Does later retirement change your healthcare consumption ? Evidence from France

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Does later retirement change one's consumption of healthcare? Evidence from France *

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Abstract

This paper examines the causal impact, among the French elderly, of retiring later on doctor visits. Previous studies have mostly focused on the impact of the switch from employment to retirement on the consumption of healthcare, leaving aside the question of the long-term impact of pension reforms on the consumption of healthcare among the retirees. This question is of interest since spillover effects may arise if savings from pension reforms are accompanied by increases in healthcare expenditure due to pension reforms. I exploit the 1993 French pension reform in a two-stage least squares regression to deal with the endogeneity of retirement. This reform led to a progressive increase in claiming age, cohort by cohort from 1934 to 1943. I use the administrative data *HYGIE* to observe both the consumption of healthcare between 2005 and 2015 and past careers. I focus on men working in the private sector and not eligible for disability pension. I find that a delay of retirement by four months decreases significantly the probability of having at least one doctor visit per year by 0.815 percentage points and decreases the annual number of doctor visits by 1.14% between ages 67 and 75. This effect is driven by making visits to general practitioners, and tends to be stronger for the first ages of consumption observed.

JEL Codes: I10, J14, J26

Keywords: *pension reform, health, consumption of healthcare.*

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Introduction

The accelerating number of reforms in Europe that increase the claiming age has led to a growing interest in the impact of retirement on health. This interest is twofold. First, it is important to ensure that these reforms do not have adverse health effects. Second, there could be several opposing mechanisms at play, which makes the overall effect of such reforms uncertain.

Over the last few years, studying the impact of retirement on the use of healthcare has been seen as a significant complement to studies focused on health issues (see Nishimura et al. (2018) and Garrouste and Perdrix (2021) for a detailed review). This additional question has two motivations. First, observations on the impact of a later retirement on health, combined with results on the use of healthcare, provide information that is important from a public policy perspective. For example, findings showing worse health and less use of healthcare could be interpreted as an increase in the number of people forgoing medical care. Second, we must account for spillover effects to avoid an overestimation of the financial benefits associated with pension reforms.

While raising the question of the impact of retirement on the consumption of healthcare, two questions are raised in fact. First, what is the impact on the consumption of healthcare of switching from employment to retirement? Second, what is the impact of delaying retirement age on this consumption among the retirees? There are numerous studies focusing on the first question (Coe and Zamarro, 2015; Eibich, 2015; Bíró and Elek, 2018; Gorry et al., 2018; Grøtting and Lillebø, 2020; Lucifora and Vigani, 2018; Shai, 2018; Zhang et al., 2018; Nielsen, 2019; Frimmel and Pruckner, 2020; Kuusi et al., 2020). However, as far as I know, Hagen (2018) is the only one studying the impact of a later retirement on hospital stays and drug use among women civil servants. These two questions have to be distinguished, because the potential underlying mechanisms explaining the effect of the switch from employment to retirement on health may differ from those explaining the effect of delaying the retirement age on health (Garrouste and Perdrix, 2021). For example, the opportunity cost of time can explain differences in the consumption of healthcare at retirement but not differences among the retirees according to the timing of their retirement. The impact of delaying the retirement age on the consumption

of healthcare may affect retirees through changes in health and health investment, due to the time spent in employment and in retirement. Moreover, in a public policy point of view, an impact of the switch to retirement on the consumption of healthcare raise the question on how to smooth the transition from employment to retirement. The possibility of an impact of delaying retirement on the consumption of healthcare raises the question of the acceptability of pension reform and the potential long term effects if the reform is designed without considering its consequences on health and on the health insurance system.

This paper explores the causal impact of retiring later on the consumption of healthcare in France and the potential underlying mechanisms. I use waves 2005 to 2015 of the administrative data *HYGIE*, which include information about career and the consumption of healthcare from the private pension scheme *CNAV* and the National Health Insurance. Since individuals can choose to retire for health-related reasons, there is a reverse causality issue to consider. I use the 1993 French pension reform as an instrumental variable to address this issue. This reform was the first one to induce later retirement in France. It affects individuals within and between cohorts with a different intensity. Those affected by the reform massively react to the incentive by increasing their claiming age (Aubert, 2009; Benallah and Mette, 2009; Bozio, 2011b) and their labour force participation (Bozio, 2011b).

I focus on men working in the private sector and not eligible for disability pension. I find that an exogenous increase in the claiming age leads to a small but statistically significant decrease in the probability of having at least one doctor visit a year. Moreover, it decreases the average number of doctor visits per year. Lastly, I show that the observed decrease cannot be attributed to income or price effects, nor to the probability of forgoing medical care. Indeed, I observe the same impact among those with co-payment exemption, I found no significant impact on the care that concentrate the forgoing care (eg. dental care), and no price effect (no change in price per visit). I cannot exclude, as a potential mechanisms, a change in health and in health' investment (preventive care). This change in health and health' investment could came both from the longer time spent in employment and from the shorter time spent in retirement. This result complements Hagen (2018)'s result. He found that later retirement decreases drug consumption in

Sweden, among women civil servants.

This paper makes two main contributions. First, it is only the second paper to document the impact of later retirement on the consumption of healthcare. Moreover, while the previous paper focuses on women civil servants, this one focuses on men from the private sector. Second, I distinguish the type of care, the effect in price and volume, and the effect on individuals with and without co-payment exemption, or chronic conditions. By doing so, it contributes to the discussion of mechanisms explaining the decline observed in the consumption of healthcare.

This paper is organised as follows: Section 1 describes the theoretical mechanisms and the literature. Section 2 describes the French pension reform used as an instrumental variable. Section 3 describes the administrative data and the empirical strategy. Lastly, Section 4 presents the main results and the potential underlying mechanisms and Section 5 presents robustness check, sensitivity analysis, and discussion of the results.

1 Theoretical framework and literature

There is a large literature on retirement and health (see Nishimura et al. (2018) and Garrouste and Perdrix (2021)). Two phenomena have to be distinguished (Garrouste and Perdrix, 2021). First, one can observe the change in the consumption of healthcare at the switch from employment to retirement. Second, one can, among the retirees, observe the impact of a change in the timing of retirement. There is no reason for these two phenomena to affect the consumption of healthcare in the same way, because the underlying potential mechanisms at play differ. Moreover, empirical strategies to be used to identify these two phenomena differ. Lastly, public policy implication of a change in healthcare consumption at retirement differ from those of a change due to a reform that delay retirement.

In this Section, I present theoretical framework, potential mechanisms and previous studies on the impact of the switch from employment to retirement (Section 1.1) and on the impact of later retirement on healthcare consumption among the retirees (Section 1.2).

1.1 Impact of a switch from employment to retirement on the consumption of healthcare

Figure 1 represents the impact of the switch from employment to retirement on the consumption of healthcare, considering an increase (Figure 1b) or a decrease (Figure 1a) in the consumption of healthcare at retirement. Most of the time, the switch s in Figure 1 is estimated through a regression discontinuity design (RDD) or a fuzzy regression discontinuity design (FRDD). The associated mechanisms behind this switch are sudden changes in: propensity to pay for care, opportunity cost of doctor's visits, perception of the usefulness of investment in healthcare, mandatory care (no more need for a doctor's attestation for sick leave or declaration of ability to work).

Figure 1: Impact of the Switch from Employment to Retirement

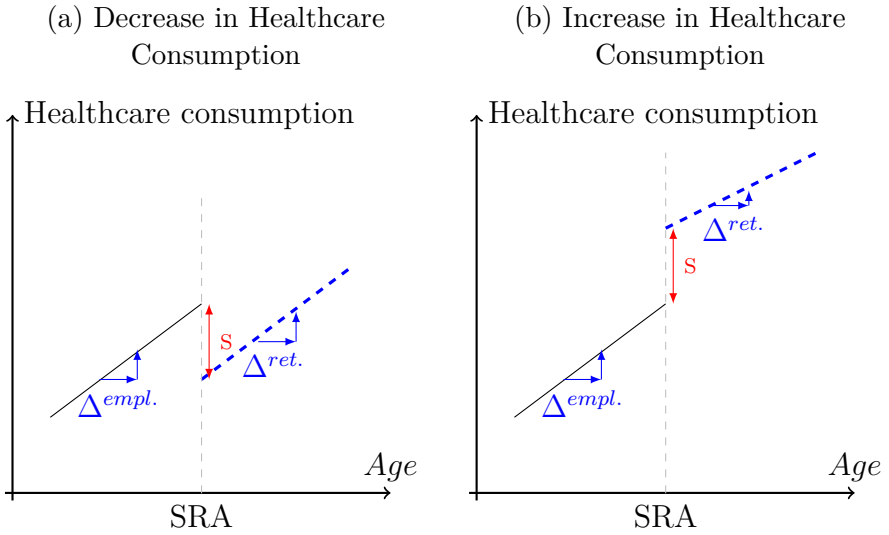


Figure (a) presents a decrease in the consumption of healthcare at statutory retirement age (SRA). Figure (b) presents an increase in the consumption of healthcare at SRA. Blue dashed lines are the trend in consumption of healthcare after retirement, and black lines before. This figure is inspired by Garrouste and Perdrix (2021).

