Behavioral responses to inheritance tax: Evidence from notches in France*

Jonathan Goupille-Lebret† and Jose Infante‡

11 mars 2016

We exploit for the first time quasi-experimental variations to investigate the impact of inheritance taxation on wealth accumulation. Using the French preferential tax scheme for inheritance, we take advantage of unique age and time discontinuities to estimate different behavioral responses to taxation. These responses are estimated directly during lifetime, rather than relying solely on observations at death. The analysis is based on a longitudinal data set of preferential tax savings from Axa over the period 2003-2013.

We obtain two main results. First, we estimate timing responses using a bunching approach. Second, we use a difference-in-differences approach to estimate real and shifting among asset portfolio responses at the individual level. We document the presence of important but relatively small responses to inheritance taxation. Our empirical findings shed a new light behind wealth accumulation and bequest motives. Taken together, our results can not be supported by the desire to retain control over wealth. We argue that small responses to inheritance tax could be better explained by psychological factors such as myopia or denial of death. Our results call for more sophisticated models incorporating psychological biases into wealth accumulation and bequest decision. *JEL* Codes : H21, H31, D91

*Jonathan is very grateful to Thomas Piketty and Emmanuel Saez for their continuous support and guidance. We thank as well Alan Auerbach, Antoine Bozio, Andrew Clark, Alejandro Esteller-Moré, Bertrand Garbinti, Wojciech Kopczuk, Etienne Lehmann, André Masson, and participants at numerous seminars for valuable comments and suggestions. We are grateful to Axa, and in particular to Mohamed Baccouche, for giving us access to the otherwise restricted data for the purposes of this research.

†Paris School of economics, 48, boulevard Jourdan - 75014 Paris ; jonathan.goupille@ens.fr

‡Axa,313, Terrasses de l'Arche - 92727 Nanterre Cedex ; josearturo.infanteacevedo@axa.fr

1 Introduction

With growing inequalities in recent decades, demand for fair and effective taxation has never been so high. Estate tax has a special place in this framework. Wealth tends to be strongly concentrated and can be transmitted from generation to generation. Progressive taxation may therefore plays as an appropriate counter-force against the perpetuation of inequality. However, estate tax generates behavioral responses from the taxpayers. [1] These responses may be harmful to the macroeconomic success of an economy. They can also reduce the efficiency of taxation to curb wealth inequality.

Previous empirical work [2] on the impact of transfer taxation on behavioral responses has found similar elasticities of net worth/reported estate with respect to the net-of-tax rate. These elasticity estimates ranges from 0.1 to 0.2. However, Kopczuk (2012) argues that the literature has not been able to come up with a fully convincing empirical strategy. Bequest and wealth accumulation result from multiple factors occurring during lifetime. Isolate properly the causal impact of inheritance taxation from other factors playing on wealth accumulation is a crucial challenge for the literature. Moreover, the recent survey of Saez et al. (2012) has emphasized the need to disentangle the different components of behavioral responses such as shifting among tax bases, timing or real responses in an inter-temporal framework.

This article breaks new ground on these questions using quasi-experimental variations created by the French preferential tax scheme for inheritance through the savings vehicle Assurance-vie. Assurance-vie is the most important financial asset owned by French households in 2010 and represents one quarter of total transmission at death. It is a flexible « wrapper » or savings account that holds financial assets (equities, bonds...) for tax purposes. In the US, Assurance-vie would be the equivalent of an unlimited Roth IRA with preferential inheritance taxation. [3]

In 1992, France introduced a reform of the preferential tax scheme for inheritance that was not retroactive. This reform generates large discontinuities depending on the opening date of Assurance-vie accounts and age at which contributions to the accounts were made. For accounts opened after November, 1991, contributions made before age 70 benefits from a preferential

1. See Kopczuk (2012) for a complete description of behavioral responses to transfer taxation.
2. See Kopczuk and Slemrod (2000), Poterba (2001) and Joulfaian (2006) for more details.
3. See section 2.2 for a more complete description of Assurance-vie in France.

tax rate of 20 % after a specific tax exemption of 152,500 euros when transmitted at death. In contrast, contributions made after age 70 are now recalled into the inheritance tax base with much higher top tax rate. As the reform was not retroactive, Assurance-vie accounts opened before November, 1991 have not been affected by the reform. Whenever the contributions were made during lifetime, they are taxed at the tax rate of 20 % after the specific tax exemption of 152,500 euros when transmitted at death. Hence, the reform provides a powerful way of identifying the causal effect of inheritance taxation on wealth accumulation directly during lifetime.

The increase in taxation after age 70 is likely to induce three different behavioral responses. First, the reform has generated a notch in the lifetime contributions of Assurance-vie, creating very strong incentives to retime contributions just before age 70 (inter-temporal shifting responses). We estimate these timing responses using bunching approach. Second, people can substitute contributions made after age 70 for other assets (shifting among asset portfolio). Finally, they can reduce wealth accumulation in order to consume more (real responses). We estimate these two last responses using a difference-in-differences approach based on the evolution of contributions over age for Assurance-vie accounts opened just before or after November, 1991.

For this analysis, we have obtained first-time access to a unique longitudinal data set of French Assurance-vie accounts from Axa over the period 2003-2013. The study of the savings vehicle Assurance-vie offers four important methodological and conceptual advantages. First, our data set is the only source describing accumulation of wealth for bequest purpose in a longitudinal way. This setting allows us to estimate medium and long-term responses to inheritance tax based on changes occurring within individuals. Second, our data set contains many very wealthy individuals allowing us to investigate whether behavioral responses increase with wealth. Third, Assurance-vie represents in France the major component of financial assets transmitted at death, which are in theory the most sensitive to taxation. Our analysis provides a way of testing to what extent this theory is supported by empirical evidence. Finally, Assurance-vie occupies an original place between bequests and gifts. It benefits from preferential taxation but, contrary to gifts, provides also a way to retain control over assets up to death. The study of Assurance-vie accounts can help theory to better understand the motivation behind wealth accumulation and bequest decisions.

Our analysis of the French preferential tax scheme yields two main empirical results. First, we use an innovative bunching approach to estimate simultaneously inter-temporal shifting elasticity

in short-and medium-term. We find compelling evidence of timing responses at age 70 increasing with the level of wealth. We show indeed large and sharp excess bunching located exactly at the notch combined with slight but wide hole (missing mass) above it. The tax change leads to an increase of 36% in contributions made at age 70 for the wealthy and 16% for the rest of the population. These estimates translate into large inter-temporal shifting elasticity with respect to the net-of-tax rate [4] in the short-term. This inter-temporal shifting elasticity is equal to 1.1 for the wealthy and 0.5 for the rest of the population. In contrast, missing mass above the notch leads to much more modest elasticities in the medium term equal for both groups to 0.10. As a result, we find that strong timing responses in the short term can reflect modest inter-temporal shifting responses in the medium term. These findings underline the need to systematically contrast strong short term responses with more realistic responses in the medium-term.

Second, we use a difference-in-differences setting to estimate shifting among asset portfolio and real responses. Our results are precisely estimated and robust to various specification forms. We obtain compelling evidence of a negative but small effect of inheritance tax on Assurance-vie contributions at the individual level. It corresponds to an elasticity of 0.24 between 70 and 75 years (long term [5]) up to 0.35 after 75 years old (medium term[5]).

Our empirical findings shed a new light on motivations behind wealth accumulation and bequest motives. The underutilization of gifts as a planning tool and the strong responses from individuals at the onset of terminal illness have been seen by the literature as a desire of individuals to retain control over wealth up to death. In our case, however, small responses to taxation can not be explained by this motive. Indeed, Assurance-vie accounts benefit from preferential taxation but, contrary to gifts, provides also a way to retain control over assets up to death.

The small magnitude of our different behavioral responses would rather suggest that people face myopia or a denial of death until an advanced age. First, small timing responses denote that tax planning is underutilized around age 70. Second, more important real and shifting responses as compared to timing responses indicates that consumption and/or utility of wealth per se matters more than bequest at this age. Finally, the increase of real and shifting elasticities with age could reveal that, when individuals get closer to death (after 75 years old), they progressively

4. The net-of-tax rate is defined from now on as 1 minus the marginal tax rate
5. As life expectancy is approximately equal to 80 years, the medium term corresponds to 5 years before death and the long term correspond to 5-10 years before death.

accept the idea of contemplating death. They are therefore more concerned about inheritance and more prompt to react to inheritance tax.

We are not the first to suggest that many people can live in denial of their own mortality. This idea is common in literature, philosophy and psychology and has already been discussed and studied theoretically by Slemrod (2003) and Kopczuk and Slemrod (2003). However, our findings constitute the first evidence of the presence of 'denial of death' and document empirically its implication on behavioral responses and wealth accumulation.

The article is organized as follows. Section 2 describes the French institutional background and the data we use. Section 3 presents the empirical analysis. Section 4 derives policy implications. Section 5 concludes.

2 Institutional background and Data

The complexity of the French inheritance tax system has always been a nightmare for an audience not familiar with its intricacies. We will not dwell here on these complexities but a short presentation is in order, as it will help make sense of the empirical strategy used in this paper. This section will offer a general overview of the inheritance tax system in France. It will then present what is Assurance-vie in France and how it is taxed. Finally, it will describe the data used.

2.1 Transfer taxation in France

The French transfer taxation differs strongly from the US one for at least three reasons. The partition of the estate among heirs is set in part by law. France has developed a progressive inheritance tax system, in which tax rates and tax exemptions depend on the wealth received by each successor and the kin relationship with the deceased. Assurance-vie accounts and gifts benefit from preferential tax schemes.

The rules of transmission

French inheritance laws have not significantly changed since the implementation of the civil Code by Napoleon in 1804. In order to protect children from being disenfranchised, only part of the

estate called the disposable portion ("quotité disponible") is freely disposable. The remaining part, called the reserved portion ("réserve héréditaire"), is automatically earmarked for deceased's children. [6] The amount of *la réserve* and the amount freely disposable depend on the number of deceased's children. For n children, the reserved portion is set to $n/n+1$ of the estate and the disposable portion to $1/n+1$.

The rules of taxation

Unlike the US, the French transfer taxation takes the form of a progressive inheritance tax based on the net assets received by each successor. The tax schedule and tax exemptions vary according to the relationship of the inheritor to the deceased. Surviving spouse are fully exempted since 2007. In "direct line", i.e. for transmissions from parents to children, marginal tax rates range from 5% to 40% after an exemption of 150,000€. [7] For collateral heirs, i.e. from a parallel line of the deceased's family, the tax schedule is almost flat with high tax rates ranged from 35% to 60% [8] and low tax exemption. [9]

Inter-vivos Gift

From 1942 to 1992, inter-vivos gifts was fully integrated to the inheritance tax in order to achieve a complete neutrality between gift and bequest. [10] The same graduated tax schedules applied to both bequests and gifts, and most importantly all inter vivos gifts was "recalled" when the donor died and was added to the bequest left at death. As a result, each heir ended up paying taxes on the basis of the total estate he or she received from the decedent. [11] In 1992, the French government introduced the "10 year rule" : gifts made more than 10 years before the time of death are not recalled anymore in the estate. This rule implies that the tax exemption is not

6. The surviving spouse is only considered as protected heir in absence of children. In this case, the reserved portion accruing to the surviving spouse is equal to 25% of the estate.

7. The top marginal tax rate has been fixed to 45% since 2011, while the tax exemption decreased from 150,000€ to 100,000€ in 2012.

8. For brothers and sisters, the marginal tax rate is equal to 35% below 24,430€ and 45% above it. For nephews and nieces, the inheritance is taxed at a flat rate of 55%.

9. The tax exemption is equal to 16,000€ for brothers and sisters and 8,000€ for nephews and nieces.

10. In realty, there has never been step-up in value of what was given before death. Only the nominal amount given is recalled at the time of death.

11. The tax paid at the time of the gift is deducted from the tax liability computed at the time of death on the sum of gift and bequest. I.e. if t(.) is the relevant tax schedule, v is the gift and b is the bequest, then one pays tax t(v) at the time of the gift, and t(b+v)-t(v) at the time of death, so that the total tax payment is t(b+v).

anymore a lifetime exemption but can be renewed every 10 years. Since 2012, the "10 year rule" has become a "15 year rule".

2.2 What is Assurance-vie in France ?

Assurance-vie is now the most widespread financial asset in France. It represents 38 % of the financial assets owned by households and 23% of total transmission at death. [12] It is used to finance supplemental retirement benefits, long-term financial projects or transmission at death.

Assurance-vie account is a flexible savings vehicle containing securities for tax purpose. Contributions to Assurance-vie accounts are unlimited and can be made at any age, either regularly or as one lump sum. They can be invested directly in stock, bond or money market or indirectly through mutual funds. At any time, individuals can change or sell underlying investments and request a cash withdrawal, convert the capital into a life-time annuity or just close down the account. At any time, the value of the Assurance-vie account corresponds to the value market of the financial products held into the account. At death, the account is transmitted to the beneficiaries.

Assurance-vie occupies a singular place in the French tax landscape. Until 1992, Assurance-vie accounts transmitted at death were fully exempt from inheritance tax. The purpose of this preferential tax scheme was to foster the development of domestic long-term savings and thus safeguard the financing of the economy from foreign investments. The increasing cost and the perverse effects of this scheme led the government to come back progressively on the preferential tax treatment of Assurance-vie transmitted at death in 1992 and 1998.

The 1992 reform has narrowed the scope of the preferential tax scheme to contributions made before age 70. The fraction of contributions made before age 70 remained exempt from inheritance taxation. In contrast, those made after age 70 were recalled into the inheritance tax base after a global exemption of 30,000€. [13] As the 1992 reform was not retroactive, Assurance-vie accounts

12. Assurance-vie represents 15 % of total private wealth and 38 % of financial assets in 2013 according to National Accounts from INSEE (France's National Institute of Statistics). The aggregate flow of Assurance-vie transmitted at death comes from the Fédération Française des Sociétés d'Assurances (French association of insurance companies). The bequest flow comes from Enquêtes Mutation à Titre Gratuit (sample of estate tax returns collected by the French ministry for the economy and finance).

