	0.002	−0.017	0.019
	(0.001)	(0.002)	(0.002)

Tax incentives for the 1st child are computed by calculating the taxes households representing the top 0.01% observation would have paid if the household was married with nochildren and married with 1 child. The difference is the tax incentive for having the first child. Tax incentives for having the second and third child are similarly constructed. All incentives are computed as percentage of income. Incentives are similarly computed for the top 0.02–5%. Standard errors are in parentheses

the fertility of other income percentiles. A statistical estimation of this differences-in-differences relationship is shown in Table 1.

I first show that the family quotient policy increased the tax incentives for wealthier families to have more children with larger increases for the larger nth dependent than for the smaller nth dependent. Panel A shows that while the tax incentive to have the first child increased substantially for the top 0.01%, it also increased for the top 0.02–5%, and the differences-in-differences shown in the third row of column 3 indicates little differential effect. However, panels B and C indicate a dramatic increase in the incentive to have the second and third child. Before 1945 the top 0.01% had a 0.002% of income reduction in tax burden for having the second child, but after 1945 the same income percentile had a 0.03% of income reduction in tax burden for having

Table 1 (*Continued*)

Panel D: Average number of dependents (differences-in-differences)			
	1936–1945	1946–1951	Difference
Top 0.01%	0.956	1.456	0.500
	(0.071)	(0.046)	(0.030)
0.02–5%	0.686	0.904	0.218
	(0.198)	(0.361)	(0.082)
Difference	−0.270	−0.552	0.282
	(0.046)	(0.094)	(0.087)
Panel E: Average number of dependents, 1929–1981 (continuous treatment)			
Incentive for 1st child	8.016		
	(1.130)		
Incentive for 2nd child		15.600	
		(5.342)	
Incentive for 3rd child			24.240
			(5.350)
n	8000	8000	8000

To construct the continuous treatment incentive, the taxes any income-year observation would pay are computed and differenced for the relevant nth child decision. Regressions in Panel E are fixed effects regressions with fixed effects for income percentile rank and year. Standard errors are in parentheses

the second child (first row of column B). However, the tax incentive for having the second child only increased from 0.004% of income to 0.011% of income for less wealthy households (second row of column B). The tax differential is equally large for the incentive to have the third child.

Having shown that the tax incentives increased at a higher rate for wealthier families, I next show that wealthier families increased fertility more than less wealthy families. I compare the average number of dependents for the top 0.01 income percentile, which represents the top two to three thousand individuals during this time period, with the average number of dependents for other income percentiles. The differences-in-differences estimate of 0.282 (third row of column 3 in panel D) is positive and statistically significant with a standard error of 0.087. Assuming that the tax incentive for having another child was an additional 0.02% of income for the wealthiest households (third row of column 3 in panels B and C), then the differences-in-differences estimate of 0.282 suggests a very large fertility response. However, this estimate is difficult to extrapolate to the modern context, to say, a $1,000 child tax deduction for a $60,000 income-earning household, because 0.02% of income would be quite sizeable for the top 0.01% income percentile of households. Nevertheless, tax incentive as percentile of income seems like a good choice to measure the behavioral response of the wealthiest 0.01–5% of households, who likely respond more to percent of income instead of nominal income.

To see if other income percentiles of households respond to fertility incentives as well, I employ the continuous treatment specification in panel E. The coefficient of

Table 2 1945 Introduction of family quotient system (cohort-specific time trends)

	Incentive for			Average number of dependents			
	1st child	2nd child	3rd child				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Top 0.01%	−5.314	−0.917	−0.401	−2.085			
	(3.665)	(0.426)	(0.310)	(14.147)			
Post 1945	0.033	0.007	0.004	0.218			
	(0.004)	(0.002)	(0.002)	(0.082)			
Top * Post	−0.019	0.017	0.017	0.273			
	(0.015)	(0.003)	(0.002)	(0.111)			
Incentive for 1st child					8.305		
					(1.252)		
Incentive for 2nd child						15.912	
						(6.331)	
Incentive for 3rd child							23.904
							(5.687)
N	8000	8000	8000	8000	8000	8000	8000
R-sq	0.575	0.262	0.133	0.132	0.915	0.888	0.906

See notes for Table 1. Treatment-specific time trends are included in columns 1–4. Income percentile-specific time trends are included in columns 5–7

9.006 in column 1 is obtained from regressing the average number of dependents on tax incentives for the 1st child. This coefficient suggests that an increase of 1% of household income in the incentive to have the 1st child increases the average number of dependents by 0.09. The estimates in columns 2 and 3 suggest that increases in the incentive to have the 2nd and 3rd child also increases the average number of dependents although these estimates are much larger. The reason that the estimates are much larger may be that larger families are more responsive to fertility incentives whereas the decision to have the first child is much less malleable.