Almost all studies on the impact of a switch from employment to retirement find a decrease in the consumption of healthcare at retirement (see Table 1, Coe and Zamarro (2015); Eibich (2015); Bíró and Elek (2018); Shai (2018); Nielsen (2019); Frimmel and Pruckner (2020); Kuusi et al. (2020); Gorry et al. (2018); Rose (2020)) Note that Frimmel and Pruckner (2020) is a particularly interesting contribution because they are able to isolate the age effect by taking advantage of a reform that increase early retirement age. Thus, they measure the impact on healthcare consumption of the switch to retirement regardless of the age at which it occurs.

The authors provide several explanations for this decrease. The main mechanism is through an improvement in health (Coe and Zamarro, 2015; Eibich, 2015; Shai, 2018; Frimmel and Pruckner, 2020). However, Bíró and Elek (2018) believe that changes in health are slow and that the sudden change in the consumption of healthcare at retirement cannot be attributed to a sudden change in health. They suggest three other mechanisms. First, individuals in employment need doctor visits for their sick-leave certificate, while pensioners do not need this (see also Nielsen (2019)). Second, individuals may be willing to invest more in their health while working. In this line, Frimmel and Pruckner (2020) show a decrease in participation in screening and preventive care at retirement. Third, the income drop at retirement may decrease the consumption of healthcare. The sudden change in opportunity cost of time might also affect healthcare consumption, but the direction is uncertain: one may think that individuals consume more care during retirement, as a consequence of a lower opportunity-cost of time. At the reverse, one could think that individuals would prefer using time off work to visit a doctor rather than using personal time for the visit during retirement (Nielsen, 2019).

Only three studies do not find a decrease in the consumption of healthcare at retirement (Bíró, 2016; Lucifora and Vigani, 2018; Zhang et al., 2018). Lucifora and Vigani (2018) uses cross-country differences in the retirement age in Europe. Assuming a normal distribution for the number of doctor visits, they find an increase in doctor visits in Europe at retirement. Their main explanation for this result is the opportunity cost of time (which is implicitly assumed to decrease and lead to an increase in visits during retirement). Zhang et al. (2018) also find an increase in the consumption of healthcare in urban China, explained by the particularly high opportunity-cost of time in urban China. Lastly, note that by investigating heterogeneous effect, Grøtting and Lillebø (2020) find a negative non-significant result for hospital stays in Norway, but a significant decrease among those with the lowest levels of education.

1.2 Impact of delayed retirement on healthcare consumption

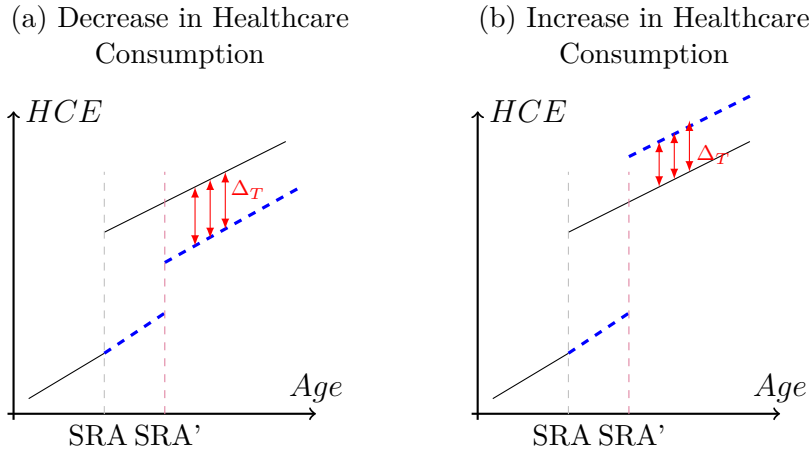
This paper does not focus on the impact of the switch from employment to retirement but on the impact of delaying retirement on the consumption of healthcare (Figure 2). The most usual empirical strategies are two-stage least squares (2SLS) regression or a

difference-in-difference. The mechanisms explaining this phenomenon differ from those relevant to a switch, and presented in the previous section. For example, the explanation in terms of sudden changes in the opportunity cost of time no longer holds, because retirees all have an opportunity-cost of time of zero. Mechanisms explaining the impact of delaying retirement on the consumption of healthcare, among retirees, can be classified into four categories: first, mechanisms related to the change in life-time total duration in employment (mechanism 1, M1); second, to the change in duration of retirement at a given age (mechanism 2, M2); third, to the change in investment in health (due to incentives over the life-cycle and inter-temporal income) (mechanism 4, M3); and fourth, those associated to an increase of foregoing care (due to the variation of inter-temporal income) (mechanism 4, M4). The length of one's working life might change one's health and its related consumption of healthcare (M1). Two opposite hypotheses can it. First, the *use-it-or-lose-it* hypothesis assumes that physical and cognitive abilities decline when individuals do not use them. Thus, later retirement would be health-preserving. The *physiological reserve* hypothesis, at the reverse, considers that individuals have a stock of health. Thus, when individuals consume their health during work, they lose it. According to this hypothesis, later retirement should lead to a deteriorated state of health. Thus, the expected impact of the mechanism M1 is uncertain. Moreover, it can differ from an individual to another, and heterogeneity could be observe according to gender, occupational group, wage, education... The second mechanisms is related to the duration of retirement (M2). It can modify the duration of exposure to behaviours specific to retirees. Once again, these changes could vary along individual characteristics. Previous studies have found evidence of changes in the consumption of alcohol and tobacco at retirement (Zins et al., 2011; Celidoni and Rebba, 2017), and changes in physical activities (Barnett et al., 2012; Celidoni and Rebba, 2017). Since an increase in retirement age decreases the amount of time spent in retirement, it decreases the duration of exposure to these specific behaviours. Once again, the expected direction of M2 is unclear. Attitudes to investment in one's health may also change with retirement (M3). The model of Grossman (Grossman, 1972) predicts a decrease in the marginal benefits of investment in health but also a decrease in the marginal costs of health. Lastly, the depreciation in the stock of health

may change at retirement.[1] Thus, the amounts of time spent being employed, and in being retired, may change the timing for re-investing in one's health. Thus, the direction of change related to attitudes about investment in health (M3) is not clear. Fourth, the inter-temporal income change due to later retirement. At retirement, individuals experience a drop of income because pension are usually lower than wage before retirement. Thus, retire later delayed the timing of this drop. As a consequence, later retirement increase inter-temporal income. The literature document an increase of healthcare consumption with income so mechanism 4, if occurs, is expected to be a positive impact.

In this paper, I cannot disentangle between mechanisms 1 to 3 but can exclude the fourth one, related to foregoing care and inter-temporal income.

Figure 2: Impact of Delayed Retirement



Note: Black line is the consumption of healthcare by age for those not affected by the reform, who retired at age SRA. Blue line is the consumption of healthcare by age for those affected by the reform, who retired at age SRA'. Among retirees, Δ_T is the average difference in the consumption of healthcare between those affected by the reform, who retired at age SRA' and those not affected, who retired at age SRA.

Although there is a large literature on the impact of a switch from employment to retirement on the consumption of healthcare, the literature on the impact of delaying retirement on the consumption of healthcare is scarce.

Only two papers have documented the impact of a change in the retirement age on the consumption of healthcare among retirees (Hagen (2018); Hallberg et al. (2015) as shown in Table 1). Among these two papers, only one targets the impact of later retirement on the consumption of healthcare (Hagen, 2018); the other one focuses on the impact of earlier retirement (Hallberg et al., 2015). Both studies use reforms that spurred individuals

[1]Changes in health habits at retirement (eg: physical activities, alcohol and tobacco intakes) may impact the rate of depreciation of one's health, which may impact the consumption of healthcare.

towards an earlier or later retirement.