13. When Assurance-vie accounts are transmitted at death, the financial institutions send automatically to the fiscal administration the share of contributions made after and before age 70.

opened before 11/20/1991 [14] remained fully tax exempt. The 1998 reform has limited the fiscal advantage of the preferential tax scheme for Assurance-vie. Instead of being fully tax exempt, all contributions not recalled into the inheritance tax base are now taxed at a flat rate of 20% after a supplemental tax exemption of 152,500 € by inheritor. [15]

Despite the upward trend in the tax burden, contributions recalled into the inheritance tax base are still subject to a preferential taxation for at least three reasons. First, Assurance-vie account is not considered as part of the estate and can therefore constitutes a way to get around the rigid "reserved portion" rule. Second, capitalized interests and capital gains from contributions made after age 70 are exempt from taxation. Finally, even contributions recalled in the inheritance tax base are less taxed than other assets due to the additional tax exemption of 30,000€.

Table 1 summarizes the taxation of Assurance-vie at death since 1998 depending on the opening date of Assurance-vie accounts and age at which contributions are made. The reforms of the preferential tax scheme have introduced a much higher tax rate on contributions made after age 70 for accounts opened after November 20, 1991. As we discuss in more detail in Section 3, this quasi-experimental variation is used to estimate different behavioral responses to inheritance tax in an inter-temporal framework. First, we exploit the notch created around age 70 to estimate timing responses using bunching estimation. Second, we exploit the fact that the increase in taxation applied only to Assurance-vie accounts opened after November 20, 1991 to estimate shifting among asset portfolio and real responses in a difference-in-differences setting.

As shown in Table 2, Assurance-vie accounts benefit also to a preferential income tax. The taxation of capital income from Assurance-vie depends on the opening date of the account and the length of time the account has been in force. We argue that the variations induced by this scheme should not affect our estimation of behavioral responses to inheritance taxation. Indeed, the estimation of timing responses relies on bunching estimation induced by the formation of a notch at age 70. As taxation of Assurance-vie at income tax does not vary discontinuously at age 70, the estimation should not be biased. The estimation using a difference-in-differences

14. In order to avoid massive timing responses, the 1992 reform was applied to accounts opened after 11/20/1992, i.e the date the reform was officially announced and discussed at Parliament.

15. Inheritors can benefit simultaneously from three different tax exemptions : the exemption of 152,500 euros applied to contributions made before age 70, the exemption of 30,000 euros applied to contributions made after age 70 and finally the inheritance tax exemption. The inheritance tax exemption varies depending on the kin relationship between the inheritor and the decedent and applied to contributions made after age 70 and other assets transmitted at death.

approach is based on the comparison of Assurance-vie accounts opened just before or after 1992. As contributions to accounts are observed between 2003 and 2013, i.e more than 8 years after the opening date of the accounts, both groups face the same flat tax rate of 7.5%.

Table 1 – Taxation of Assurance-vie at death since 1998

	Contributions made	
	Before aged 70	After aged 70
Opening date of the account		
Before 11/20/1991	Flat tax rate of 20%	
After 11/20/1991	Flat tax rate of 20%	Recalled into the inheritance tax base

Note : At death, the fraction of contributions taxed at the flat rate of 20% benefits from a tax exemption of 152,500€. The fraction of contributions recalled into the inheritance tax base faces top marginal tax rates going up to 40% for direct descendants and 60% for collateral heirs.

Table 2 – Taxation of Assurance-vie at income tax

	Accounts opened during				
	<2 years	2 to 4 years	4 to 6 years	6 to 8 years	≥ 8 years
Accounts opened					
Before 1/1/1983	fully tax-exempt				
Before 1/1/1990	45%	25%	15%	7.5% [a]	7.5% [a].
After 1/1/1990	35%	35%	15%	15%	7.5% [a].

Note : Only capital income withdrawn from the account are taxed. Capital income withdrawn are taxed at flat tax rates, instead of the progressive income tax schedule, depending on the opening date of the account and the length of time the account has been in force.

a. Before 1/1/1998, the tax rate of 7.5% was equal to 0%. Since 1/1/1998, capital income from Assurance-vie taxed at 7.5% benefits to a tax exemption of 4600€ for a single person and 9200€ for married couples.

2.3 Data

The empirical analysis is based on a French longitudinal data set from the financial company Axa over the period 2003-2013. It includes detailed information about Assurance-vie accounts and socio-demographic variables of all French clients at Axa at a monthly frequency. More importantly, our data set contains the daily date at which contributions were made.

This data set regroups two categories of individuals. The first group corresponds to individuals opening a standard preferential tax savings vehicle (referred to as "classical individuals"). The second group corresponds to wealthy individuals that entrust Axa with the management of their wealth (referred to as "wealthy indiviuals"). A minimum capital subscription of hundreds of thousand euros is required to benefit from personalized management of wealth. [16] Therefore, Assurance-vie account from the second group are significantly more important than those from the first one.

We focus our analysis on individuals aged between 60 and 80 years old and having not terminated their account during lifetime. As described previously, individuals can open an Assurance-vie account to constitute a cash reserve that will be used during lifetime. Contributions made before age 60 can also be dedicated to the payment of a supplemental retirement benefit. In these cases, the contributions will not be transmitted at death and are therefore not relevant in our analysis. We take advantage of the longitudinal structure of the data to control for this issue. [17] We restrict also our sample to individuals aged more than 60 because they are less likely to make contributions for these motives. [18]

Table 3 presents spell-level summary statistics. Panel A corresponds to the sample used for the bunching estimation. It includes individuals aged between 60 and 80 years old with accounts opened after 11/20/1991. Panel A shows the following. First, the value of the accounts and the contributions made by the wealthy individuals are strongly higher than those from the classical individuals. Second, the distribution of Assurance-vie account is extremely skewed. The top one percent hold closed to 30% of total Assurance-vie. Third, the data set includes 7.8 millions observations corresponding to 350 000 individuals observed during 23 quarters (5 to 6 years).

Panel B presents the particular sub-sample used for the difference-in differences approach. It includes individuals aged between 60 and 80 years old with accounts opened up to two years before or after the 1992 reform of the preferential tax scheme (November 20, 1991). As compared to panel A, individuals from panel B have opened their account for a longer period of time. Consequently, the duration of the account is twice as big as in the panel A. The value of the

16. The minimum capital required depends on the financial products contained by the account. Relatives to wealthy clients such as spouse or children can also open an account with portfolio manager without having the minimum capital required.
17. Specifically, we exclude all accounts having been terminated during lifetime.
18. Most individuals retired at the legal retirement age of 60.

account is also more important, whereas the contributions made are significantly less important. This is due to the fact that individuals from panel B have already reallocate a part of their wealth into Assurance-vie accounts. The contributions result mainly from new accumulation of wealth rather than substitution effect among portfolio assets.

Table 3 – Descriptive statistics on Assurance-vie, France 2003-2013

Panel A : Assurance-vie accounts opened after 11/20/1991

	All	Wealthy	Standard
Age	68.5	69.5	68.4
	(5.88)	(6.04)	(5.85)
Value of the accounts (in '000s of 2013 euros)			
mean	60.2	192.7	41.7
p50	14.5	54.7	11.5
p99	611.2	2,002.5	419.1
P99-100	1,757.7	6,473.7	829.8
Quarterly contributions (in '000s of 2013 euros)			
mean	1.2	3.0	0.9
p99	20.1	41.8	17.8
Number of observations	7,826,454	958,265	6,868,189
Number of individuals	347,253	41,074	306,179
Average number of spells	22.5	23.3	22.4
Duration of the account (in years)	12.4	13.5	12.3

Panel B. Assurance-vie accounts opened between 11/20/1989 and 11/20/1993

	All	Accounts opened	
		before 11/20/1991	after 11/20/1991
Age	70.2	70.1	70.2
	(6.25)	(6.24)	(6.27)
Value of the accounts (in '000s of 2013 euros)			
mean	89.5	73.5	106.4
p50	26.3	23.5	29.5
p99	822.3	719.1	967.7
P99-100	2,970.7	1,987.6	3,978.3
Quarterly contributions (in '000s of 2013 euros)			
mean	0.6	0.6	0.6
p99	2.9	2.5	3.2
Number of observations	747,307	383,153	364,154
Number of individuals	31,073	15,531	15,542
Average number of spells	24.1	24.7	23.4
Duration of the account (in years)	21.9	23.0	20.8

Source : Computation of the authors from Axa data set.
Note : This table presents a number of summary statistics coming from Axa longitudinal data set during the period 2003-2013.
Panel A corresponds to the sample used for the bunching estimation. It includes individuals aged between 60 and 80 years old with accounts opened after the implementation of the preferential tax scheme reform. "Standard" referred to individuals opening a standard account. "Wealthy" referred to wealthy individuals that entrust Axa the management of their wealth.
Panel B show the sample used for the difference-in-differences approach. It includes individuals aged between 60 and 80 years old with accounts opened up to two years before or after the reform of the preferential tax scheme.
Summary statistics are computed at the spell-level apart from the number of individuals, the number of spells and the duration of the account which are computed at the individual level. A spell corresponds to a quarter of a year. The value of the account and the contributions are expressed in thousand of 2013 euros.

3 Empirical Approach

In the following section, we estimate the impact of inheritance taxation on wealth accumulation. Our strategy takes advantage of the fact that Assurance-vie transmitted at death are taxed differently whether contributions were made before or after age 70. As shown in Figure 1, the increase in taxation at age 70 is likely to generate timing, shifting among asset portfolio and real responses.

Individuals can avoid the increase in taxation by re-timing contributions just before age 70. This behavior should generate excess bunching located exactly at the notch combined with hole after age 70. For accounts opened after 1991, we can therefore estimate timing responses in the short and medium run using bunching approach (Figure 2.A).

The increase in taxation can also generate a reduction of Assurance-vie accumulation. This reduction could reflect either shifting among asset portfolio or wealth disaccumulation (real and shifting responses). We exploit the fact that the tax change implemented in 1992 is not retroactive in order to estimate these responses. Accounts opened just after November 20, 1991 are indeed subject to the taxation change after age 70, while those opened just before the implementation of the reform encounters no change in taxation during lifetime. We take advantage of this difference-in-differences setting to estimate medium and long term responses to taxation (Figure 2.B).

This section will be organized in three parts. The first part presents the estimation of timing responses using bunching estimation. The second part is dedicated to the estimation of real and shifting responses using difference-in-differences approach. The third part summarizes and discuss the results.