To see if these effects are driven by cohort-specific time trends, in Table 2, I include treatment specific-time trends for the differences-in-differences specification (columns 1–4) and income percentile-specific time trends for the continuous treatment specification (columns 5–7). All of the results are qualitatively and quantitatively very similar to the estimates in Table 1. These analyses suggest that the quality-quantity mechanism, whereby income reduces the number of children, is outweighed by the income-substitution mechanism, whereby reducing the cost of children increased the number of children.

3.2 Removal of the tax penalty on childless couples

Removing the tax penalty on childless couples appears to have decreased fertility. Figure 4 displays the proportion of married households with 1 or more dependents for the top 0.01 and 1% income percentile. The fertility measure for the top 0.01% and 1% trend together before 1950 but diverge after 1950. After 1950, the proportion

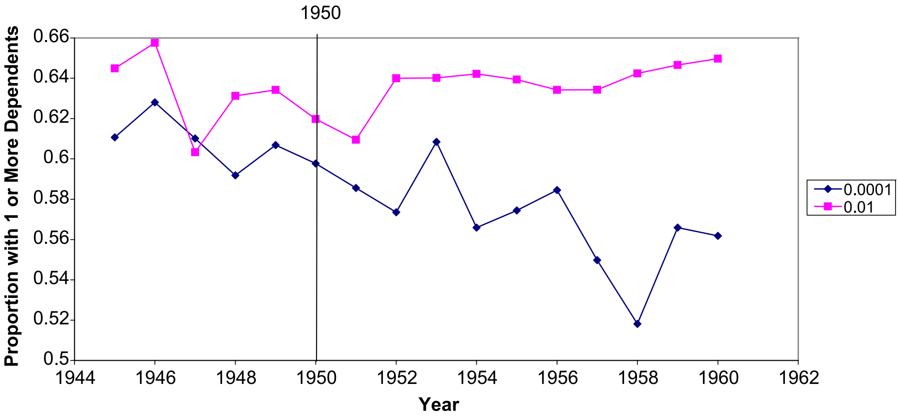

Fig. 4 Proportion of married households with 1 or more dependents by income percentile 1945–1960

of married households with 1 or more dependents for the top 0.01% falls more than the proportion of married households with 1 or mode dependents for other groups. The top 0.01% also saw the sharpest reductions in the incentive to have the first child, falling from 0.088 to 0.045% of income (panel A Table 3). The other income percentiles only saw a reduction from 0.038 to 0.024.

Having shown that the tax incentives decreased more for wealthier families, I next show that fertility decreased more for wealthier families than it did for less wealthy families. I compare the proportion of married households with 1 or more dependents for the top 0.01 income percentile with the proportion of married households with 1 or more dependents for other income percentiles. The differences-in-differences estimate of −0.115 (third row of column 3 in panel B) is negative with a standard error of 0.072. While the differences-in-differences estimate is not statistically significant at conventional levels, the continuous treatment specification suggests that an increase of 1% in income through tax incentive increases the proportion of families with 1 or more children by a little over 4.5%. The differential increase in tax incentives for the top 0.01% relative to other income groups was 0.03% of income, so the differences-in-differences analysis (−0.115) produces estimates comparable to those produced by the continuous treatment specification. When cohort-specific time trends are included in Table 4, there is no effect on the incentive for having the first child, so, not surprisingly, there is no effect on the proportion of married households with 1 or more dependents in the differences-in-differences specification (columns 1–2). However, the continuous treatment specification is robust (column 3). Taken together, these analyses provide stronger evidence for the hypothesis that an increase in tax incentives increases fertility than for the hypothesis that a decrease in tax incentives decreases fertility.