Hagen (2018) uses the Swedish pension reform of local government workers as an instrumental variable. This reform increased the claiming age from 63 to 65. He finds no significant change in inpatient care but a significant decrease in the consumption of drugs on the part of women between the ages of 65 and 69. Hagen (2018) concludes that work is health preserving for these women civil servants.

Hallberg et al. (2015) use the Swedish early retirement offer at age 55 implemented for military officers (rather than 60 before the reform) as an instrumental variable. They focus on the impact of this exogenous decrease in the claiming age on the consumption of healthcare. They find a significant decrease in the consumption of inpatient care between ages 56 and 70, and interpret this as a consequence of improvement in health linked to earlier retirement.

Table 1: Literature Review on the Impact of Retirement on Healthcare Consumption

Authors (year)	Country	Sample	Age	Method	Instrument	Results on Doctor	Hospi	Drugs
Impact of the switch from employment to retirement								
Coe and Zamarro (2015)	Europe + USA	Men, workers at 50y.o.	50+	RDD	SRA	↘	NS	-
Eibich (2015)	DEU	Civil servants & self-employed	55-70	RDD	ERA: 60. SRA: 65	↘	NS	*n.a.*
Bíró (2016)	EU	-	50+	IV-Probit	ERA and SRA	↗	*n.a.*	*n.a.*
Bíró and Elek (2018)	HUN	Women	54-60	2SLS (TPM)	ERA: 57	↘	↘	↘
Bíró and Elek (2018)	HUN	Men	57-63	2SLS (TPM)	ERA: 60	↘	↘	↘
Gorry et al. (2018)	USA	Workers at age 50	50-93	2SLS	SS threshold	NS	↘	↘
Grøtting and Lillebø (2020)	NOR	-	56-79	FRDD	SRA: 67	-	NS	-
Lucifora and Vigani (2018)	EU	-	50-69	RDD	ERA and SRA	↗	*n.a.*	*n.a.*
Shai (2018)	ISR	Men	40-74	DiD	SRA: 65 ⇒ 67	↘	*n.a.*	*n.a.*
Zhang et al. (2018)	CHN	Workers	40-75	RDD	SRA: 60 (♂) 50 (♀)	↗	↗	*n.a.*
Nielsen (2019)	DNK	Cohort 1939, without ERP or DRP	60-70	2SLS	SRA: 67 ⇒ 65	NS	NS	*n.a.*
Nielsen (2019)	DNK	-	55-65	RDD	ERA: 60	↘	↘	*n.a.*
Frimmel and Pruckner (2020)	AUT	Private sector	41-74	FRDD	ERA: 60 ⇒ 65 (♂) 55 ⇒ 60 (♀)	↘	↘	NS
Kuusi et al. (2020)	FIN	Workers before ERA	62-67	2SLS	SRA: 63	*n.a.*	↘	↘
Rose (2020)	GBR	Women	55-65	RDD	SRA: 60	↘	*n.a.*	*n.a.*
Rose (2020)	GBR	Men	60-70	RDD	SRA: 65	NS	*n.a.*	*n.a.*
Impact of earlier retirement								
Hallberg et al. (2015)	SWE	Men, military	56-79	2SLS	SRA: 60 ⇒ 55	-	↘	-
Impact of later retirement								
Hagen (2018)	SWE	Women, civil servants	65-69	DiD	SRA: 63 ⇒ 65	-	NS	↘
This paper	FRA	Men, private sector	66-76	2SLS (TPM)	SRA ↗	↘	NS	↘

Note: Main results reported on doctor visits; hospital stays; drugs.
Abbreviations: Country abbreviations are 3-letter codes from the United Nations. Column "sample": ERP, early retirement pension; DRP, disability retirement pension. "-" No specific sample restriction. Column "method": (F)RDD, (fuzzy) regression discontinuity design; DiD, difference in difference; 2SLS, two-stage least squares; TPM, two part model. Column "instrument": ERA, early retirement age; SRA, statutory retirement age. Results: NS, not significant at the 5% level; n.a. Not applicable (outcome not included in the study).

2 The 1993 Pension Reform in the Private Sector

In France, pension claiming relies on the number of quarters one has been contributing. To contribute one quarter, one have to earn 150 times the hourly minimum wage during the year (ie. 1204,5 € in 2005). Thus, to contribute four quarters in a year, one have to earn 600 times the hourly minimum wage during the year (4,818 € in 2005). It means that both part-time workers and a full-time workers contribute four quarters per year. To not have four quarters while working, one has to earn less than a third of the minimum wage. The maximum number of contributed quarters per year is four. In addition to the quarters contributed through employment, individuals are counted as having contributed during sick leave, maternity leave, or unemployment. There is no financial incentive to claim for a pension after reaching the full replacement rate.

Before the 1993 pension reform, workers from the private sector could benefit from a pension with a full replacement rate[2] if one of the two following conditions was fulfilled: i) being 65 years old or more; or ii) being 60 years old or more and having contributed at least 150 quarters.

The 1993 pension reform is the first in France to increase the length of the career. This reform only applied to workers from the private sector. Individuals could not have anticipated it because there was no announcement before the reform. Moreover, the reform was voted and adopted very quickly.[3] This reform increased the required number of contributing quarters needed to benefit from a full pension, from 150 to 160, cohort by cohort, starting with the cohort of 1934. As shown in Table 2, cohort 1934 had to contribute 151 quarters for a full pension, cohort 1935 had to contribute 152 quarters, and so on.

Table 2: Increase in Required Contribution Length in the Private Sector

Birth year	**Nb of contr. quarters required**	
	in quarter	in year
1933 and before	150	37 years and 6 months
1934	151	37 years and 9 months
1935	152	38 years
1936	153	38 years and 3 months
...	...	
1942	159	39 years and 9 months
1943 and after	160	40 years

Note: Individuals born in 1933 or before have to contribute 150 quarters to benefit from a full replacement rate; those born in 1934 have to contribute 151 quarters; and so on.

As a consequence of this reform, individuals are affected differently according to their birth cohort but also to their contribution lenght at age 60. Thus, within a cohort, individuals are not affected with the same intensity (as shown in Table 3 those born in 1934 and who had contributed 150 quarters at age 60 have to contribute one quarter

[2]The full replacement rate is 0.5. It decreases by 1.25 percentage point per quarter of missing contribution. The replacement rate for an individual with one missing quarter is 0.4875; with two missing quarters, it is 0.475 etc. See Appendix A and also Bozio et al. (2021); Blake and Garrouste (2019) for more details on this reform.

[3]The reform was voted in July 1993. The implementing decree was published one month later with an application date of January 1st, 1994.

more due to the reform while those born the same year but who have contributed 151 quarters at age 60 do not have to contribute one quarter more due to the reform). Those really affected are those born in 1934 who had contributed at age 60 between 131 and 150 quarters; those born in 1935 who had contributed at age 60 between 131 and 151 quarter, and so on until those born in 1943 who by age 60 had contributed between 131 and 159 quarters.

Table 3: Number of additional quarter required

Number of contributed quarter at age 60	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943
131	1	1	1	1	1	1	1	1	1	1
132	1	2	2	2	2	2	2	2	2	2
133	1	2	3	3	3	3	3	3	3	3
134	1	2	3	4	4	4	4	4	4	4
135	1	2	3	4	5	5	5	5	5	5
136	1	2	3	4	5	6	6	6	6	6
137	1	2	3	4	5	6	7	7	7	7
138	1	2	3	4	5	6	7	8	8	8
139	1	2	3	4	5	6	7	8	9	9
140	1	2	3	4	5	6	7	8	9	10
141	1	2	3	4	5	6	7	8	9	10
142	1	2	3	4	5	6	7	8	9	10
143	1	2	3	4	5	6	7	8	9	10
144	1	2	3	4	5	6	7	8	9	10
145	1	2	3	4	5	6	7	8	9	10
146	1	2	3	4	5	6	7	8	9	10
147	1	2	3	4	5	6	7	8	9	10
148	1	2	3	4	5	6	7	8	9	10
149	1	2	3	4	5	6	7	8	9	10
150	1	2	3	4	5	6	7	8	9	10
151	0	1	2	3	4	5	6	7	8	9
152	0	0	1	2	3	4	5	6	7	8
153	0	0	0	1	2	3	4	5	6	7
154	0	0	0	0	1	2	3	4	5	6
155	0	0	0	0	0	1	2	3	4	5
156	0	0	0	0	0	0	1	2	3	4
157	0	0	0	0	0	0	0	1	2	3
158	0	0	0	0	0	0	0	0	1	2
159	0	0	0	0	0	0	0	0	0	1
160	0	0	0	0	0	0	0	0	0	0
161	0	0	0	0	0	0	0	0	0	0

Note: Individuals born in 1934 and who contributed 131 quarters by age 60 need one more quarter in order to qualify for the full rate. The control group is made up of individuals in the white boxes '0' while those affected are those in the coloured boxes. The darker the box, the more important the treatment intensity.