Figure 1 – Behavioral responses induced by the preferential tax scheme

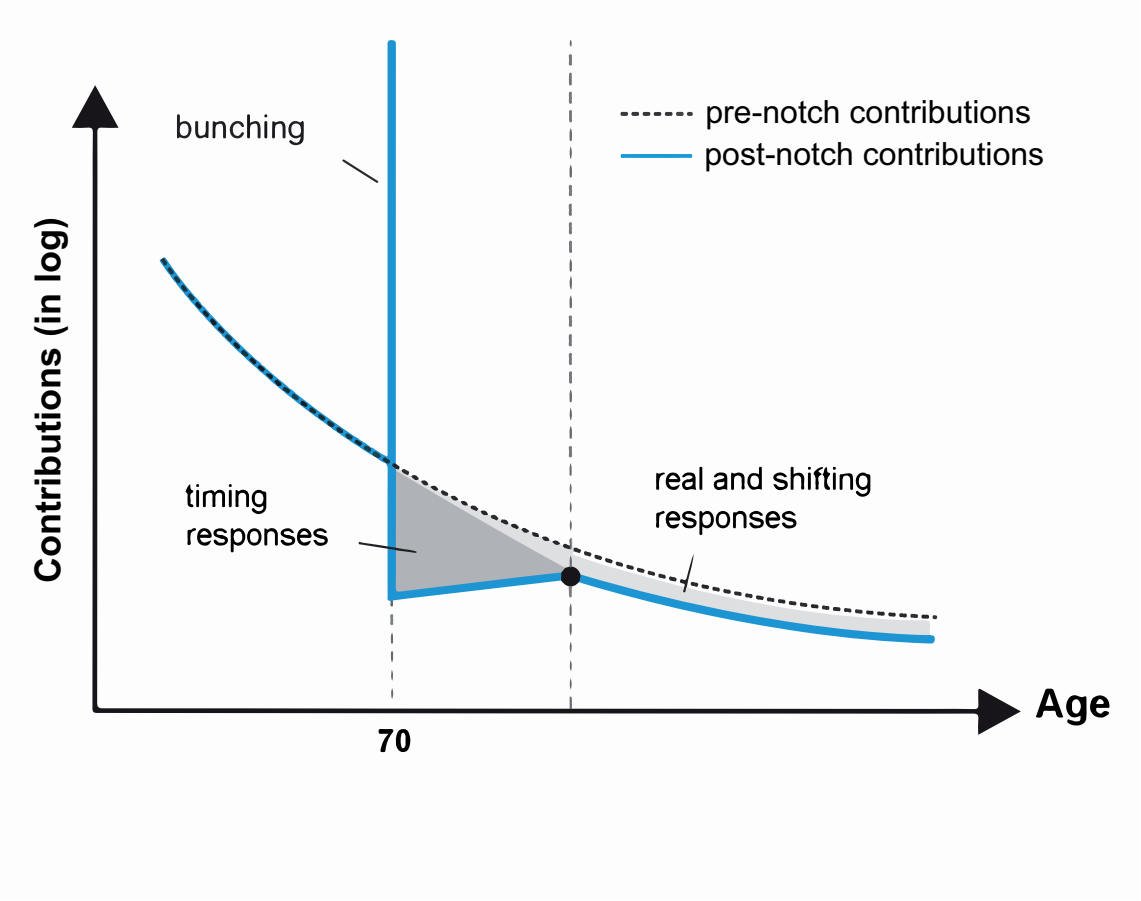
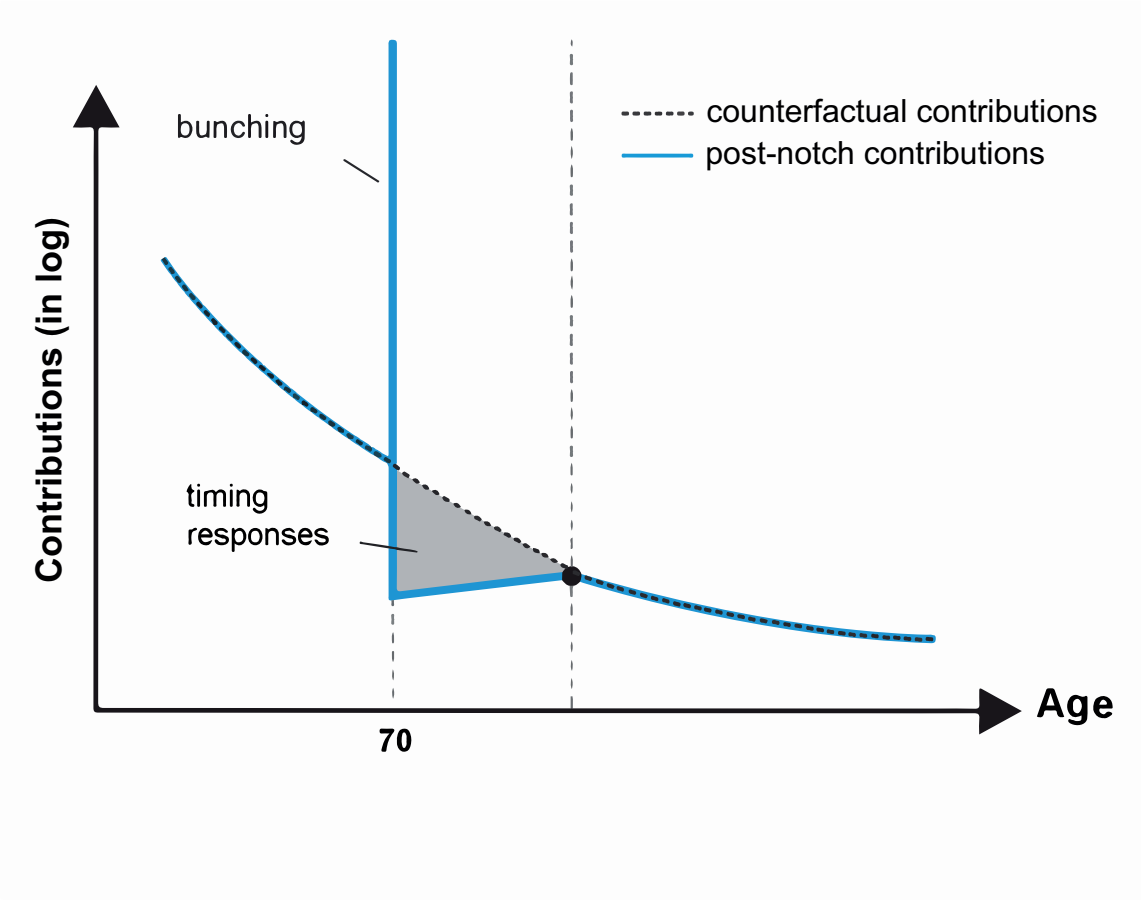
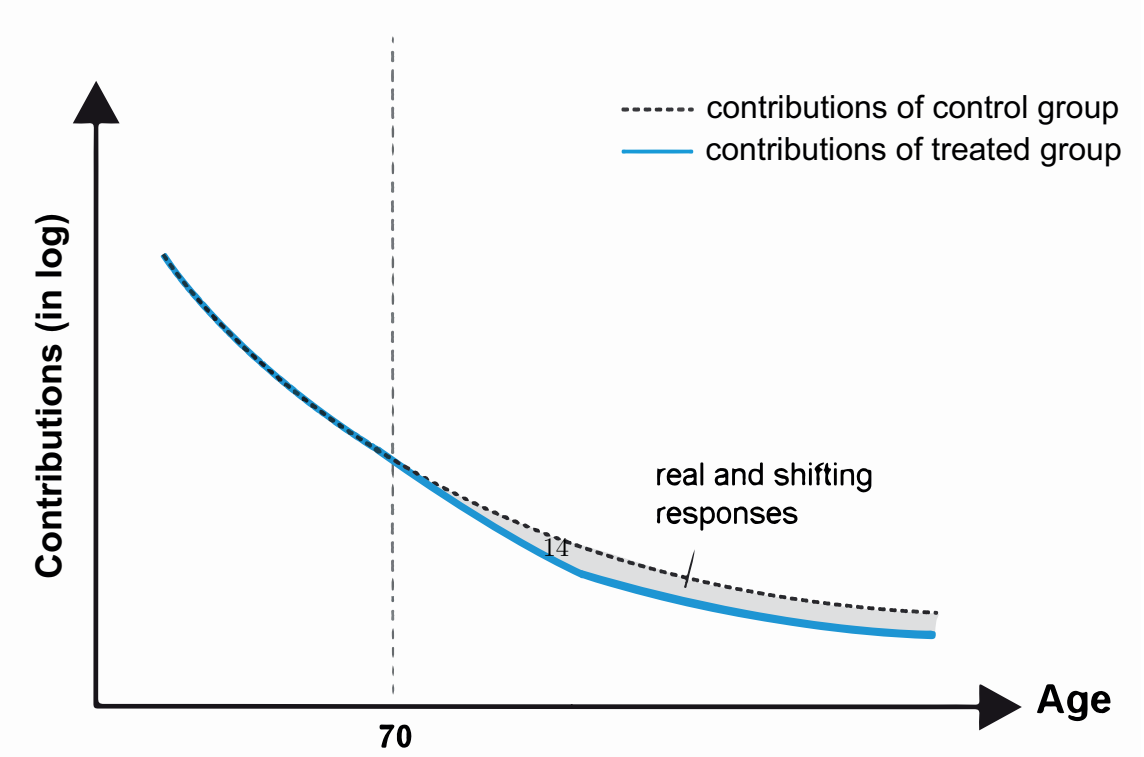


FIGURE 2 – ESTIMATION OF BEHAVIORAL RESPONSES TO INHERITANCE TAX

A. BUNCHING APPROACH



B. DIFFERENCES-IN-DIFFERENCE APPROACH



3.1 Timing responses due to the notch

3.1.1 Empirical Methodology and identification

Estimation of timing responses takes advantage of the formation of a notch induced by the permanent change in taxation starting from age 70. More precisely, strong and permanent increase in taxation at age 70 introduces an incentive to retime contributions before the tax change takes place. As a result, the empirical function of contributions should exhibit excess bunching at age 70 and a hole just above the cutoff. We can then derive reduced-form estimates of timing responses by comparing the empirical function to an estimate of the smooth counterfactual that would be expected in the absence of notch. The identification assumption underlying causal inference is that the empirical function would have been smooth if there were no jump in the tax rate. [19]

We now address one potential concern with our approach. As shown in Figure 1, the tax change at age 70 is likely to induce other behavioral responses such as shifting among asset portfolio or wealth disaccumulation. These responses may affect the observed contributions above the cutoff. Therefore, the estimated counterfactual is not stripped of all behavioral responses. As emphasized by Kleven and Waseem (2013), the estimation approach is still valid as long as the counterfactual is stripped of timing responses. In addition, we will be able to estimate these other behavioral responses using difference-in-differences approach in the next section.

Following recent developments in bunching literature (Saez (2010); Chetty et al. (2011); Kleven and Waseem (2013)), we estimate first a counterfactual function of contributions in the absence of notch. To do so, we fit a flexible polynomial to the empirical function, excluding data in a range around the notch. The estimation model takes the following form :

$$\log y_a = \sum_{j=0}^{J} \beta_j \cdot (age_a)^j + \sum_{k=a_l}^{a_u} \gamma_k \cdot \mathbb{1}_{age_a=k} + \varepsilon_a \tag{1}$$

where the dependent variable is contributions (in log) made by individuals of age a, $(age_a)^j$ are non-parametric polynomial fits for age, $[a_l, a_u]$ is the excluded range around the notch point and ε_a is the residual resulting from potential misspecification of the model.

19. In order to assess the validity of the identifying assumption, Figure 5 from section A.1. depict the empirical contributions by age for accounts opened before 11/20/1991. As the 1992 law is not retroactive, this group encounters no taxation change at age 70. Consistency with our identifying assumption, the empricial function exhibits no bunching at age 70.

The counterfactual function is then : [20]

$$\log y_a^c = \sum_{j=0}^{J} \hat{\beta}_j \cdot (age_a)^j \tag{2}$$

Finally, we can obtain reduced-form estimates of timing responses by fitting the following regression model :

$$\log y_a = \sum_{j=0}^{J} \beta_j \cdot (age_a)^j + \gamma_1 \cdot \mathbb{1}_{a_l \leq age_a \leq \bar{a}} + \gamma_2 \cdot \mathbb{1}_{\bar{a} < age_a \leq a_u} + \varepsilon_a \tag{3}$$

where $\mathbb{1}_{a_l \leq age_a \leq \bar{a}}$ and $\mathbb{1}_{\bar{a} < age_a \leq a_u}$ are respectively dummies for age a being in the excluding range below or above the notch. The coefficients we are interested in are γ_1 (short-term timing responses) and γ_2 (medium-term timing responses). They correspond respectively to the difference of contributions (in log) between the empirical and the counterfactual functions in the excluded range below the notch or above the notch.

Our methodology differs slightly from traditional bunching estimations for at least two reasons. First, our approach is based on an inter-temporal setting. The taxation occurs only at death but depends on age at which contributions were made. Therefore, the relevant dependant variable is the amount of contributions made instead of the number of individuals or accounts. [21] Second, our empirical strategy exploits both sides of the notch to estimate simultaneously timing responses in the short and in the medium term. This joint estimation does help to assess to what extend the short-term timing responses just before 70 years affect the future accumulation behavior. More specifically, the difference between the empirical and the counterfactual functions above the notch

20. We can define bunching b (and missing m), which is respectively the excess (the missing) mass in the excluded range below (above) the notch $\bar{a}$ in proportion to the counterfactual contribution at the notch.

$$\hat{b} = \frac{\sum_{a=a_l}^{\bar{a}} \log y_a - \log y_a^c}{\log y_{\bar{a}}^c}$$

$$\hat{m} = \frac{\sum_{a=\bar{a}}^{a_u} \log y_a^c - \log y_a}{\log y_{\bar{a}}^c}$$

21. The increase in taxation at age 70 should only affect the amount of contributions made. As Assurance-vie transmission and taxation will occur only at death, individuals having opened an account before age 70 will keep this account until death. As a result, the density distribution should remain smoothed. Figure 6 in appendix reports the number of accounts by quarterly age. In contrast with the function of contributions by age (Figure 3), the density distribution of accounts exhibits no discontinuity at age 70.

allow us to estimate the real impact of the timing responses on Assurance-vie accumulation. The size of the hole determines the length of the horizon over which there is re-timing. The estimation of medium-term responses could be difficult to convincingly identify because tax change and time effects are often not dissociable. The originality of our estimation comes from the fact that the tax change is associated with age. By pooling together different cohorts of individuals in a long period of time, we can then isolate properly medium-term responses to taxation.

3.1.2 Results

Figure 3 reports the empirical function of contributions (in log) and our estimated counterfactual function by quarterly age around the notch. Specifically, Figure 3 is split in two panels. Panel A makes reference to wealthy individuals with accounts under the supervision of portfolio manager ("wealthy individuals"). Panel B corresponds to individuals with standard accounts ("standard individuals"). Each panel shows estimates of b, m and m-b, respectively our estimates of the excess mass, missing mass and the difference between the two scaled by the average contributions at the notch, with its standard error shown in parentheses.

Our main findings are the following. First, we observe bunching concentrated just during the last quarter before 70 years old in both panels. The size of the bunching differs significantly depending on the level of wealth. Panel A depicts important bunching corresponding to 0.82 time the height of the counterfactual contribution at age 70 for the wealthy. Panel B shows moderate bunching corresponding to 0.15 time the height of the counterfactual contributions for the classical individuals. Second, both notches are associated with a slight but wide hole above the cutoff. The size of the hole is larger than the size of excess bunching, although the difference between the two is not statistically significant from zero. Finally, the horizon of timing responses is four years for wealthy individuals and two years for standard individuals.

Table 4 presents timing responses and reduced-form estimates of the inter-temporal shifting elasticity with respect to the net-of-tax rate. [22] Bunching excess mass encounters at the notch leads to strong inter-temporal shifting elasticity in the short run. The elasticity is equal to -0.51 for the classical individuals and -1.1 for the wealthy individuals. In contrast, the medium-term

22. As described in detail in Appendix A.1., our results are robust to the choice of functional form for the counterfactual function. They are also robust to the estimation method of the excluded zone.

elasticity is much more modest and equal for both groups to 0.10.

The difference between short and medium term elasticities can be explained easily. The increase in taxation after age 70 has only reduced by 3% the contributions that would have been made. However, the overall reduction of contributions observed during several years after age 70 has has been entirely shifted just before age 70. Consequently, the short-term elasticity is quite high, although it only reflects modest inter-temporal shifting responses in the medium run.