Table 3 1950 Removal of penalty on childless couples

Panel A: Tax Incentive for 1st child as percent of income			
	1945–1950	1951–1959	Difference
Top 0.01%	0.088	0.045	−0.043
	(0.020)	(0.040)	(0.017)
0.02–5%	0.038	0.024	−0.014
	(0.023)	(0.017)	(0.006)
Difference	−0.049	−0.020	−0.029
	(0.011)	(0.014)	(0.017)
Panel B: Proportion 1 or more children (differences-in-differences)			
	1945–1950	1951–1959	Difference
Top 0.01%	0.610	0.572	−0.037
	(0.013)	(0.025)	(0.011)
0.02–5%	0.522	0.600	0.078
	(0.183)	(0.043)	(0.058)
Difference	−0.087	0.028	−0.115
	(0.069)	(0.015)	(0.072)
Panel C: Proportion 1 or more children, 1945–1981 (continuous treatment)			
	Proportion 1 or more kids		
Incentive for 1st child	5.376		
	(0.899)		
n	7500		

Tax incentives for the 1st child are computed by calculating the taxes households representing the top 0.01% observation would have paid if the household was married with no children and married with 1 child. The difference is the tax incentive for having the first child. Tax incentives for having the second and third child are similarly constructed. All incentives are computed as percentage of income. Incentives are similarly computed for the top 0.02–5%

To construct the continuous treatment incentive, the taxes any income-year observation would pay are computed and differenced for the relevant nth child decision. Regressions in panel C are fixed effects regressions with fixed effects for income percentile rank and year. Standard errors are in parentheses

4 The marriage response to tax

4.1 Removal of the tax penalty on single-parent households

Removing the tax penalty on single-parent households also appears to have decreased marriage rates. Figure 5 shows that the top 0.01% trended downward in its marriage rates after 1959 whereas the top 1% had relatively constant marriage rates. The tax incentives for marriage were quite large and changed dramatically after 1959. Before 1959, the top 0.01% of households had a marriage incentive of 13.4% of income. This marriage incentive dropped to 2.3% after the 1959 removal of the tax penalty on singles (row 1 panel A Table 5). In stark contrast, the 0.02% to 5% percentile of households saw their incentives for getting married to increase from 7.7% to 9.2%

Table 4 1950 removal of penalty on childless couples (cohort-specific time trends)

	Incentive for 1st child	Proportion 1 or more children	
	(1)	(2)	(3)
Top 0.01%	17.139	10.904	
	(6.735)	(3.867)	
Post 1950	−0.014	0.077	
	(0.006)	(0.070)	
Top * Post	0.037	−0.072	
	(0.033)	(0.071)	
Incentive for 1st child			5.069
			(0.906)
N	7500	7500	7500
R-sq	0.121	0.097	0.860

See notes for Table 3. Treatment-specific time trends are included in columns 1–2. Income percentile-specific time trends are included in columns 3

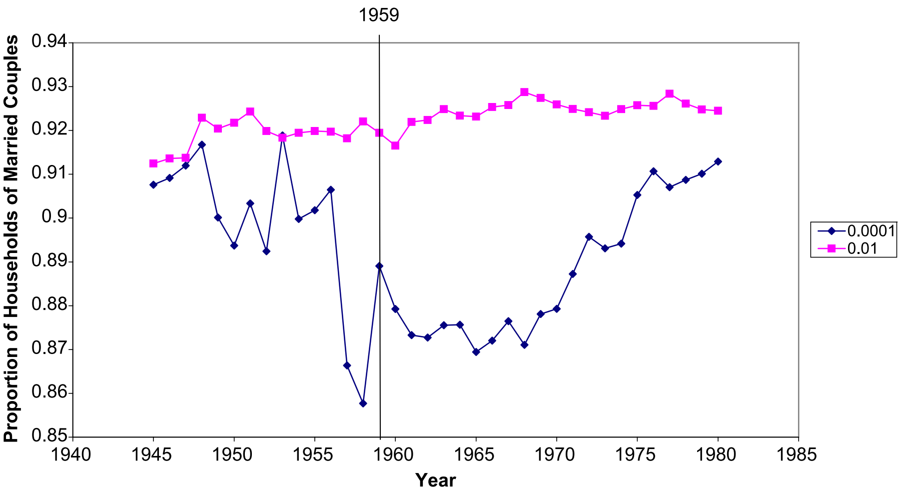

Fig. 5 Proportion of households of married couples by income percentile 1945–1981