This reform changed the incentive to claim a pension at a certain age. This is different from a change in the mandatory claiming age. Thus, individuals affected by the reform can retire at the same age as before the 1993 reform if they accept a decrease in their pension.

3 Data and empirical strategy

I use the 1993 pension reform as an instrumental variable to estimate the causal impact of later retirement on the consumption of healthcare. It requires data including both information about the length of the contributions and the claiming age, as well as information about the consumption of healthcare.

3.1 Data

I use the administrative data set *HYGIE*, provided by IRDES,[4] which includes information from the private pension scheme (CNAV) and from the National Health Insurance. It includes 1/20th of all individuals born between 1935 and 1989 and who have contributed at least once in the private sector. The data include information about careers (number of contributed quarter, claiming age, pension). All health information is aggregated at the yearly level for each individual between 2005 and 2015. Thus, the consumption of healthcare of individuals born in 1935 is observed between the ages of 70 and 80, those born in 1936, between the ages of 69 and 79, and so on.

The information about the consumption of healthcare include: the number of doctor visits and total expenditure on visits, the number of days in private hospitals,[5] the total associated cost, and the total cost of prescription drugs. Doctor visits are those provided out of the hospital setting. Ambulatory surgery is excluded.[6]

I am interested in retirees aged 66 and over. For these individuals, the only time varying information is that related to the consumption of healthcare, which constitutes my dependent variables. Thus, a panel data analysis is not possible.

3.2 Sample selection and variables of interest

Sample selection. I selected all men,[7] born between 1935 (the oldest I observe) and 1943 (the last cohort affected by the 1993 reform but not by the following pension reforms); who contributed at least once during their career in the private sector;[8] who had contributed between 131 and 160 quarters at age 60;[9] who were alive and retired before age 67. I observe consumption between the ages of 66 and 76 for individuals born between 1935 and 1943 (Detailed summarise in Appendix, Table B1).

The method implemented take into account the age differences between cohorts (see Section 3.3). Moreover, as a complementary analysis, I provide results by age range. Thus, I select a sub-sample, namely, those individuals born between 1939 to 1943, and observe their consumption between the ages 66 and 68 (each individual is observed three times:

[4]Institut de recherche et de documentation en économie de la santé.

[5]Private hospitals provide both scheduled care and emergency care. In 2015, 25% of emergency care (excluding paediatric emergencies) were in the private sector (Toulemonde, 2017).

[6]More details on the French healthcare system are available in Appendix A.2.

[7]This is due to data constraints. As shown in Appendix B, I have the information on the total number of contributed quarters for men but not for women. Note that the 1993 reform mainly affects men, and thus it is not without interest to explore the impact of the reform on men (only).

[8]The 1993 reform affects only the private sector.

[9]i.e. having been, by age 60, in the labour force at least 32 years and 9 months and up to 40 years.

at ages 66, 67 and 68); I select individuals born between 1938 and 1943 and observe their consumption between the ages of 67 and 69 and so on, until the selection of individuals born between 1935 and 1939, for whom I observe their consumption between the ages of 74 and 76 (Detailed summarise in Appendix, Table B2).

I observe individuals' consumptions between ages 66 and 76. There are several reasons that prevent looking at younger ages. First, since individuals retire up to age 65, the sample of those who retired between age 60 and 65 suffers from a selection bias (those most affected by the reform have an incentive to retire closer to age 65 and not 60, while those not affected have an incentive to retire at age 60). Second, after retirement, the French are used to changing their supplementary health insurance. In the very short term, this can lead to many temporary manipulations of the timing of healthcare. However, once all individuals have been retired for at least one year, this manipulation no longer occurs. Third, at age 62, I observe only cohort 1943, and at age 63, I observe only cohorts 1942 and 1943, and so on. Thus, selecting from age 66 allows the observation of at least five cohorts.

Variables of Interest. I measure the probability of having at least one doctor visit. For *consumers*,[10] I take into account the yearly number of doctor visits as well as the expenditure on doctor visits.[11] Expenditure includes both the part which is reimbursed by insurance and the out-of-pocket payment.[12] All these variables are subjected to a logarithmic transformation. I distinguish between general practitioners and specialists. I also provide results on the number of dental visits and the total expenditure on dental visits; the number of days spent in private hospitals and the associated expenditure;[13] the expenditure on prescription drugs, as well as the total expenditure on all the previously quoted types of medical care.

Descriptive Statistics. Table 4 provides descriptive statistics regarding the health and careers of the individuals included in this study. Over the whole sample, individuals who have or had a chronic condition after age 65 account for 44% of the observations. Moreover, 71% of the observations from the main sample are individuals who benefited from a co-payment exemption, meaning that they did not have to make any out-of-pocket payments for a doctor visit. Those observations without this exemption, constituting 29% of the total, have an out-of-pocket payment for doctor visits around 30% of the total expenditure if they don't have supplemental health insurance. Those with this co-payment exemption are usually consumers of healthcare (94%).

In the main sample, 24.3% of observations do not make any doctor visits. This is higher than the 10% of non-consumers found among the 75 and older in France by Calvet (2012) and Sourty-Le-Guellec (1999) among the French registered at the National Health

[10]In this article, by consumer, I mean an individual who has made use of healthcare services, whether paying or not for this service.

[11]In euros 2016. I use the inflation index from the French National Institute of Statistics (INSEE) https://www.insee.fr/fr/information/2417794.

[12]Appendix A.2 provides details about the French health insurance system and reimbursement rate.

[13]The impact of delayed retirement on hospital care in the private sector can be interpreted as the impact on the whole hospital care only under two additional assumptions. First, delaying retirement does not change the preference between public and private hospitals. Second, the preference between public and private hospitals is not exclusive.

Insurance. Moreover, 72% had at least one visit to a general practitioner during the year, which is, once again, lower that the national statistics (Calvet and Montaut (2013) show that after age 60 only 7% do not make any doctor visit). One explanation is that I focus on men who worked in the private sector, and had contributed between 131 and 160 quarters at age 60, who usually are in better health than the average French inhabitant, because it leads to the exclusion of self-employed workers, inactive, handicapped, and a large part of blue collar workers, who are on average in worse health than the whole population.

I find no significant differences in the characteristics of the careers for the sample as a whole from those for the sub-samples of those who have made doctor visits, of individuals with chronic conditions, and those exempt from having to make co-payments. Thus, the selection of consumers does not appear to bias the sample in terms of career characteristics. The average claiming age is 61.87 for the whole sample as well as the sub-sample of those with at least one doctor visit a year; the average number of added quarters required due to the reform (ΔRCL) is 3.518 quarters (respectively 3.417 for consumers); the number of contributed quarters by age 60 is 149.5 (respectively, 149.8).

Figure 3 shows the point estimate of the impact of the number of added quarters required on the number of doctor visits by year of consumption (Figure 3a) and by age (Figure 3b), controlling for age, number of contributed quarters by age 60, suffering from a chronic disease, and the geographic region (reduced-form estimation). It shows that the average level of consumption is higher among those not-affected, for almost all years of consumption (Figure 3a) and at all ages (Figure 3b). Moreover, it seems that on average, the more an individual is affected, the lower their consumption of healthcare.

3.3 Empirical strategy

The question of the impact of later retirement on healthcare consumption raises two methodological issues: reverse selection and zero consumption. Reverse selection emerges because health might affect retirement decision (Llena-Nozal Ana et al., 2004). As a consequence, individuals who retire later may be in better health than those who retire earlier. The large proportion of non consumers prevents from making the usual assumption on the distribution of variables. I address both issues by using a 2SLS in a two-part model. This model allow to analyse separately the marginal effect at the extensive and intensive margin.

In this Section, I present the instrumental variable used. Then, I present the estimation equations of the impact at the extensive margin and at the intensive margin. Note that in both equations, since I control for birth cohort ($Birth$) and number of contributed quarters by age 60 ($RCL60$), these models are equivalent to a generalised difference-in-difference.