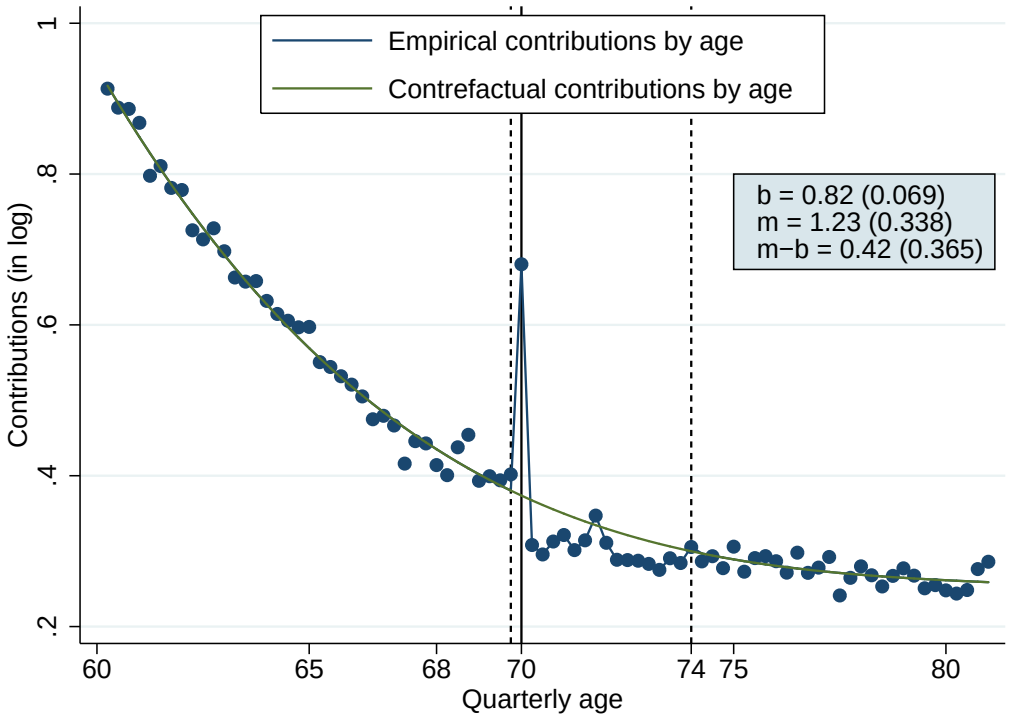
Timing horizon constitutes also a crucial parameter in the particular framework of inter-temporal shifting responses. It reflects the maximum length of the horizon over which individuals are able to shift contributions. Timing horizon equals two years for standard individuals and four years for wealthy individuals. Differences in time horizon can explain why the short-term elasticity is twice as big for the wealthy than it is for standard individuals, whereas the medium-term elasticity is equal for both groups. The taxation change at 70 years old has induced the same reduction of contributions for both groups. However, this response has lasted twice as long for the wealthy. As a result, the short-term elasticity is twice as big for the wealthy.

Wealthy and classical individuals do not only differ in the level of wealth. Wealthy individuals are richer than classical individuals but benefit also from personalized management of their wealth. Differences among groups could be explained either by asymmetric information (salience of tax) or wealth differences. In order to isolate the proper effect of wealth differences on timing responses, Table 4.B presents results for wealthy and classical individuals with similar values of Assurance-vie accounts. [23]. The results show similar timing responses for both groups denoting that only differences in wealth can explain a differential behavior among groups. Salience of tax is therefore irrelevant in this framework.

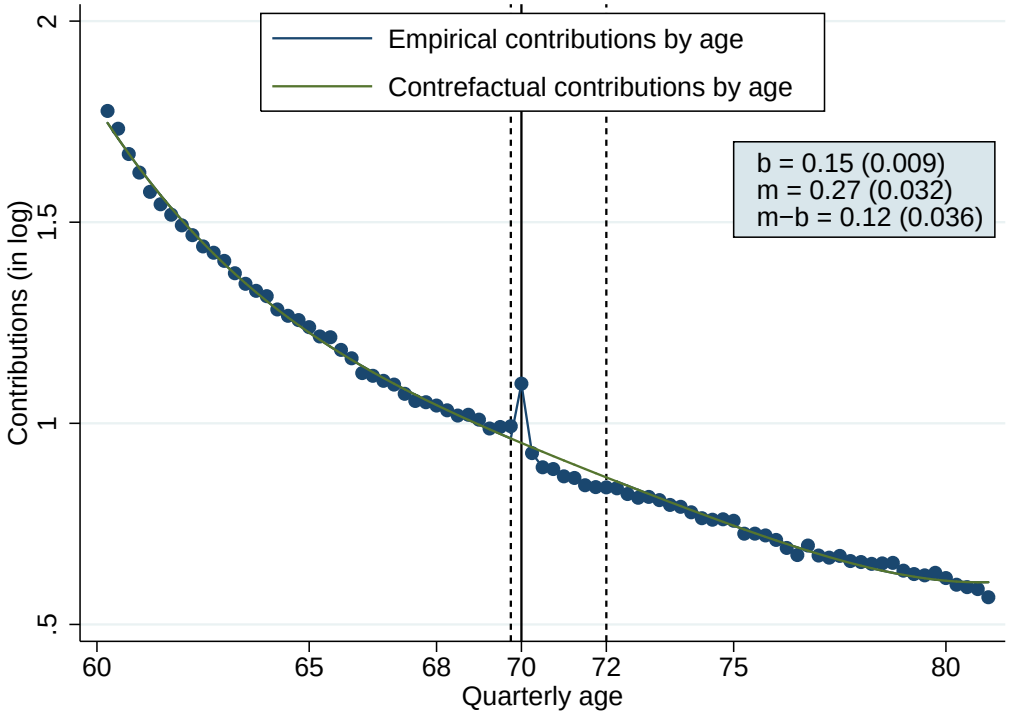
23. We restrict our sample to individuals with accounts between 100,000€ and 700,000€ in 2003.

Figure 3 – Contributions by age around the notch, France 2003-2013

A. For wealth individuals



B. For standard individuals



Notes : Figures 3.A and 3.B report the empirical function of contributions (in log) and our estimated counterfactual function by quarterly age. The sample corresponds to French Assurance-vie account opened after 11/20/1991 over the period 2003-2013. Figure 3.A corresponds to wealthy individuals with accounts under the supervision of portfolio manager. Figure 3.B corresponds to individuals with standard accounts.
At the notch (denoted by the vertical line), taxation changes radically. Contributions made before age 70 are taxed at a flat rate of 20% after an exemption of 150,000€. Contributions made after 70 are recalled into the inheritance tax base with top marginal tax rate going up to 40%. The counterfactual function is estimated as in Equations 1 and 2, using a polynomial of order 4. The vertical dashed lines denote the upper and lower bounds of the excluded region around the notch. The lower bound of the excluded region is set at the point where excess bunching starts while the upper bound is chosen at the point where the empirical function changes slope from positive to negative as implemented by Best and Kleven (2014). b, m and m-b are respectively our estimates of the excess mass, missing mass and the difference between the two scaled by the average contribution at the notch, with its standard error shown in parentheses. All standard errors are obtained by block-bootstrap procedure at the individual level with 600 replications.

Table 4 – Absolute value of timing responses and reduced-form elasticity estimates

	Timing responses		Reduced-form shifting elasticity		Horizon of timing responses
	short term	medium term	short term	medium term	
Panel A : All individuals					
Standard individuals	0.15***	0.032***	0.51***	0.11***	2 years
	(0.008)	(0.004)	(0.028)	(0.013)	
Wealthy individuals	0.31***	0.029***	1.07***	0.10***	4 years
	(0.023)	(0.008)	(0.081)	(0.029)	
Panel B : Individuals with accounts between 100,000€ and 700,000€					
Standard individuals	0.36***	0.035***	1.24***	0.12***	4 years
	(0.03)	(0.012)	(0.10)	(0.041)	
Wealthy individuals	0.37***	0.049***	1.29***	0.17***	4 years
	(0.046)	(0.015)	(0.16)	(0.052)	

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Bootstrap standard errors in parentheses.
The table shows the absolute values of timing responses and reduced-form estimates of the inter-temporal shifting elasticity implied by bunching at the notch. Timing responses are directly obtained from the estimation of Equation 3. Short-term timing responses correspond to γ_1, whereas medium-term timing responses are equal to γ_2. Standard errors are obtained by block-bootstrap procedure at the individual level with 600 replications.
The reduced-form elasticities are computed by dividing timing responses by $\log(1-0.4) - log(1-0.2)$ and the standard errors associated are derived by the delta method.
As described in detail in Appendix A.1., these results are robust to the choice of functional form for the counterfactual function. They are also robust to the estimation method of the excluded zone.

3.2 Real and shifting responses : difference-in-differences approach

3.2.1 Empirical Methodology and identification

Apart from timing responses, the preferential tax scheme for Assurance-vie can also generate real and shifting responses. In order to investigate these effects, we exploit the fact that the tax change implemented in 1992 is not retroactive. Therefore, accounts opened before 11/20/1991 are not subject to taxation change after age 70. They can then constitute a proper counterfactual to those opened after the implementation of the reform in a difference-in-differences approach.

Unfortunately, we only observe contributions made from 2003 to 2013, i.e at least 12 years after accounts had been opened. To avoid comparability issues, we restrain our sample to accounts opened up to two years before or after the implementation of the reform.

We now address two potential concerns with our approach. First, our sample includes only

accounts (a) not terminated before 2003 and (b) not terminated during lifetime between 2003 and 2013. If the reform of 1992 is likely to play on (a) or (b), then our estimation will suffer from selection bias. More specifically, the reform may have increased the probability to terminate the accounts opened after 11/20/1991 during lifetime, while they would have been transmitted at death in absence of the reform. We argue that it should not be the case because these accounts still benefit from a supplemental tax exemption of 30 000€ and a complete exemption of the capitalized interests. The reform should only play on the supplemental contributions made after age 70 and above the tax exemption. Therefore, the reform should not affect the probability to terminate the account. Second, individuals could anticipate the reform by opening an account just before its implementation. In this case, the assignment in treated or control group would no longer be considered as exogenous and the estimation would be biased. However, this latter point should not be a concern in our analysis. Indeed, the 1992 reform was applied to Assurance-vie accounts opened after 11/20/1991, i.e 40 days before the law was voted, in order to avoid this kind of behavior.

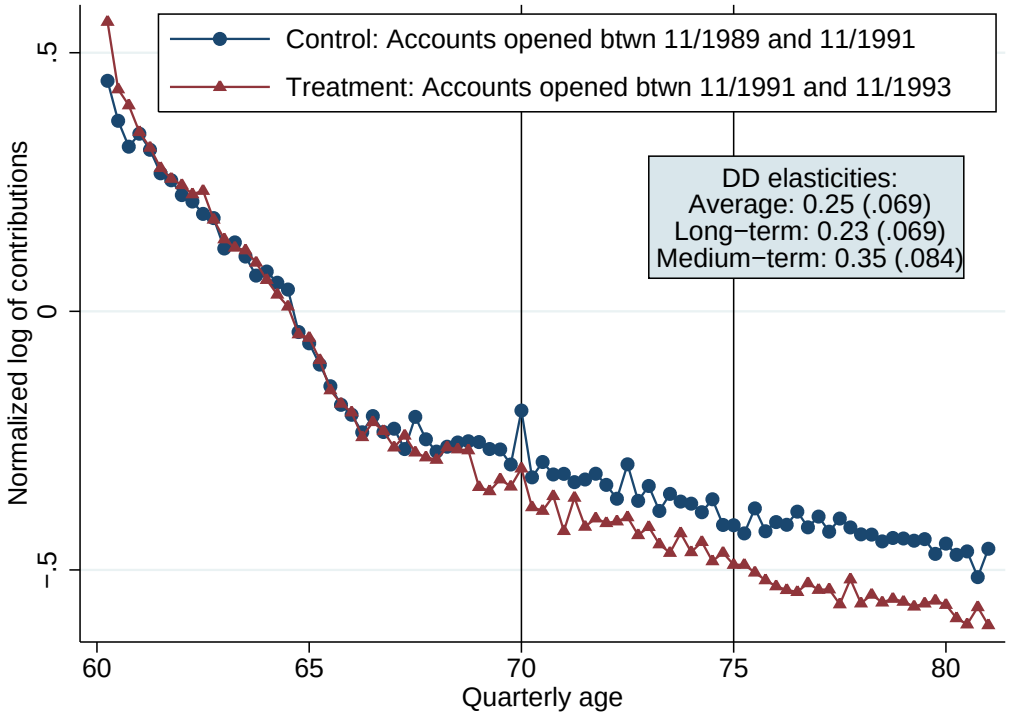
Formally, we can test the presence of selection bias using the following intuition. If the treatment selection based on the 1992 reform is not exogenous, we should expect the number of accounts opened after the reform to be much less important than those opened before the reform. In contrast, Figure 7 exhibits no difference in the number of accounts coming from both groups.

Figure 4 compares the normalized log of contributions by quarterly age coming from accounts opened just two years before or after the 1992 reform. Both series display similar trend leading up to age 70 and then begin to diverge. [24] Contributions from the treated group remain almost constant after 70 years old, whereas those from the control group decrease continuously. The growing difference between the two groups after age 70 could be due to the fact that more and more individuals from the treated group begin to plan for the disposition of their estate as they age and get closer to death. In this case, behavioral responses should be less important in the long run (between 70 and 75 years old) than in the medium run (after 75 years old). [25]

24. As robustness checks, Figures 8.A and 8.B from Appendix A.2. depict the evolution of contributions in falsification experiments, in which control and treatment groups are either both affected or both unaffected by the taxation change at age 70. In these falsification experiments, both series display parallel trend during lifetime and show no divergence at age 70.

25. As life expectancy is approximately equal to 80 years, the medium run corresponds to 5 years before death and the long run correspond to 5-10 years before death.

Figure 4 – Impact of inheritance tax on wealth accumulation : Difference-in-differences evidence



The figure shows the evolution of contributions (in log) by quarterly age in the control and treatment group. Contributions from accounts opened after 11/20/1991 (treatment group) encounters a sharp increase in taxation after age 70, while contributions coming from accounts opened before 11/20/1991 (control group) are not affected by the tax reform. The figure shows the normalized log of contributions by quarterly age defined as the log of contributions for a given quarterly age minus the average of the log of contributions between 60 and 70 years old. The corresponding elasticity estimates are reported (see Table 5).