(row 2 panel A). The proportion of married couples also decreased for the wealthiest 0.01%, from 89.4% to 87.6%, but it increased slightly for the other income groups, from 91.4% to 92.0% (panel B). The differences-in-differences estimate suggests that a marriage tax incentive equivalent to 12.5% of household income raises the proportion of married households by 2.4 percentage points. The estimate is comparable in the continuous treatment specification. The estimate of 0.268 under the continuous treatment specification indicates that an increase in 10% of income by tax incentive (panel C) raises the proportion of married households by 2.68 percentage points. This estimate is robust to including cohort-specific time trends (Table 6 column 3), however the differences-in-differences estimate is not (column 2). These results provide mixed evidence that the opportunity cost mechanism, whereby higher income reduces the likelihood of being married, is outweighed by the income-substitution

Table 5 1959 Removal of penalty on singles

Panel A: Tax incentive for marriage as percent of income			
	1949–1959	1960–1969	Difference
Top 0.01%	0.134	0.023	−0.111
	(0.023)	(0.012)	(0.011)
0.02–5%	0.077	0.092	0.014
	(0.031)	(0.032)	(0.012)
Difference	−0.056	0.068	−0.125
	(0.013)	(0.009)	(0.016)
Panel B: Proportion married (differences-in-differences)			
	1949–1959	1960–1969	Difference
Top 0.01%	0.894	0.876	−0.018
	(0.018)	(0.005)	(0.008)
0.02–5%	0.914	0.920	0.006
	(0.013)	(0.006)	(0.003)
Difference	0.020	0.044	−0.024
	(0.008)	(0.002)	(0.008)
Panel C: Proportion married, 1945–1981 (continuous treatment)			
Incentive for marriage	0.180		
	(0.0602)		
n	10500		

Tax incentives for marriage are computed by calculating the taxes households representing the top 0.01% observation would have paid if the household was single vs. married. The difference is the tax incentive for marriage. All incentives are computed as percentage of income. Incentives are similarly computed for the top 0.02–5%. Standard errors are in parentheses

To construct the continuous treatment incentive, the taxes any income-year observation would pay are computed and differenced for the marriage decision. Regressions in panel C are fixed effects regressions with fixed effects for income percentile rank and year. Standard errors are in parentheses

mechanism, whereby reducing the cost of having a spouse and raising income increases the likelihood of being married.

5 Conclusion

Can nations use tax policy to reverse the decline in fertility? This paper uses archival data and an unusual tax regime to estimate the effect of tax incentives on fertility and marriage. Using three substantial changes in tax policy in France, I find mixed evidence that fertility responds to both positive and negative changes in tax incentives and that marriage responds to a negative change in tax incentives. France is unusual among similarly developed countries in that fertility is higher for the wealthiest than for the poorest (Fig. 1, which is from Perusse 1993). The evidence presented

Table 6 1959 Removal of penalty on singles (cohort-specific time trends)

	Incentive for marriage	Proportion married	
	(1)	(2)	(3)
Top 0.01%	−1.337	3.632	
	(3.012)	(2.277)	
Post 1959	0.014	0.006	
	(0.012)	(0.003)	
Top * Post	−0.132	−0.004	
	(0.024)	(0.018)	
Incentive for marriage			0.194
			(0.072)
N	10500	10500	10500
R-sq	0.051	0.096	0.685

See notes for Table 5. Treatment-specific time trends are included in columns 1–2. Income percentile-specific time trends are included in columns 3

here suggests one reason for this exceptionalism: a tax incentive equivalent to 1% of household income increases the average number of dependents by 0.09 and the proportion of families with 1 or more children by 4 percentage points. A tax incentive equivalent to 10% of household income increases the proportion of married households by 3 percentage points. The average tax incentive for these decisions was just under 0.1% of household income.

There are a number of limitations to this study. First and foremost, lacking individual-level data, I must construct synthetic cohorts based on inferences regarding the family composition and income representing various income percentiles, which adds a considerable amount of noise. For most years, a synthetic cohort is likely drawn from the same income bracket over time, but in some years the synthetic cohort will be drawn from a different income bracket, so sharp jumps in the time series can occur since income brackets can be quite large. Despite the possibility for rather imprecise estimates, some significant effects are found.

Second, I am unable to directly address the possibility that tax avoidance would contribute to mismeasurement of the wealthiest households. For example, if the tax penalty on singles is removed, then singles may choose to report more. This would cause the proportion of married households to decline. On the other hand, if larger families receive additional tax breaks, they may choose to report more. This would cause the fertility of the income groups that received the greatest tax breaks to increase the most. While tax avoidance is a serious issue, given the relatively small fraction of household income that these tax incentives represented, it is unlikely that households are choosing to evade taxes based on the margin of 0.1% of household income. Moreover, Piketty and Saez (2003) report in their study of the evolution of top incomes in the United States from 1913 to 2002 that tax evasion through the establishment of trusts was not a significant factor leading to the mismeasurement of wealth concentration.