The 1993 reform as an instrumental variable. To observe the causal impact of later retirement on the consumption of healthcare, I use the 1993 pension reform as an instrumental variable. This reform is exogenous to the individual's consumption of healthcare, and led individuals to delay their retirement. I assume that the reform is independent of the consumption of healthcare (exclusion restriction). This assumption is not testable, but is highly credible because the reform applied to every worker in the private sector, without taking health into consideration. Moreover, those who had

Table 4: Descriptive Statistics

		All	GP	Consumers of Specialist	Ambulatory care	Individuals with Co-payment exemption	Chronic condition
Probability of	General practitioner visit	0.725	1	0.936	0.957	0.906	0.803
		(0.447)	(0)	(0.244)	(0.203)	(0.292)	(0.398)
	Specialist practitioner visit	0.510	0.660	1	0.674	0.637	0.594
		(0.500)	(0.474)	(0)	(0.469)	(0.481)	(0.491)
	Doctor visit	0.757	1	1	1	0.944	0.831
		(0.429)	(0)	(0)	(0)	(0.230)	(0.374)
	Hospital stay	0.120	0.156	0.230	0.158	0.151	0.151
		(0.325)	(0.363)	(0.421)	(0.364)	(0.358)	(0.358)
	Chronic condition	0.440	0.487	0.512	0.483	0.488	1
		(0.496)	(0.500)	(0.500)	(0.500)	(0.500)	(0)
	Co-payment exemption	0.710	0.888	0.886	0.885	1	0.788
		(0.454)	(0.315)	(0.318)	(0.318)	(0)	(0.409)
Number of	General practitioner visits	4.590	6.335	6.491	6.064	5.836	5.779
		(5.923)	(6.112)	(6.413)	(6.116)	(6.229)	(6.774)
	Specialist practitioner visits	2.458	3.206	4.817	3.248	3.097	3.122
		(4.624)	(5.077)	(5.525)	(5.067)	(4.934)	(5.049)
	Doctor visits	7.048	9.541	11.31	9.311	8.933	8.901
		(8.531)	(8.729)	(9.237)	(8.664)	(8.760)	(9.497)
	Hospital stays (in days)	0.433	0.556	0.754	0.554	0.566	0.651
		(4.651)	(5.040)	(5.627)	(5.050)	(5.396)	(6.166)
Expenditure for	General practitioner visits	127.0	174.0	182.9	167.3	163.0	162.3
		(142.0)	(140.3)	(152.6)	(141.2)	(144.5)	(154.8)
	Specialist practitioner visits	236.0	308.6	434.7	310.3	297.6	316.6
		(545.7)	(606.3)	(701.7)	(608.2)	(608.3)	(682.2)
	Doctor visits	314.3	420.3	552.7	415.2	399.4	411.1
		(474.1)	(505.9)	(560.0)	(505.0)	(507.3)	(559.0)
	Prescription drugs	713.2	934.6	1047.6	926.2	922.6	966.6
		(1258.6)	(1337.7)	(1535.2)	(1362.4)	(1399.2)	(1545.6)
	Hospital stays	291.0	374.5	540.5	378.8	378.6	427.9
		(1749.8)	(1904.6)	(2297.3)	(1957.3)	(2033.1)	(2241.7)
	Total expenditure	2277.8	2973.0	3630.8	2960.3	2922.9	3041.6
		(4200.6)	(4501.1)	(5211.4)	(4569.0)	(4708.0)	(5121.6)
Career	Claiming age	61.87	61.73	61.79	61.78	61.83	61.72
		(2.113)	(2.019)	(2.048)	(2.043)	(2.073)	(2.059)
	Added quarters	3.518	3.411	3.417	3.434	3.547	3.232
		(3.073)	(3.050)	(3.043)	(3.051)	(3.087)	(2.966)
	Contrib. length at age 60	149.5	149.8	149.8	149.7	149.6	149.6
		(8.076)	(8.028)	(7.997)	(8.050)	(8.106)	(8.129)
	N	66,698	48,324	34,040	50,488	47,365	29,323

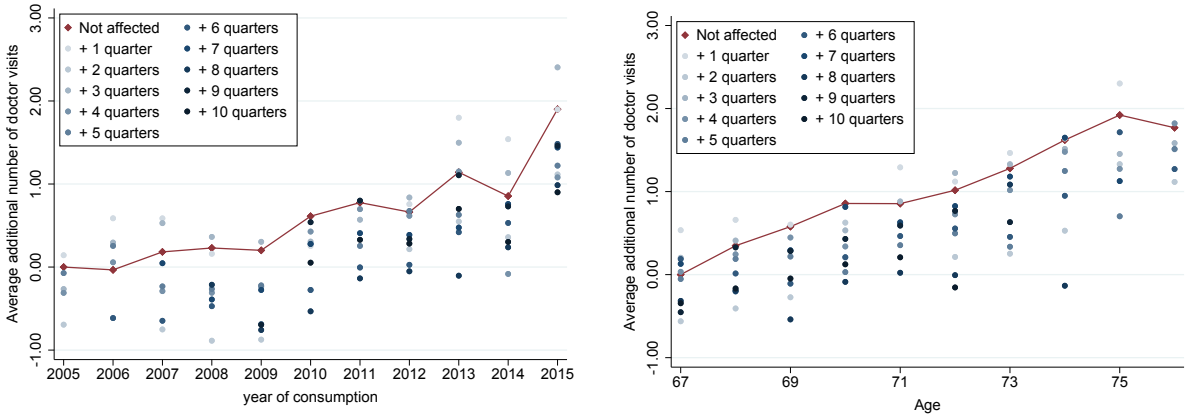
Note: "Added quarters" is the number of additional quarters required due to the reform. "Contrib. length at age 60" is the number of quarters contributed by age 60. Hospital stays include only private hospital stays.
Sample: Men who had contributed at least once in the private sector and had contributed at age 60 between 131 and 160 quarters, retired before age 67, ages comprised between 66 and 76.
Source: HYGIE 2005 – 2015.

contributed fewer quarters for reasons of health are eligible for a disability pension, and thus are never-takers. Secondly, to be relevant, the reform must affect the claiming age (non-zero assumption). I show in the following section that this assumption is verified. Thirdly, I assume total independence with respect to the instrument. This assumption means, in particular, that there was no anticipation effect nor bypass effect (no way for individuals to move from the treatment to the control group). This is highly credible for the first cohorts affected. Those individuals cannot have anticipated this reform since it was the first one to increase the claiming age in France. On the other hand, the last cohort affected was aware of the reform for about a decade before their retirement. However, they have very low flexibility in changing their number of contributed quarters because individuals contribute quarters even if in a part-time work, sick-leave or unemployment. They cannot change the duration of their education so as to have entered earlier into the

Figure 3: Healthcare Consumption among Individuals Affected and not Affected by the Reform

(a) Average Consumption by Year and Treatment Intensity

(b) Average Consumption by Age and Treatment Intensity



Note: These Figures are the reduced-form. It shows the point estimates of the number of added quarters required on the number of doctor visits, controlling for age, year, contribution length at age 60, department, proxy for health status, logarithm of pension, estimated by OLS regression. Results are shown by year (Figure a) and by age (Figure b) for individuals not affected by the reform (red square) and individuals affected (blue circles). There is one dot by treatment intensity, going from 1 added quarter in light blue, until 10 added quarters in dark blue. The darker the circle is, the stronger the treatment intensity is. Figure (a) shows that on average, those with 6 additional quarters to contribute, have consumed in 2005 0.61 doctor visit less than those without additional quarters to contribute. Figure (b) show that on average, those with 6 added quarters have consumed 0.55 visit less at age 67 than those with no additional contribution.
Sample: Men who contributed at least once in the private sector and had contributed by age 60 between 131 and 160 quarters, retired before age 67, ages between 67 and 76.
Source: HYGIE 2005–2015.

labour force. Lastly, I assume that individuals react in the same direction to the incentive (i.e. there are no defiers, which is the monotonicity assumption). This assumption is also credible with regards to the high financial penalty in case of retirement before reaching the full replacement rate. Under these assumptions, the Wald estimator identifies the local average treatment effect among the compliers. The effect of this reform on claiming age have been proven in Bozio (2011b), and the validity of this reform as an instrumental variable has already been assessed in Bozio et al. (2021).[14]

Causal impact of later retirement on the probability of consuming healthcare. The impact of retiring later on the probability of consuming healthcare is estimated through a two-stage least squares regression. The first step is the estimation, among individuals cross waves, using an OLS, of the impact of requiring one more quarter (ΔRCL) for the claiming age (A) (see Equation 1). The second step is a linear regression of the estimated claiming age due to the reform on the consumption of healthcare (2nd step of a 2SLS, as written in Equation 2).