Formally, we can quantify the impact of the inheritance tax change on Assurance-vie accumulation using regression specifications of the form :

$$\log y_{iagt} = \delta \cdot \log(1 - \tau_{ga}) + \beta_g + \gamma_a + \nu_t + \varepsilon_{ia} \tag{4}$$

$$\log y_{iagt} = \delta \cdot \log(1 - \tau_{ga}) + \alpha_i + \gamma_a + \nu_t + \varepsilon_{ia} \tag{5}$$

where the dependent variable is contributions (in log) made by individual i of age a from group g at time t. α_i, β_g, γ_a and ν_t are respectively individual, group, age and year fixed effects. The treatment group is defined as individuals with accounts opened up to two years after 11/20/1991, and the control group is defined as individuals with accounts opened up to two years before 11/20/1991. τ_{ga} is the marginal tax rate facing by individuals from group g at age a. Consistent with the reform of the preferential tax scheme, it is equal to 40% for individuals from the treated group aged more than 70 years old and 20% otherwise. δ represents the difference-in-differences elasticity estimate. In Equation 5, group fixed effects are substituted by individual fixed effects to fully exploit the longitudinal dimension of our dataset.

3.2.2 Results

Regression Estimates. Table 5 summarizes the graphical evidence described above by presenting elasticity estimates. All estimates are derived from Equations 4 and 5.

Column 2 reports the elasticity estimates from Equation 4, while column 1 omits year fixed effects. The estimated elasticity is essentially the same in both specifications around 0.33. Time is indeed irrelevant in our framework because the tax change depends only on age and opening date of the account. [26]

Our estimates should only be biased if both groups follow different age trends before the tax change. Specification 3 investigates a potential difference in preexisting trends between the treatment and control groups. In this specification, we introduced a « placebo » treatment variable for the five-year period before the increase in taxation at age 70. The placebo elasticity is small (0.087) and not statistically significant. The real treatment elasticity is almost unchanged (from 0.33 to 0.4) and the change is not statistically significant.

26. Adding interacted age-year or group-year fixed effects has also no impact on elasticity estimates.

Specification 4 tests the robustness of the elasticity to the introduction of individual fixed effects (Equation 5). The elasticity decreases slightly to 0.25 and remains statistically significant at the 1% level. This specification is the most reliable and constitutes our baseline specification for now on.

Specification 5 investigates dynamic effects of the tax change by splitting the post-treatment period into a long-term horizon (70-75 years old) and a medium-term horizon (75-80 years old) [27]. The medium-term elasticity is statistically more important [28] than the long-term elasticity.

Following the influential paper of Bertrand et al. (2004), column 6 tests the potential bias of the standard errors. The elasticity reported in column 6 is identical to that reported in column 4 but a block bootstrap method at the individual level is used to derive standard errors. The bootstrap standard errors are similar to the clustered standard errors. As noted by Bertrand et al. (2004), clustering performs well when the number of clusters is large.

Taken together, these results show that elasticities are small (0.25-0.35) and precisely estimated. The small magnitude of elasticities can be explained by the fact that despite a huge increase in taxation at age 70, the tax change has only induced a reduction of contributions of 7%.

The elasticities reflect the aggregate effect of two different types of responses : (i) a substitution of Assurance-vie for other assets (shifting among asset portfolio) and (ii) a substitution of Assurance-vie for consumption (wealth disaccumulation).Our estimated elasticities should be seen as an upper bound of the true elasticity of taxable estate. If 100% of the estimated elasticity was due to real responses, our estimated elasticity would be similar to the elasticity of taxable estate. However, a part of the estimated elasticity is due to shifting responses. As shifting responses do not affect the overall level of wealth, this part of the elasticity should not matter. Ideally, one should compare the evolution of wealth composition in both groups in order to disentangle the shifting and real components of the elasticity. Unfortunately, our data set include only the share of wealth dedicated to Assurance-vie.

27. As life expectancy is approximately equal to 80 years, the medium term corresponds to 5 years before death and the long term correspond to 5-10 years before death.
28. Medium and long-term elasticities are statistically significant from each other at 5% level.

Table 5 – Impact of inheritance tax on wealth accumulation : Difference-in-differences elasticity estimates

Dependent variable	Contributions (in log)					
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.339***	0.330***	0.400***	0.250***		0.250***
	(0.101)	(0.101)	(0.132)	(0.069)		(0.072)
Before treatment			0.087			
			(0.066)			
Treatment (long-term)					0.232***	
					(0.069)	
Treatment (medium-term)					0.348***	
					(0.084)	
Age FEs	x	x	x	x	x	x
Year FEs		x	x	x	x	x
Individual FEs				x	x	x
Sample size	672134					
No. individuals	25820					

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The standard errors in parentheses are clustered at the individual level. The table displays elasticity estimates of the impact of the 1992 inheritance tax reform on Assurance-vie accumulation. The estimates are based on Equations 4 and 5. The control group corresponds to accounts opened just before the tax reform (between 11/20/1989 and 11/20/1991). The treated group corresponds to accounts opened just after the tax reform (between 11/20/1991 and 11/20/1993). For contributions made by the treatment group after 70 years old, top marginal tax rate goes from 20% to 40%, while it remains constant at 20% for the control group. Specification 3 controls for differential preexisting age trends specific to control and treatment groups. It includes a « placebo » treatment variable for the five-year period before the increase in taxation at age 70. In column 4, individual fixed effects are substituted to group fixed effects. Specification 5 investigates equal dynamic effects. The elasticity is broken down into medium and long-term elasticities. Medium-term refers to 0 to 5 years before age 80 (death) and long-term equals 5 to 10 years before age 80. Column 6 reports the same elasticity as in column 4 but a block bootstrap method at the individual level with 200 replications is used to derived standard errors.

Robustness checks. Table 6 considers various robustness checks. Column 1 reproduces our baseline estimate (column 4 from Table 5).

In specifications 2 and 3, we consider alternative control groups. In specification 2, we select accounts opened between 11/20/1987 and 11/20/1989 as control group, i.e 2 to 4 years before the implementation of the tax reform (instead of 0 to 2 years in the baseline specification). The elasticity increases moderately from 0.25 to 0.38. As the alternative control group is a poorer substitute to the baseline control group, it is less likely to reflect the evolution of the treatment group in absence of the tax change. However, elasticity from column 2 is very close to that obtained in the baseline specification. In specification 3, we conduct a "falsification experiments" in which the control group is also affected by the tax change at age 70, i.e accounts opened 2 to 4 years after the implementation of the tax reform (instead of 0 to 2 years before in the baseline specification). In this new setting, both groups encounter exactly the same change in taxation at 70 years old. Consistent with this framework, the placebo elasticity is small (0.09) and insignificant.

In specifications 4 and 5, we carry out a sensitivity analysis with respect to the window width used to select the sample. Specification 4 reports the elasticity estimate for "± 1 year" window (accounts opened one year before or after the implementation of the 1992 reform). Specification 5 is based on "± 4 year" window. Broadly speaking, the results are robust to the window width used. All elasticities are very similar. Elasticity from specification 5, however, is less significant due to the smaller size of the sample.

Table 6 – Robustness checks : Difference-in-differences elasticity estimates

		Varying control group		Varying year window	
	Baseline	Control#2	Placebo	± one-year	±4 years
	(1)	(2)	(3)	(4)	(5)
Treatment	0.250***	0.378***	0.094	0.180*	0.231***
	(0.069)	(0.072)	(0.063)	(0.101)	(0.044)
Sample size	672134	563618	1112130	284842	1698172
No. individuals	25820	22721	42262	10805	65693

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The standard errors in parentheses are clustered at the individual level.
The table presents various robustness checks. Column 1 reproduces the baseline elasticity (column 4 from Table 5). For the baseline specification, the difference-in-differences estimation is based on accounts opened up to two years before or after 11/20/1991, i.e the implementation date of the reform.
Columns 2 and 3 show the results with alternative control group. In column 2, the control group corresponds to accounts opened 2 to 4 years before the tax reform (instead of 0 to 2 years). In column 3, both groups encounters the tax change at age 70. The « treated control group » corresponds to accounts opened 2 to 4 years after the tax reform.
Columns 4 and 5 show the results with varying year window. In the baseline specification, the sample was restricted to accounts opened up to 2 years before or after 11/20/1991 (±2 year window). Column 4 and 5 report the results for ±1 and ±4 year window.

3.3 Discussion

The analysis of behavioral responses to inheritance tax yields five main results. All elasticities are small, although they are precisely estimated and robust to various robustness checks. Second, timing responses around aged 70 are small around 0.1. Third, the small magnitude of timing responses cannot be explained by tax salience. Fourth, real and shifting responses are more important than timing responses but remain limited around 0.25. Finally, real and shifting responses increase significantly when individuals get closer to death.

Our empirical findings shed a new light on motivations behind wealth accumulation and bequest motives. Poterba (2001) and Joulfaian and McGarry (2004) (among others) have shown that gifts appear to be significantly underutilized as a tax planning tool, while Kopczuk (2007) documented tax-motivated actions at the onset of a terminal illness. Kopczuk (2007) concluded that individuals may actively care about disposition of their estates, but that this preference is dominated by the desire to hold on to their wealth while alive. Our analysis provides a way of testing to what extent this theory is supported by empirical evidence.

Our results are consistent with findings highlighted by previous literature. However, our interpretation differs strongly. As for gifts, we find that individuals failed to fully use Assurance-vie as a planning tool. The increasing elasticity over age is also consistent with the fact that people care more about the disposition of their estate when closer to death. However, these finding could not be explained by a desire of individuals to retain control over death. Indeed, Assurance-vie benefits from preferential taxation but, contrary to gifts, provides also a way to retain control over assets up to death.[29] Small timing responses show that individuals fail to minimize tax liabilities even when this tax planning tool allows them to retain control over wealth. As most liquid assets of individuals are already invested into Assurance-vie account, timing responses can only occur if people reduce their consumption or sell illiquid assets (housing) to accumulate Assurance-vie before age 70. Small timing responses denotes that people around age 70 tend to value more consumption and detention of housing assets than leaving a bequest. These findings are corroborated by the fact that timing responses are less important than real and shifting responses at the same age (70-75 years old).

Our findings, added to those from the literature, can be supported by a "denial of death effect" implying a limited horizon of tax planning before death. Tax planning tools and more generally bequest remind people of death, which is associated to a painful event. They will therefore avoid to deal with death and inheritance until an advanced age. Long before death, individuals would save only for future consumption or for utility of wealth per se. When individuals get closer to death, they progressively accept the idea of contemplating death and are more prompt to react to inheritance tax.

4 Public policy implications

In this section, we investigate public policy implications of the reform of the preferential tax scheme. We also estimate optimal inheritance tax rate using the behavioral responses estimated in the previous section.

29. Preference for lifetime wealth retention, 'rotten kid theorem' or uncertainty about death are irrelevant in our framework because Assurance-vie remains part of individuals' wealth and can be cash out at anytime without cost.

Public policy implications of the reform. The reform of 1992 has decreased the erosion of the inheritance tax base by reincorporating contributions made after age 70 into the inheritance tax base. However, it has induced three types of behavioral responses : wealth disaccumulation, a shifting of contributions across time and a shifting among asset portfolio.

From a government revenue-maximizing perspective, the different behavioral responses have the following impact. First, timing responses has no impact on government revenues. Indeed, timing responses allow people to avoid the increase in taxation. These responses can therefore limit the efficiency of the reform. Second, shifting among asset portfolio should not matter. After the implementation of the reform, inheritance taxation becomes the same whether individuals accumulate Assurance-vie or other assets after age 70. Finally, real responses decrease government revenues by reducing accumulation of wealth. As all estimated behavioral responses are low, the reform of the preferential tax scheme has had a positive impact on the government revenues without creating important efficiency costs.

Revenue-maximizing tax rate. From a broader perspective, the estimated elasticities could be used to derive inheritance tax rate. We consider first a simple application of our estimated elasticity : the revenue-maximizing tax rate. This rate is equal to $1/(1+e_B)$ where e_B corresponds to the elasticity of the taxable estate. Using our estimated elasticity of 0.25 (Table 5 column (4)), we obtain a revenue-maximizing tax rate equal to 80%. This tax rate relies on the hypothesis that our estimated elasticity can be generalized to the overall estate and that the elasticity is only due to real responses. As previously noted, our elasticity captures the impact of taxation on financial assets, which are in theory the most sensitive to taxation. In addition, the elasticity measures an aggregate effect of real and shifting among asset portfolio responses, while only real responses reduce the overall estate. The elasticity should be therefore seen as an upper bound of the true elasticity and the tax rate as a lower bound.

Optimal inheritance tax rate. From a normative point of view, one should take into account that the government can have redistribute tastes. Its purpose is to maximize the social welfare of the population rather than inheritance tax receipts. Piketty and Saez (2013) provide a "sufficient statistic" formula for optimal inheritance tax that take into account the redistributive tastes

of the government. In this particular framework, there is only two sources of taxation : labor taxation and inheritance taxation (capital income tax rate is equal to 0%). When the government wants to maximize the welfare of a particular group of the distribution of the bequest receivers, the formula takes the following form :

$$\tau_B = \frac{1 - \left[1 - \frac{e_L \tau_L}{1-\tau_L}\right]\left[\frac{\bar{b}^{\text{received}}}{\bar{y}_L}(1+\hat{e}_B) + \frac{\nu}{R/G}\frac{\bar{b}^{\text{left}}}{\bar{y}_L}\right]}{1 + \hat{e}_B - \left[1 - \frac{e_L \tau_L}{1-\tau_L}\frac{\bar{b}^{\text{received}}}{\bar{y}_L}(1+\hat{e}_B)\right]} \tag{6}$$

where $\bar{b}^{left}$, $\bar{b}^{received}$ and $\bar{y}_L$ are respectively the ratios of bequest left, bequest received and earnings of the sub-group targeted by the government to population averages. e_B and e_L are respectively the elasticities of aggregate taxable bequests and taxable income. $R/G = e^{(r-g)H}$ with r the return on capital and g the growth rate. ν is the parameter for pure bequest motive.

Table 7 presents simulations of optimal linear and non-linear tax rates using Equation 6. All parameters except the elasticity of taxable bequest come from Piketty and Saez (2013). The value of the elasticity of taxable bequest is derived from our estimated elasticity reported in Table 5 column 4. This estimate includes both shifting and real responses, while only real responses reduce the overall bequest. Table 7 show various optimal tax rates depending on the share of the elasticity of taxable bequest that results from real responses.