Without data on the mother's age, I am also unable to construct measures of the total fertility rate in order to compare this study with other studies. Nevertheless, the fact that smaller changes in tax incentives in Quebec and France in the 1980s and

1990s also increased fertility and the fact that the Quebec study also finds that the wealthiest households responded more to bonuses of up to C$8,000 suggest that the findings in this paper are realistic and broadly consistent with the possibility that tax policy can affect demographics.

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Appendix

Piketty (2001) presents details on year-to-year policy variation in tax incentives for fertility. All the subsequent referenced tables are found in Piketty (2001). The Standard Laws (IGR) are provided in Tables 4-1 to 4-5. For years 1915–1918 see Table 4-1, for years 1919–1935 see Table 4-2, for years 1936–1941 see Table 4-3, for years 1942–1944 see Table 4-4, and for years 1945–1998 see Table 4-5. The tables display income brackets in the left-hand column and tax rates in the right-hand column. Tax rates that are displayed as a range are graduated linearly within the respective income bracket.

Exceptional increases are detailed in Table 4-6. For years 1923–1925, there was an increase in tax of 20%. For year 1924, there was an additional increase of 20%. For years 1932–1933, there was an increase of 10%. For years 1934–1935, the income bracket 80,000–100,000 received an extra marginal rate of 25%; for incomes above 100k, the marginal rate was an extra 50%. For years 1936–1937, an extra 20% was charged on all whose income was above 20,000. For year 1937, there was an additional increase of 8%. For years 1938–1940, there was an increase of 33.33%. For year 1941, there was an increase of 50%. For year 1947, there was an increase of 20% on all whose income was greater than 50,000. For years 1955–1960, there was an increase of 10% for all whose income exceeded 600,000 (6,000 of new francs). For years 1961–1965, there was an increase of 5% for all whose income exceeded 6,000 (in 1961); 6,000 was replaced by 8,000 (in 1962); 8,000 was replaced by 36,000 (in 1963); 36,000 was replaced by 45,000 (in 1964); and finally 45,000 was replaced by 50,000 (in 1965). For years 1967 to 1984, the table displays the rest of the exceptional taxes rules.

Family laws are described in Table C-1. For years 1920–1945, unmarried taxpayers without children were taxed an extra 25%. Also for years 1920–1945, taxpayers married without children at the end of two years of marriage were taxed an extra 10%. For years 1915–1944, an additional system of deductions was applied, with the figures in Table C-1 indicated for the nth child. Note that before 1934, disabled persons and grandparents also counted as children. From 1936–1939, deductions only applied fully to those whose income was lower than 75,000, while deductions were reduced 20% for 75,000–150,000, 40% for 150,000–300,000, 60% for 300,000–600,000, and 80% for those whose income exceed 600,000. In 1945, there was a switch from deductions to the QF system, which affected all families, i.e., divide by the QF number, calculate the tax, and multiply by the QF number, where the QF number is computed using the rule (single = 1, couple = 2, each child = 0.5). Note that a QF of 2.5 can mean either a married couple with 1 child or a single with 2 children, so when I compute fertility measures, I make the assumption that children are found in two-parent households. In 1951, the rule under which a QF of 1.5 was assigned to those who were married with no children after three years was removed.

Finally, there are some miscellaneous rules. In 1945, a QF of 2 was assigned to married couples who did not have a child by their third year of marriage but had a child who either reached adulthood or became deceased, assuming that the deceased child reached at least 16 years of age. In 1945, all single parents who were unmarried, divorced, or widowed received 1 share for their first dependent child: in other words, a QF of 2 instead of 1.5. Such receipt of 1 share created an incentive for 2 people to cohabit and be unmarried, with 1 child each, since they would benefit twice from this whole-share QF system. In 1945, the "family countervailing charge" was suppressed, and this suppression benefited singles without children (previously there was a 25% surcharge). However, in 1945, singles without children and having a QF of 1 had a top marginal rate of 70 instead of 60. Similarly, for all rates down the range of marginal rates, instead of 45, 48, 50, and 60, their top rates were 48.75, 54, 55, and 70. In 1958, this rule was removed.

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