The vector $X \in \mathscr{M}_{n,3}$ includes a control for the reference wage, as a proxy of income, to take into account potential heterogeneity by wage; the number of contributed quarters for

[14]In Bozio et al. (2021), the 1993 pension reform is used as an instrumental variable to measure the impact of later retirement on mortality. They use similar data as in this study: the administrative data from the private pension. In their study, they also show the "parallel trends" before the refom, i.e. the absence of change in claiming age by contribution quarters for the cohorts not affected by the reform.

sick-leave, as a proxy for health heterogeneity; and for the French department of residence (NUTS3).[15] Finally, I also control for age. Since I control for birth, this is equivalent to controlling for wave. The main specification includes a weight inversely proportional to the number of observations, to avoid any bias associated with the number of times each individual is observed.

$$A_i = \alpha_0 + \alpha_1 \Delta RCL_i + \alpha_2 Birth_i + \alpha_3 RCL60_i + X_i\alpha_4 + \alpha_5 Wave_i + \varepsilon_i \quad (1)$$

$$\mathbb{1}_{HC_i>0} = \beta_0 + \beta_1 \hat{A}_i + \beta_2 Birth_i + \beta_3 RCL60_i + X_i\beta_4 + \beta_5 Wave_i + \nu_i \quad (2)$$

Causal impact of later retirement on the level of consumption. The impact of retiring later on the level of consumption of healthcare is also estimated using a 2SLS, among those who consume healthcare. The dependent variable is the logarithm of the number of doctor visits made by those who consume healthcare. As a complementary analysis, to distinguish between price and volume effects, the price by visit and the expenditure in euros are also considered as dependent variables. The control variables included are the same as in the analysis at the extensive margin.

$$A_i = \kappa_0 + \kappa_1 \Delta RCL_i + \kappa_2 Birth_i + \kappa_3 RCL60_i + X_i\kappa_4 + \kappa_5 Wave_i + \varepsilon_i' \quad (3)$$

$$log(HC_i) = \gamma_0 + \gamma_1 \hat{A}_i + \gamma_2 Birth_i + \gamma_3 RCL60_i + X_i\gamma_4 + \gamma_5 Wave_i + \nu_i' \quad (4)$$

Note that in many cases, it is not possible to disentangle the effect of retirement from an income effect, since both changes occur at the same time. In this empirical strategy, due to the nature of the reform used as an IV, I can observe the effect of retiring later independently from the income effect of retirement. The reform affects the size of the pension of all retirees with the same intensity. Since I observe the difference between cohort and within cohort for different numbers of contributed quarters, this effect is isolated. Another income effect could happen since those who choose not to delay their retirement when affected see a decrease of their pension. However, the 2SLS estimator measures the impact for the compliers (local average treatment effect, LATE). Thus, there is no issue regarding those who choose not to react to the reform.

4 Results

4.1 Impact of the Reform on Claiming Age

Table 5 shows the impact of adding one quarter to the requirements for benefiting from a full pension at the claiming age (in quarters). The results are shown for a large set of samples (Main sample in Column (1), sample of individuals benefiting from a co-payment

[15] This control serves as a proxy for the local supply of healthcare services and also to control for the specificities of the departments of Alsace-Moselle, which were part of Germany from 1871 to 1919, and maintained, for historical reasons, a higher National Health Insurance coverage.

exemption in Column (2) and sample of individuals having a chronic condition after age 65 in Column (3)), and for sub-samples of individuals having at least one visit a year to a general practitioner, specialist, or other type of healthcare. Requiring one additional quarter to get a full pension increases the claiming age by 0.859 quarter. This impact is similar in all samples: between 0.688 quarter for the sample of individuals with a chronic condition and who have at least one hospital stay, and 0.891 in the sample of individuals with a chronic condition and who have at least healthcare consumption in a year. Thus, this result shows that the 1993 reforms can serve as an instrumental variable. It is consistent with Bozio (2011a) and Bozio et al. (2021).

Table 5: Impact of the Reform on Claiming Age

			(1) Main sample	(2) Co-payment exemption	(3) Chronic condition
	All	Reform	0.859***	0.850***	0.874***
			(0.0317)	(0.0352)	(0.0423)
		N	66,698	47,365	29,323
Had at least once during the year:	**General practitioner visit**	Reform	0.844***	0.840***	0.880***
			(0.0349)	(0.0364)	(0.0464)
		N	48,324	42,911	23,546
	Specialist practitioner visit	Reform	0.796***	0.786***	0.837***
			(0.0413)	(0.0423)	(0.0550)
		N	34,040	30,161	17,429
	Any type of practitioner visit	Reform	0.839***	0.833***	0.874***
			(0.0343)	(0.0359)	(0.0461)
		N	50,488	44,705	24,376
	Dental visit	Reform	0.830***	0.816***	0.866***
			(0.0903)	(0.0954)	(0.119)
		N	7,396	6,149	3,524
	Prescription drugs	Reform	0.863***	0.860***	0.891***
			(0.0341)	(0.0358)	(0.0459)
		N	51,855	45,846	24,773
	Hospital stay	Reform	0.813***	0.787***	0.688***
			(0.0823)	(0.0844)	(0.111)
		N	8,008	7,140	4,428
	Any of the previous care	Reform	0.858***	0.854***	0.891***
			(0.0339)	(0.0356)	(0.0458)
		N	52,463	46,317	24,943

Standard errors in parentheses

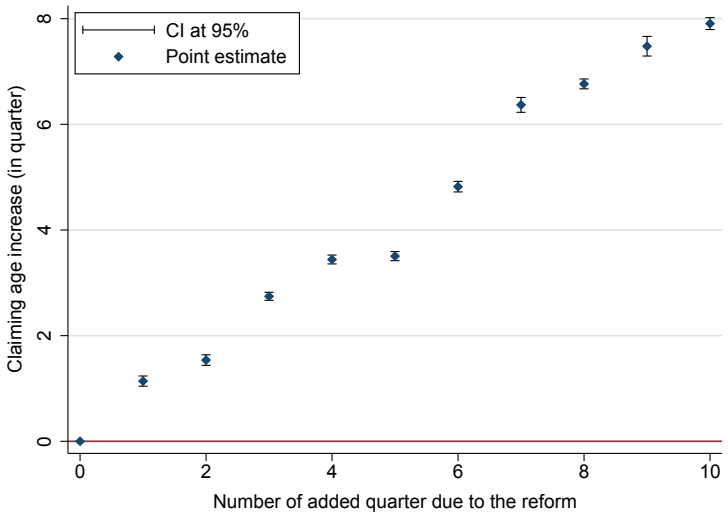
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Impact of the number of added quarters required due to the reform on the claiming age.
Sample: Men who contributed at least once in the private sector and had contributed by age 60 between 131 and 160 quarters, and retired before age 67. Estimation in the main sample (Column (1)); in the sub-sample of individuals with a co-payment exemption (Column (2)); in the sub-sample of individuals with a chronic condition (Column (3)). The first line is with all individuals; the second line is among individuals who had at least one general practitioner visit a year, the third line, a specialist practitioner, and the following lines: among individuals who either have visited a doctor at least once (general or specialist); have a dental visits; have a stay in a private hospital; consumed prescription drugs. F-statistics of the instrumental variable, and adjusted R^2 of the model are in Appendix, Table D4.
Source: HYGIE 2005-2015.

Figure 4 shows that the average claiming age increases when more quarters are required, following a linear trend with a leading coefficient very close to one. This shows

that the variation in intensity can be assumed to be linear.

Figure 4: Impact of the Reform on Claiming Age



Note: This graph shows the average impact on the claiming age of the number of added quarters imposed on an individual due to the reform (1st stage regression). Confidence Intervals at 95%.
Sample: Men who contributed at least once in the private sector and contributed by age 60 between 131 and 160 quarters, and retired before age 67.
Source: HYGIE 2005–2015.

4.2 Impact of Later Retirement on the Probability of Consuming Healthcare

Column (1) of Table 6 shows the causal impact of delaying retirement on the probability of having at least one visit to a general practitioner, a specialist, a dentist, any doctor visit, consume prescription drugs, and stay in a private hospital. An exogenous increase in the claiming age by one quarter statistically significantly decreases the probability of having at least one doctor visit by 0.815 percentage point, i.e. one less individual per 120. Moreover, the decrease in the probability of visiting a general practitioner (-0.828 percentage points) is slightly greater than the decrease in the probability of visiting a specialist (-0.724 percentage points). Probably as a consequence of the decrease in doctor visits, the probability of consuming prescription drugs decreases by 0.599 percentage points. However, the probability of visiting a dentist and having an hospital stay does not change significantly.