Optimal tax rates depend on two factors : the percentile groups of bequest received favored by the government in its social welfare function and the fraction of the bequest elasticity due to real responses. We find that optimal linear tax might be as large as 60%–70% for France and between 55% and 65% for the U.S in the "Meritocratic Rawlsian" and "Median Voter" cases. Top tax rates could be even higher in the case of non-linear taxation. Even when the elasticity of taxable bequest is due entirely to real responses, optimal tax rates remains as large as 60% for both countries. This is due to the fact that the bottom 50% and median bequest-receivers leave substantially less wealth than average to their heirs, whereas their earnings are very close to average. As "Meritocratic Rawlsian" and "Median Voter" criteria put only weight to these groups, inheritance tax rate should then be relatively high in order to reduce their labor tax burden [30].

30. See Piketty and Saez (2013) for a complete description of the mechanisms.

Alternatively, when the government put only weight on the top bequest receivers ("pro-capitalist" case), optimal tax rate should be negative.

TABLE 7 – OPTIMAL INHERITANCE TAX RATE CALIBRATIONS

	Optimal Tax Rate (by Percentile of Bequest Received)									
	France					U.S.				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Fraction of the Bequest Elasticity due to Real Responses	100%	75%	50%	25%	0%	100%	75%	50%	25%	0%
Real Elasticity	0,25	0,19	0,13	0,06	0,00	0,25	0,19	0,13	0,06	0,00
1. Optimal Linear Tax Rate by Percentile of Bequest Received										
Meritocratic Rawlsian Case :										
P0-50	61%	64%	67%	71%	76%	56%	59%	63%	66%	70%
Median Voter Case :										
P40-60	59%	63%	66%	70%	74%	56%	59%	63%	66%	71%
Pro-Capitalist Case :										
P90-95	-340%	-328%	-315%	-300%	-284%	-93%	-82%	-70%	-57%	-43%
2. Optimal Top Tax Rate Above Positive Exemption Amount for Zero Receivers (bottom 50%)										
Above 500,000	61%	66%	72%	79%	88%	55%	58%	62%	67%	73%
Above 1,000,000	61%	67%	74%	82%	92%	54%	58%	62%	67%	73%

This table presents simulations of the optimal inheritance tax rate using Equation 6 for France and the United States. Tax rates depend on percentile groups of bequest received favored by the government in its social welfare function (Rawlsian meritocratic, median voter or pro-capitalist cases). Tax rates vary also depending on the share of elasticity of aggregate taxable bequests that results from real responses. The elasticity of taxable bequest is set to 0.25 and is based on our estimate reported in Table 5. All parameters except the elasticity of taxable bequest e_B and the bequest motive ν comes from Piketty and Saez (2013). $\bar{b}^{\text{left}}$, $\bar{b}^{\text{received}}$ and $\bar{y}_L$ was obtained by these authors from the survey data (SCF 2010 for the U.S., Enquête Patrimoine 2010 for France). They consider the following benchmark values for the parameters $e_L = 0.2$, $\tau_L = 30\%$, $R/G = e^{(r-g)H} = 1.82$ with $r - g = 2\%$ and H = 30 years.
$\nu = 0.7$, the pure bequest motive, is based on estimates from Kopczuk and Lupton (2007).

5 Conclusion

Our article has analyzed the effect of inheritance taxation on different components of behavioral responses in an inter-temporal framework. This study has benefited from first-time access to a unique longitudinal dataset from the financial company Axa. Our empirical strategy exploits quasi-experimental variations created by the French preferential tax scheme for wealth transmission through Assurance-vie account. This scheme offers an opportunity to credibly disentangle timing

responses from other responses such as shifting among tax base and wealth disaccumulation in the medium and long run.

We have obtained two main results. First, we estimate simultaneously timing responses in the short and medium-term using an innovative bunching approach. We document large bunching at age 70 leading to important timing responses in the short run. We show that these responses reflect only modest inter-temporal shifting responses in the medium run. The small magnitude of timing responses around 0.1 cannot be explained by tax salience. Second, we use a difference-in-differences setting to estimate shifting among asset portfolio and real responses. These responses are more important than timing responses but remain limited around 0.25. They increase significantly when individuals get closer to death.

Our empirical findings shed a new light on motivations behind wealth accumulation and bequest motives. Our findings cannot be supported by the desire to retain control over wealth and may better be explained by denial of death. They suggest that savings are mainly driven by future consumption and utility of wealth per se until an advanced age. When individuals get closer to death (after 75 years old), they progressively accept the idea of contemplating death. They are therefore more concerned about inheritance and more prompt to react to inheritance tax.

Finally, we use our estimated elasticity of taxable bequest to derive optimal inheritance tax rate for France and the United States. We find that inheritance tax rate might be as large as 60%–70% for France and between 55% and 65% for the U.S.

Références

Arrondel, Luc and Anne Laferrere, "Taxation and wealth transmission in France," *Journal of Public Economics*, 2001, *79* (1), 3–33.

Auerbach, Alan J. and Laurence J. Kotlikoff, "How Rational Is the Purchase of Life Insurance ?," NBER Working Papers 3063, National Bureau of Economic Research, Inc August 1989.

Auten, Gerald and David Joulfaian, "Bequest taxes and capital gains realizations," *Journal of Public Economics*, 2001, *81* (2), 213–229.

Bakija, Jon and Bradley T. Heim, "How Does Charitable Giving Respond To Incentives And Income ? New Estimates From Panel Data," *National Tax Journal*, 2011, *64* (2), 615–50.

Bakshi, Gurdip S and Zhiwu Chen, "The Spirit of Capitalism and Stock-Market Prices," *American Economic Review*, 1996, *86* (1), 133–57.

Bastani, Spencer and Hakan Selin, "Bunching and non-bunching at kink points of the Swedish tax schedule," *Journal of Public Economics*, 2014, *109* (C), 36–49.

Bernheim, B. Douglas, Robert J. Lemke, and John Karl Scholz, "Do estate and gift taxes affect the timing of private transfers ?," *Journal of Public Economics*, 2004, *88* (12), 2617–2634.

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan, "How Much Should We Trust Differences-in-Differences Estimates ?," *The Quarterly Journal of Economics*, 2004, *119* (1), 249–275.

Best, Michael and Henrik Jacobsen Kleven, "Housing Market Responses to Transaction Taxes : Evidence from Notches and Stimulus in the UK," Working Paper 2014.

Cagetti, Marco and Mariacristina De Nardi, "Entrepreneurship, Frictions, and Wealth," *Journal of Political Economy*, October 2006, *114* (5), 835–870.

_ **and Mariacristina De Nardi**, "Wealth Inequality : Data And Models," *Macroeconomic Dynamics*, September 2008, *12* (S2), 285–313.

_ **and Mariacristina De Nardi**, "Estate Taxation, Entrepreneurship, and Wealth," *American Economic Review*, March 2009, *99* (1), 85–111.

Carroll, Christopher D., "Why Do the Rich Save So Much ?," National Bureau of Economic Research Working Papers 6549 1998.

Chetty, Raj, "Is the Taxable Income Elasticity Sufficient to Calculate Deadweight Loss ? The Implications of Evasion and Avoidance," *American Economic Journal : Economic Policy*, 2009, *1* (2), 31–52.

_ , "Sufficient Statistics for Welfare Analysis : A Bridge Between Structural and Reduced-Form Methods," *Annual Review of Economics*, 2009, *1* (1), 451–488.

_ **, John N. Friedman, Tore Olsen, and Luigi Pistaferri**, "Adjustment Costs, Firm Responses, and Micro vs. Macro Labor Supply Elasticities : Evidence from Danish Tax Records," *The Quarterly Journal of Economics*, 2011, *126* (2), 749–804.

Cremer, Helmuth and Pierre Pestieau, "Wealth transfer taxation : a survey of the theoretical literature," in S. Kolm and Jean Mercier Ythier, eds., *Handbook on the Economics of Giving, Reciprocity and Altruism*, Vol. 2, Elsevier, 2006, chapter 16, pp. 1107–1134.

Francis, Johanna L., "Wealth and the capitalist spirit," *Journal of Macroeconomics*, September 2009, *31* (3), 394–408.

fu Zou, Heng, "'The spirit of capitalism' and long-run growth," *European Journal of Political Economy*, July 1994, *10* (2), 279–293.

Gale, William G. and Joel B. Slemrod, "Rethinking the Estate and Gift Tax : Overview," National Bureau of Economic Research Working Papers 8205 2001.

Goolsbee, Austan, "What Happens When You Tax the Rich ? Evidence from Executive Compensation," *Journal of Political Economy*, April 2000, *108* (2), 352–378.

Gruber, Jon and Emmanuel Saez, "The elasticity of taxable income : evidence and implications," *Journal of Public Economics, Elsevier*, April 2002, *84* (1), 1–32.

Holtz-Eakin, Douglas and Donald Marples, "Distortion Costs of Taxing Wealth Accumulation : Income Versus Estate Taxes," National Bureau of Economic Research Working Papers 8261 2001.

Joulfaian, David, "Gift taxes and lifetime transfers : time series evidence," *Journal of Public Economics*, 2004, *88* (9-10), 1917–1929.

_ , "Choosing between gifts and bequests : How taxes affect the timing of wealth transfers," *Journal of Public Economics*, 2005, *89* (11-12), 2069–2091.

_ , "The Behavioral Response of Wealth Accumulation to Estate Taxation : Time Series Evidence," *National Tax Journal*, 2006, *59* (2), 253–68.

_ **and Kathleen McGarry**, "Estate and Gift Tax Incentives and Inter Vivos Giving," *National Tax Journal*, 2004, *57* (2), 429–44.

Kleven, Henrik J. and Mazhar Waseem, "Using Notches to Uncover Optimization Frictions and Structural Elasticities : Theory and Evidence from Pakistan," *The Quarterly Journal of Economics*, 2013, *128* (2), 669–723.

Kleven, Henrik Jacobsen, Camille Landais, Emmanuel Saez, and Esben Schultz, "Migration and Wage Effects of Taxing Top Earners : Evidence from the Foreigners' Tax Scheme in Denmark," *The Quarterly Journal of Economics*, 2013, *129* (1), 333–378.

Kopczuk, Wojciech, "Bequest and Tax Planning : Evidence from Estate Tax Returns," *The Quarterly Journal of Economics*, 2007, *122* (4), 1801–1854.

_ , "Taxation of Intergenerational Transfers and Wealth," National Bureau of Economic Research Working Papers 18584 2012.

_ , "Incentive Effects of Inheritances and Optimal Estate Taxation," *American Economic Review*, 2013, *103* (3), 472–77.

_ **and David J. Munroe**, "Mansion Tax : The Effect of Transfer Taxes on the Residential Real Estate Market," National Bureau of Economic Research Working Papers 20084 2014.

_ **and Emmanuel Saez**, "Top Wealth Shares in the United States, 1916-2000 : Evidence from Estate Tax Returns," *National Tax Journal*, 2004, *57* (2), 445–87.

_ **and Joel Slemrod**, "The Impact of the Estate Tax on the Wealth Accumulation and Avoidance Behavior of Donors," National Bureau of Economic Research Working Papers 7960 2000.

_ **and** _ , "Dying to Save Taxes : Evidence from Estate-Tax Returns on the Death Elasticity," *The Review of Economics and Statistics*, 2003, *85* (2), 256–265.

_ **and Joseph P. Lupton**, "To Leave or Not to Leave : The Distribution of Bequest Motives," *Review of Economic Studies*, 2007, *74* (1), 207–235.

Maire, Daniel Le and Bertel Schjerning, "Tax bunching, income shifting and self-employment," *Journal of Public Economics*, 2013, *107* (C), 1–18.

Manoli, Day and Andrea Weber, "Nonparametric Evidence on the Effects of Financial Incentives on Retirement Decisions," CESifo Working Paper Series 4619 2014.

Modigliani, Franco, "The Role of Intergenerational Transfers and Life Cycle Saving in the Accumulation of Wealth," *Journal of Economic Perspectives*, 1988, *2* (2), 15–40.

Nardi, Mariacristina De, "Wealth Inequality and Intergenerational Links," *Review of Economic Studies*, 2004, *71* (3), 743–768.

Ohlsson, Henry, "The legacy of the Swedish gift and inheritance tax, 1884-2004," *European Review of Economic History*, 2011, *15* (03), 539–569.

Piketty, Thomas, "On the Long-Run Evolution of Inheritance : France 1820–2050," *The Quarterly Journal of Economics*, 2011, *126* (3), 1071–1131.

_ **and Emmanuel Saez**, "A Theory of Optimal Inheritance Taxation," *Econometrica*, 2013, *81* (5), 1851–1886.

_ **and Gabriel Zucman**, "Capital is Back : Wealth-Income Ratios in Rich Countries," *forthcoming, The Quarterly Journal of Economics*, 2014.

_ **, Gilles Postel-Vinay, and Jean-Laurent Rosenthal**, "Wealth Concentration in a Developing Economy : Paris and France, 1807-1994," *American Economic Review*, 2006, *96* (1), 236–256.

Poterba, James, "Estate and gift taxes and incentives for inter vivos giving in the US," *Journal of Public Economics*, 2001, *79* (1), 237–264.

Ramnath, Shanthi, "Taxpayers' responses to tax-based incentives for retirement savings : Evidence from the Saver's Credit notch," *Journal of Public Economics*, 2013, *101* (C), 77–93.

Saez, Emmanuel, "Using Elasticities to Derive Optimal Income Tax Rates," *Review of Economic Studies*, 2001, *68* (1), 205–29.

_ , "Do Taxpayers Bunch at Kink Points ?," *American Economic Journal : Economic Policy*, 2010, *2* (3), 180–212.

_ **, Joel Slemrod, and Seth H. Giertz**, "The Elasticity of Taxable Income with Respect to Marginal Tax Rates : A Critical Review," *Journal of Economic Literature*, 2012, *50* (1), 3–50.

Sallee, James M. and Joel Slemrod, "Car notches : Strategic automaker responses to fuel economy policy," *Journal of Public Economics*, 2012, *96* (11), 981–999.

Seim, David, "Real or Evasion Responses to the Wealth Tax ? Theory and Evidence from Sweden," *mimeo, Stockholm University , November*, 2014.

Slemrod, Joel, "Thanatology and Economics : The Behavioral Economics of Death," *American Economic Review*, May 2003, *93* (2), 371–375.

Wojciech, Kopczuk and Slemrod Joel, "Denial of Death and Economic Behavior," *The B.E. Journal of Theoretical Economics*, 2005, *5* (1), 1–26.

Appendix

A.1. Appendix to bunching estimation

In this section, we investigate the validity of the identifying assumption and the sensitivity of our bunching estimation (choice of the upper bound of the excluded zone, choice of the polynomial degree).

The validity of the bunching estimation is based on the identifying assumption that absence the tax change at age 70, the empirical function of contributions would have bee smoothed. In order to verify the validity of this assumption, Figure 5 depict the empirical function of contributions from accounts opened before 11/20/1991. As the 1992 law is not retroactive, there is no taxation change at age 70 for this group. Consistency with our assumption, the empirical function show no bunching at age 70.

Consistent with our framework, the increase in taxation at age 70 should only affect the contributions made around age 70, letting unchanged the density distribution of accounts. As Assurance-vie transmission and taxation will occur only at death, individuals having made contributions before age 70 will keep their account until death. As a results, the density distribution of accounts should remain smoothed. Figure 6 reports the number of accounts by quarterly age. In contrast with the empirical function of contributions (Figure 3), the density distribution of the accounts exhibits no discontinuity at age 70.

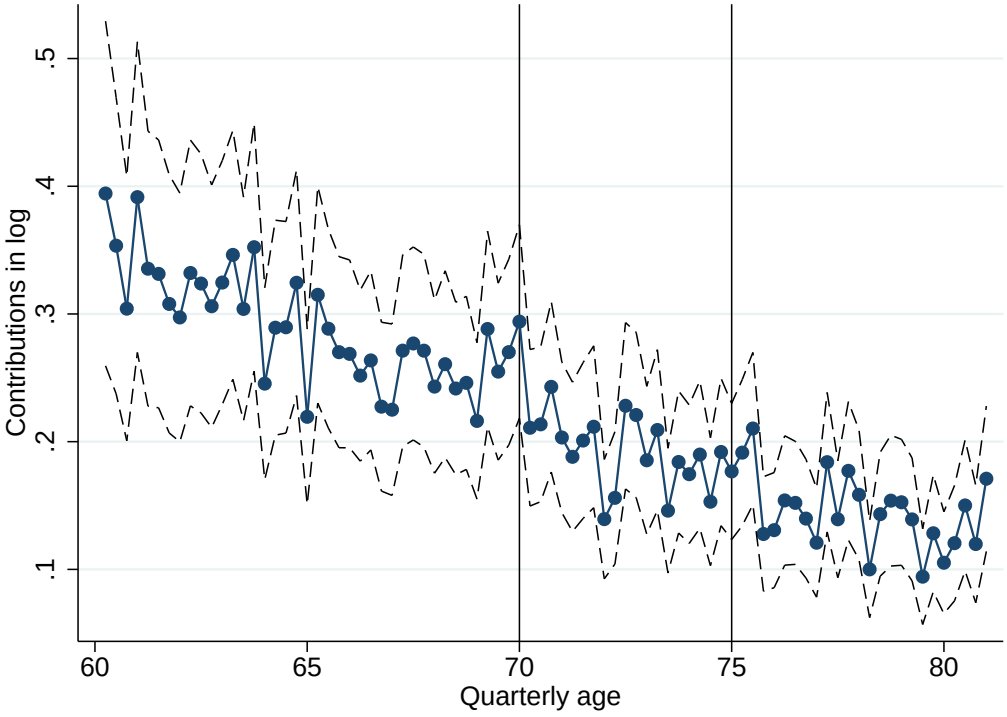
In section 3.1, the estimation of the counterfactual function is based on a fourth-order polynomial for age. The upper bound of the excluded zone a_u is set at the point where the empirical function changes slope from positive to negative. In order to asses the robustness of our results, we therefore carry out a sensitivity analysis with respect to the polynomial degree. We also investigate sensitivity of the results to the choice of the upper bound a_u. The upper bound of the excluded zone is set visually (Best and Kleven (2014)), or alternatively such as the missing mass is equal to the bunching mass (Kleven and Waseem (2013)).

In Table 8, we show that the results are very robust to the choice of functional form for the counterfactual function. Table 9 presents sensitivity of timing response estimates to the estimation method of a_u. The first two rows reproduce the results from our core analysis and reported in Table 4. The last two rows depict the results derived from the alternative estimation method of

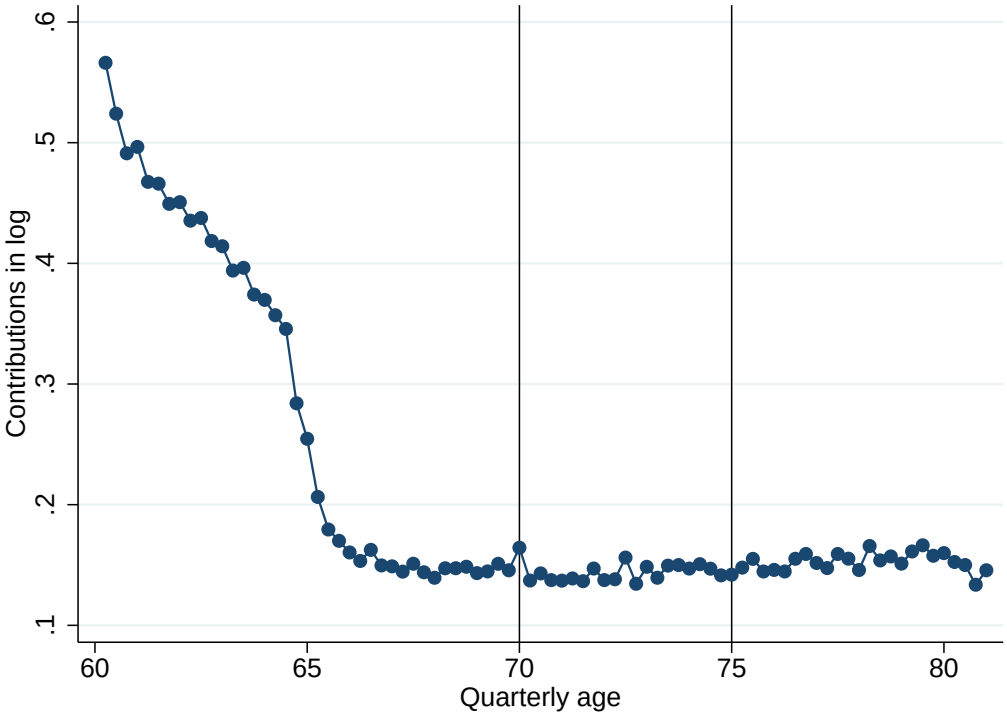
a_u. We find that our results are robust to the estimation method of a_u. Moreover, these findings imply that bias in estimation of a_u have very little impact on our results.

Figure 5 – Contributions from accounts opened before 11/20/1991

A. For wealthy individuals



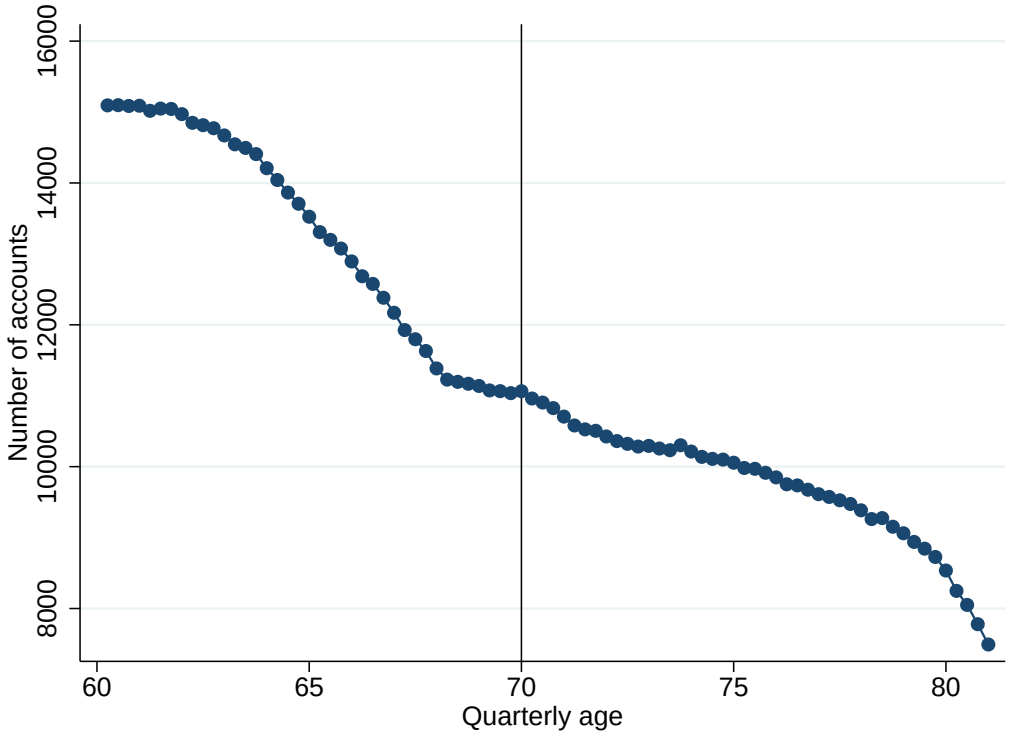
B. For standard individuals



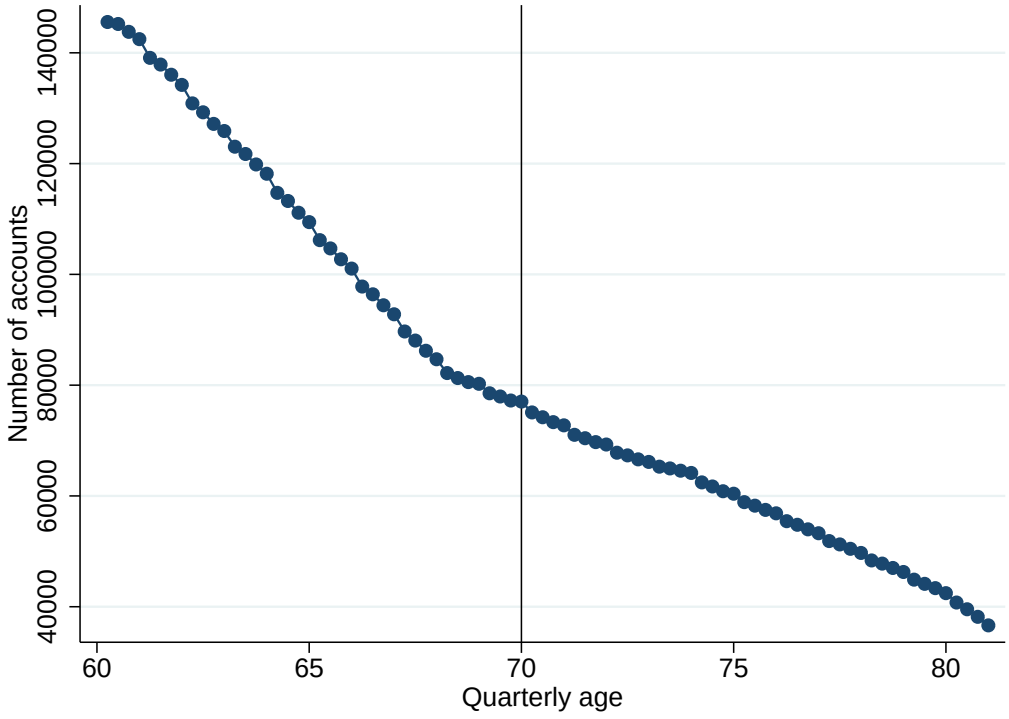
Notes : The figure shows the evolution of contributions (in log) by quarterly age. The sample corresponds to French accounts opened before 11/20/1991 over the period 2003-2013. Figure 5.A corresponds to wealthy individuals with accounts under the supervision of portfolio manager. Figure 5.B corresponds to individuals with standard accounts. In Figure 5.A, the function of contributions is reported with 95% confidence interval.
For accounts opened before 11/20/1991, there is no taxation change at age 70. As the empirical function exhibits no bunching mass at age 70, the identifying assumption of the bunching estimation seems to be verified.

Figure 6 – Number of accounts opened after 11/20/1991

A. For wealthy individuals



B. For standard individuals



Notes : The figure shows the number of accounts by quarterly age. The sample corresponds to French accounts taken out after 11/20/1991 over the period 2003-2013. Figure 6.A corresponds to wealthy individuals with accounts under the supervision of portfolio manager. Figure 6.B corresponds to individuals with standard accounts.
The increase in taxation at age 70 should only create a notch on the empirical function of contributions and let unaffected the density distribution of accounts. As Assurance-vie transmission and taxation will occur only at death, individuals having made contributions before age 70 will keep their account until death. As a results, the density distribution should remain smoothed.