4.3 Impact of Later Retirement on Healthcare Consumption

Among those who consume healthcare, an exogenous increase by one quarter in claiming age statistically significantly decreases the annual number of doctor visits by 1.14% (Table 6, Column (2)). On a baseline of 9.30 doctor visits per year, this means a decrease in

Table 6: Impact of Later Retirement on Healthcare Consumption

		Probability	Number of	Expenditure for	Price for
General practitioner visits	Claiming age	-0.00828***	-0.00522	-0.00370	0.00152
		(0.00217)	(0.00476)	(0.00482)	(0.00175)
	N	66,698	48,324	48,324	48,324
Specialist practitioner visits	Claiming age	-0.00724***	-0.00797	-0.0177**	-0.00970
		(0.00254)	(0.00680)	(0.00831)	(0.00609)
	N	66,698	34,040	34,040	34,040
Any type of practitioner visit	Claiming age	-0.00815***	-0.0114**	-0.0164***	-0.00499
		(0.00209)	(0.00501)	(0.00635)	(0.00333)
	N	66,698	50,488	50,488	50,488
Dental visits	Claiming age	-0.000332	-0.00252	-0.0202*	-0.0177*
		(0.00165)	(0.00514)	(0.0230)	(0.0226)
	N	61,567	7,396	7,396	7,396
Prescription drugs	Claiming age	-0.00599***	n.a.	-0.0138*	n.a.
		(0.00203)	n.a.	(0.00772)	n.a.
	N	66,698	n.a.	51,855	n.a.
Hospital stays	Claiming age	-0.000433	-0.00661	-0.00917	-0.00257
		(0.00166)	(0.0144)	(0.0159)	(0.0120)
	N	66,698	8,008	8,008	8,008
Any of the previous care	Claiming age	-0.00516***	n.a.	-0.0236***	-n.a.
		(0.00200)	n.a.	(0.00739)	n.a.
	N	66,698	n.a.	48,468	n.a.

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Retiring one quarter later due to the reform leads to a decrease in the probability of making a doctor visit by 0.815 percentage points, and a decrease in the number of doctor visits among consumers by 1.14%, the expenditure on doctor visits by 1.64% and the expenditure per visit by 0.00499 (but not significantly).
Sample: Men who contributed at least once in the private sector and contributed by age 60 between 131 and 160 quarters, and retired before age 67.
Source: HYGIE 2005–2015.

the number of visits by 0.10 visit per individual, i.e. around one visit less for one individual per 10. The overall consumption of doctor visits decreases significantly by 0.9%. Expenditure for doctor visits decreases by 1.64% but the price per doctor visit does not significantly change. Thus, the change in expenditure is driven by the decrease in the number of doctor visits.

This effect on doctor visits can be split between the effect on visits to general practitioners and on visits to specialists. The number of visits to general practitioners decreases by 0.522% and the number of visits to specialists decreases by 0.797%. None of these decreases are significant, due to statistical power limitations (less observations and a smaller effects than in the analysis of the overall effect on the number of doctor visits).

There is no significant impact on the number of dental visits or expenditure on dentists. There is also a negative non-significant impact on the number of days in private hospitals and on the expenditure for hospital stays. This supports there being no substitution effect between ambulatory care and hospital care.

The decrease in the consumption of healthcare is similar in the whole sample and in the sub-sample of individuals having a chronic condition (Table D1). Thus, among those with a chronic condition, retiring later decreases the probability of having a doctor visit

by 1.46 percentage points and the number of doctor visits by 1.80%. This decrease is only slightly higher than in the main sample, meaning that the impact is not massively driven either by those with a chronic condition nor those without.

The magnitude of the effect does not vary a lot for large set of subsample of different age, cohort and year of observation (see Figure D1).

4.4 Size of the Effect and Comparison with the Literature

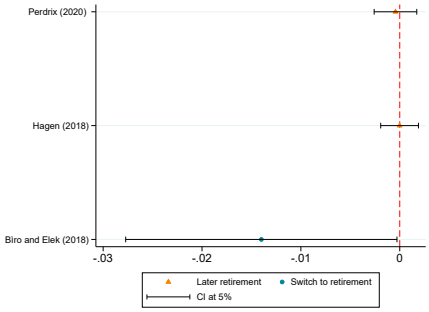
The results found on hospital stays and consumption of drugs complement those found by Hagen (2018) among women civil servants, and are of similar amplitude and sign. At the individual level, it represents a really small decrease.

Delaying retirement by one quarter leads to one consumer less per 120 individuals. Among the consumers, it leads to one visit less for one individual out of ten. Thus, the overall effect is a decrease by 2.44% of expenditure for doctor visits. This means, for the baseline individual who spends 314.3€ on doctor visits per year, a decrease by 7.67€. The decrease of the total expenditure – including all types of care – is 2.75%, which represents a decrease by 62.71€ for our baseline individual.

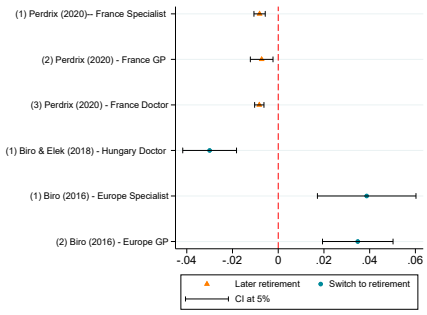
As shown in Figure 5, this effect is smaller than the impact of the switch to retirement on the consumption of healthcare.

Figure 5: Literature on the Impact of Retirement on Healthcare Consumption

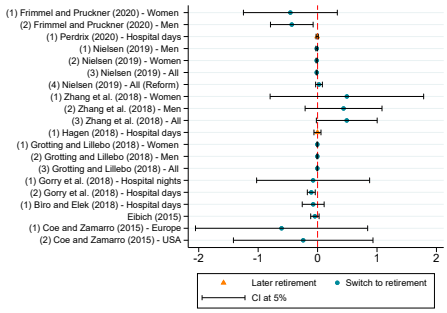
(a) Probability of Hospital Stay



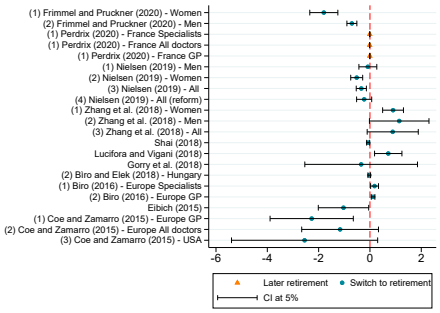
(b) Probability of General Practitioner Visits



(c) Days in Hospital



(d) Number of Practitioner Visits

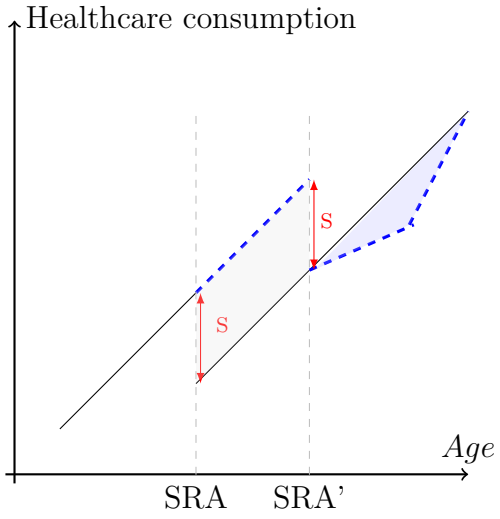


Source: Figures reproduced from Garrouste and Perdrix (2021).

If the magnitude is small at the individual level, it makes up a large amount for the National Health Insurance, which counts around 30,000 individuals per cohort at the ages affected by the reform.[16] However, this decrease in public expenditure has to be balanced with what happened before retirement.

Figure 6 represents schematically the effect of retirement on the consumption of healthcare by age for individuals who retire at age SRA (black line) and for those who retire at age SRA' due to the reform (dashed blue line). According to the literature, they are all exposed to the same drop in consumption S at retirement, but not at the same age (respectively SRA and SRA') (Coe and Zamarro, 2015; Eibich, 2015; Bíró and Elek, 2018; Nielsen, 2019; Frimmel and Pruckner, 2020). Moreover, those who retire later do not experience the same trend of consumption during their retirement, as shown in Hagen (2018) and in this paper. Thus, the overall effect, over the life cycle, of retiring later on the consumption of healthcare is an increase in expenditure between ages SRA and SRA' (grey parallelepiped area) and a decrease of expenditure after age SRA' (blue triangle area). Thus, the cost or benefit for the National Health Insurance must take into account both the impact during the working life and during retirement.