Table 8 – Timing response estimates with different polynomial degrees for the counterfactual function (France, 2003-2013)

Polynomial degree for age	Timing responses short term	Timing responses medium term	Reduced-form shifting elasticity short term	Reduced-form shifting elasticity medium term
Standard individuals				
two	0.17***	0.00	0.60***	0.00
	(0.008)	(0.004)	(0.028)	(0.014)
three	0.17***	0.01***	0.58***	0.05***
	(0.008)	(0.004)	(0.028)	(0.014)
four	0.15***	0.03***	0.51***	0.11***
	(0.008)	(0.004)	(0.028)	(0.013)
five	0.15***	0.03***	0.52***	0.09***
	(0.008)	(0.004)	(0.028)	(0.013)
six	0.15***	0.02***	0.53***	0.08***
	(0.008)	(0.004)	(0.028)	(0.013)
Wealthy individuals				
two	0.31***	0.01*	1.09***	0.05*
	(0.024)	(0.008)	(0.083)	(0.029)
three	0.31***	0.03***	1.07***	0.10***
	(0.024)	(0.007)	(0.083)	(0.026)
four	0.31***	0.03***	1.07***	0.10***
	(0.023)	(0.008)	(0.081)	(0.029)
five	0.30 ***	0.03***	1.06***	0.12***
	(0.023)	(0.008)	(0.081)	(0.028)
six	0.31***	0.03***	1.07***	0.11***
	(0.023)	(0.009)	(0.081)	(0.032)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Bootstrap standard errors in parentheses. The table shows the absolute values of timing responses and reduced-form estimates of the inter-temporal shifting elasticity implied by bunching at the notch. The counterfactual distribution is estimated as in equations 1 and (2, using different polynomial degrees.
Timing responses are directly obtained from the estimation of equation 3. Short-term timing responses corresponds to γ_1 whereas medium-term timing responses are equal to γ_2. Standard errors are obtained by block-bootstrap procedure at the individual level with 600 replications.
The reduced-form elasticities are computed by dividing timing responses by $\log(1-0.4) - log(1-0.2)$ and the standard errors associated are derived by the delta method.

Table 9 – Timing response estimates with different estimation methods for the upper bound of the excluded zone a_u (France, 2003-2013)

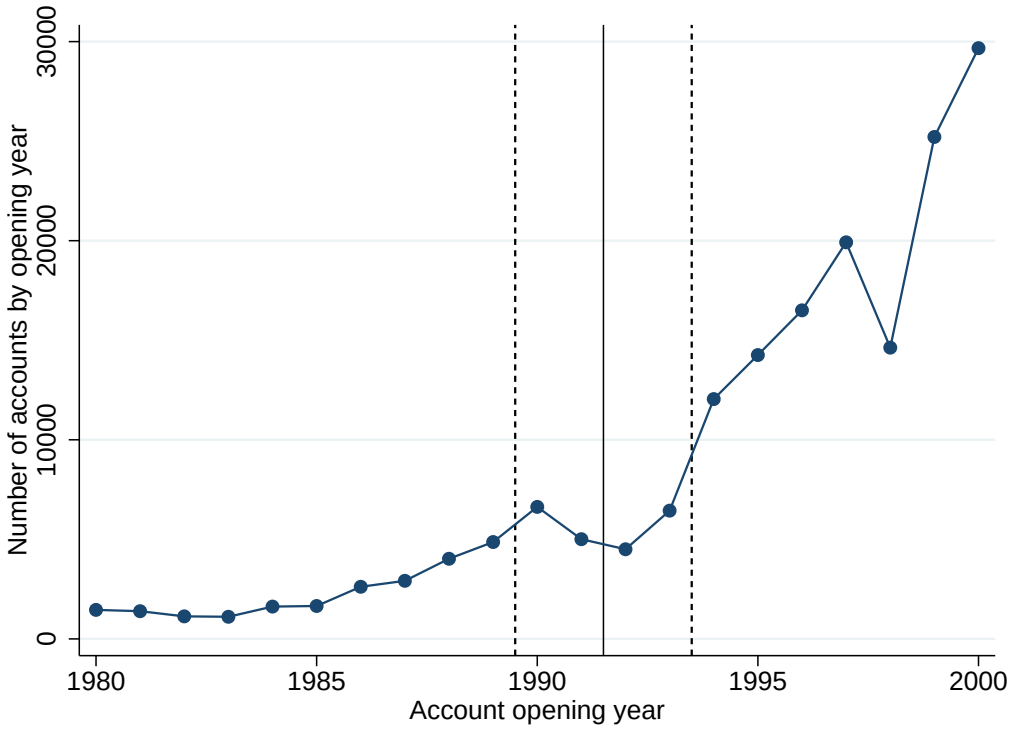
Polynomial degree for age	Timing responses short term	Timing responses medium term	Reduced-form shifting elasticity short term	Reduced-form shifting elasticity medium term	Upper bound of the excluded zone
Upper bound a_u determined visually					
Standard individuals	0.15***	0.03***	0.51***	0.11***	72 years old
	(0.008)	(0.004)	(0.028)	(0.013)	
Wealthy individuals	0.31***	0.03***	1.07***	0.10***	74 years old
	(0.023)	(0.008)	(0.081)	(0.029)	
Upper bound a_u determined such as bunching mass is equal to missing mass					
Standard individuals	0.14***	0.03	0.50***	0.11***	71.5 years old
	(0.008)	(0.004)***	(0.028)	(0.014)	
Wealthy individuals	0.31***	0.04***	1.09***	0.12***	72.75 years old
	(0.023)	(0.008)	(0.081)	(0.028)	

* p < 0.1, ** p < 0.05, *** p < 0.01. Bootstrap standard errors in parentheses.
The table shows the absolute values of timing responses and reduced-form estimates of the inter-temporal shifting elasticity implied by bunching at the notch. The counterfactual function is estimated as in equations 1 and (2, using different values for the upper bound of the excluded zone a_u.
Timing responses are directly obtained from the estimation of equation 3. Short-term timing responses corresponds to γ_1 whereas medium-term timing responses are equal to γ_2. Standard errors are obtained by block-bootstrap procedure at the individual level with 600 replications.
The reduced-form elasticities are computed by dividing timing responses by $\log(1-0.4) - log(1-0.2)$ and the standard errors associated are derived by the delta method.

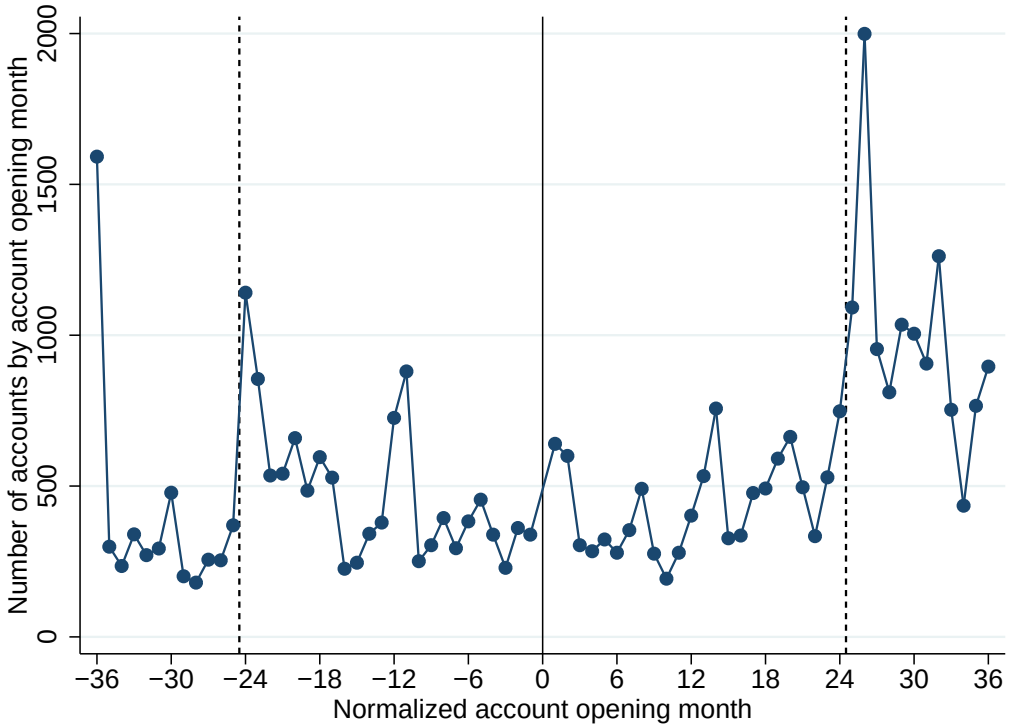
A.2. Appendix to difference-in-differences estimation

Figure 7 – Number of accounts by date of subscription

A. Number of accounts by year of subscription around 11/20/1991



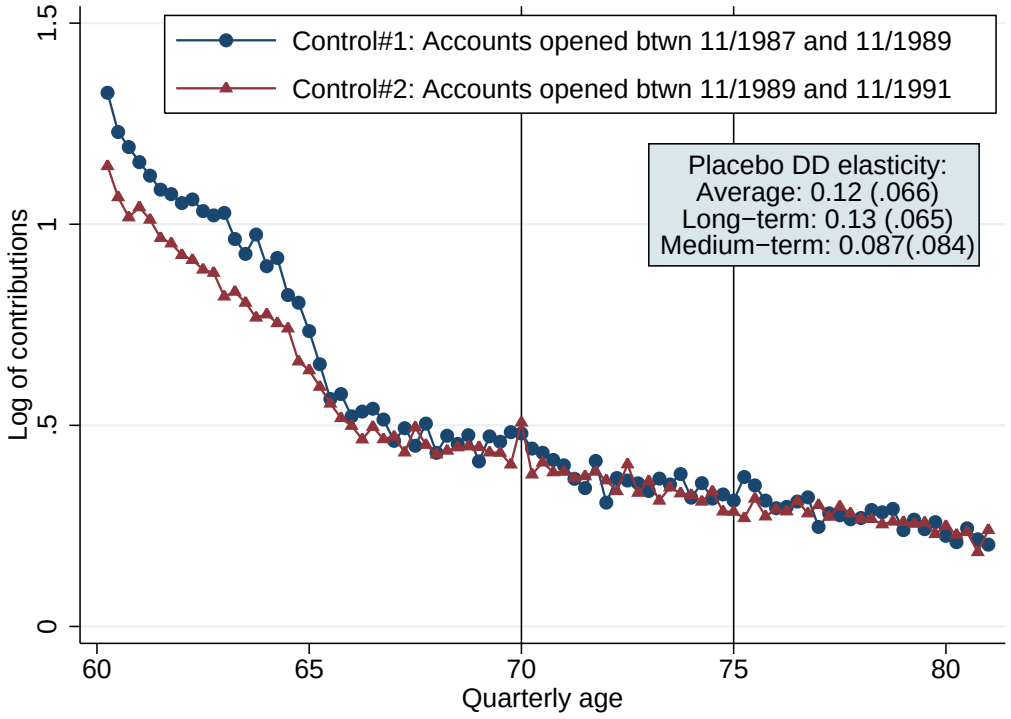
B. Number of accounts by month of subscription around 11/20/1991



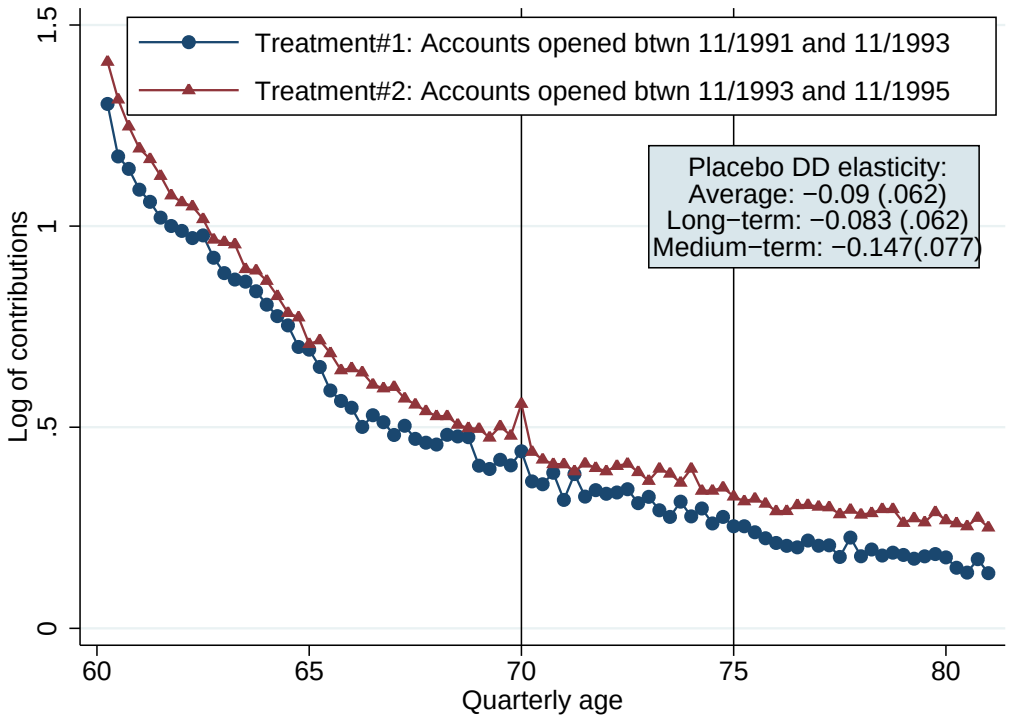
Notes : Figures 7.A and 7.B show the number of accounts by date of subscription around 11/20/1991. In both figures, the vertical solid line denotes the implementation date of the reform : 11/20/1991. The dashed lines delimits accounts from the control and treated group. In Figure 7.A, 1990 makes reference to the accounts opened between 11/20/1989 and 11/19/1990. In Figure 7.B, -6 makes reference to the accounts opened five to six month before 11/20/1991, i.e between 5/20/1991 and 6/20/1991.

Figure 8 – Contributions by age in falsification experiments, France 2003-2013

A. Falsification experiment with both groups unaffected by the reform



B. Falsification experiment with both groups affected by the reform



Notes : The figure shows the evolution of contributions (in log) over lifetime in falsification experiments.
In Figure 8.A, the control group is accounts opened between 11/20/1987 and 11/20/1989 while the treatment group is accounts opened between 11/20/1989 and 11/20/1991. Since both groups encounter no change in taxation at 70 years old, contributions remain taxed at constant tax rate of 20%.
In Figure 8.B, the control group is accounts opened between 11/20/1991 and 11/20/1993 while the treatment group is accounts opened between 11/20/1993 and 11/20/1996. Both groups encounter exactly the same change in taxation at 70 years old.