Figure 6: Schematic Representation on the Overall Effect of Pension Reforms on Healthcare Consumption



Note: Consumption of healthcare by age for individuals who retire at age SRA (black line) and individuals who retire at age SRA' (dashed blue line) due to the pension reform. The drop in the consumption of healthcare at retirement is based on previous studies. This paper only documents the decline after retirement (light blue area).

4.5 Underlying Mechanisms

As mentioned in Section 1.2, mechanisms explaining this result can be classified into four categories: M1) those associated with a longer working life; M2) those associated with a shorter retired life; M3) those associated with health investment; and M4) those associated with foregoing care.

[16] A rough calculation would be 1.8 million euros per year and per cohort saved due to the reform.

the mechanism M4 is not likely to explain the decrease in healthcare consumption due to later retirement. Thus, if later retirement leads to an increase of those foregoing care, we would expect those with co-payment exemption to not change their healthcare consumption. I show that among those with a co-payment exemption, the results are similar: a decrease by 0.740 percentage point in the probability of having a doctor visit, and a decrease by 1.30% in the number of doctor visits (see Table D2). Thus, this mechanisms is not likely. Moreover, there is no impact on visits to the dentist, which is the first type of care that individuals forego.

Note that we can also exclude an income effect, for at least two reasons. First, all individuals in a given cohort, regardless of whether they were affected or not, experience the same change in pension due to the reform. Moreover, retiring later increases intertemporal income. Thus, if this mechanism were to apply, it would have been in the opposite direction of what we observe in this paper. Thus, it is unlikely that the decrease due to the reform is explained by an increase in individuals foregoing healthcare for financial motives. This suggests that neither the cost of healthcare nor the income would explain the observed decrease.

The mechanism M3 cannot be excluded. One may think that the decrease is attributable to a decrease in investment in one's health, through a decrease in preventive care for those who retire later. This decrease could be a compensation for an increasing investment during working life. This result would be consistent with the decrease in preventive care found at the switch from employment to retirement by Frimmel and Pruckner (2020); Eibich and Goldzahl (2021). Unfortunately, this hypothesis could not be tested in this study.

The mechanisms M1 and M2 cannot be excluded neither. Thus, one may think that the decrease of the consumption of healthcare is explained by an increase in health. This decrease could be due to the time spent in employment (validation of the *use-it-or-lose-it* hypothesis) or to the time spent in retirement. However, I show that there is no significant changes in the probability of having a chronic condition (Table D3) nor in the probability of having a co-payment exemption.

Lastly, out of these four mechanisms, one may also think that the reform has been associated with a more progressive retirement, which has been health preserving, through arrangements with the employers (eg: lighter work scheduling, working hours, part-time paid full time, pre-retirement offers...).

Thus, this study allows excluding the interpretation by an income effect or a foregoing care effect. The observed decrease in the consumption of healthcare due to later retirement can be explained both by a health effect and by changes in investment in one's health (such as preventive care, for example). The effect of a smoother transition from employment to retirement might also have an impact.

5 Robustness check and discussion

5.1 Robustness check

Sample selection on contributed quarters. Since the reform only affects individuals who contributed between 131 and 160 quarters at age 60, the sample is restricted to this

population. Small changes in this threshold are not expected to drive the results, but large changes may. By including in the panel individuals that were not affected but with very different characteristics than the affected, bias may arise. For example, the inclusion of individuals with very long careers (more than 170 quarters by age 60) leads to the inclusion of individuals who were not affected by the reform since they started working around age 16 (control group) while the treatment group started working between the ages of 23 and 27. Moreover, note that it is not possible to include individuals with either fewer than 131 quarters or more than 160 quarters since these individuals are not affected by the reform but left at very different claiming ages (the first group left at age 65 and the second at age 60). As a robustness check, I show that small changes in the contribution length threshold of individuals included in the study does not statistically significantly change the results, whereas large changes do (see Figure C1 in Appendix).

Sensitivity to the econometric specification. I show that the results are not sensitive to the econometric specification. Thus, using an IV-probit, IV-GMM using linear or Poisson regression models, does not significantly affect the results at the extensive (Table C2) and intensive margin (Table C2).

5.2 Discussion

Using a Two-Part Model. A large proportion of the observed population has zero consumption at a given point of time. There are two main ways to tackle this issue: using sample selection models (e.g. Heckman models), or using two-part models. There is a large literature on the choice between these two models (Leung and Yu, 1996; Jones, 2000), called the 'cake' debate Mullahy (1998). While both models have advantages and drawbacks, Dow and Norton (2003) and Madden (2008) provide criterion to choose between two-part model and Heckman model. In this paper, a two-part model is choosen for several reasons. First, in the absence of a good exclusion variable, two-part models provide better estimates than sample selection models (Manning et al., 1987; Hay et al., 1987). In this paper, I cannot find a convincing exclusion variable, and the use of the Inverse Mill Ratio leads to non-convergence. Second, the sample selection issue is not likely to be an issue when zero is not a missing value but a real zero (Dow and Norton, 2003). Third, it allows using a logarithmic transformation without difficulties regarding individuals with zero consumption (in particular, those associated with the smearing coefficient). Fourth, as reiterated by Belotti et al. (2015), this very flexible specification does not require any assumption regarding the independence between the binary dependent variable and the conditional on positive continuous variable. Fifth, the instrumental variable strategy reduces the limitation associated with the use of a two-part model. Lastly, delayed retirement may affect differently the probability of consuming and the level of consumption. From a public policy point of view, this distinction is of great interest, because the potential mechanisms explaining a zero consumption may differ from those explaining a change in its level. For example, one may argue that foregoing healthcare can only be measured through the probability of consuming and not through the level of consumption. Moreover, measuring only the overall effect could lead to a wrong interpretation in terms

of public policy.[17]

Restriction to compliers. I am interested in the impact of the reform among the compliers (estimation of the LATE). In a public policy point of view, focusing on the effect of later retirement on compliers is relevant because the financial gains from the reform came from these individuals. Even if it would have been of interest, I cannot measure the effect of later retirement on never-takers. It would be interesting to measure the impact of the decrease of pension for the never-takers affected by the reform, compared to the never-takers not affected. It was not the aim of this study but could be an interesting question to explore in future research.

One might worry about the selection bias of the compliers. In this paper, this selection bias is unlikely. First, non-compliers are scarce in this study (probably because of the high financial incentive to comply). Indeed, the first stage shows that having to contribute one quarter more leads to delay retirement by 0.86 quarters. Since the effect is linear, it can be interpreted as 86% of those who have to contribute one quarter more do so. As reminded by Angrist and Pischke (2009), when the number of compliers is close to 100%, the results of the LATE is close to the result of the average treatment effect. Thus, if it had been an issue, it would have been of very limited amplitude.

Second, a selection bias could have occur if individuals were affected by the reform according to their nature as complier, never-taker or always-taker. However, being affected or not by the reform depends only on the birth year and the number of quarters contributed at age 60. These parameters have no reason *a priori* to be correlated to individual compliance. Thus, I have the same selection in both group.

External validity. This study does not suffer from selection bias among compliers. However, the selection of this population of interest leads to a weak external validity. The reform does not affect those with very long career and people with large discontinuity in their career (those with 130 quarters at age 60 start working at age 27,5 years old, those with 160 quarters start working at 20 years old (ie. after 2 years of education after the *baccalauréat.*)). It does not affect neither those eligible to disability pension. Thus, this paper focus on the impact of later retirement on healthcare consumption among those in relative good health compared to the whole French population. The result can be interpreted as the impact of later retirement on healthcare consumption of the healthy French born between 1934 and 1943. Thus, this result cannot be extended to a reform that would increase claiming age for the whole population.

Unobservable effect before age 66 and after age 78. The decrease observed holds between age 66 and 76 years old. In order to have an inter-temporal view of the impact of later retirement on healthcare consumption, it would have been usefull to be able

[17]Let us imagine that the pension reform leads to both an increase in the share of individuals foregoing healthcare for financial reasons but also impairs the health of those who can still afford care. The latter increase their consumption of healthcare as a consequence of their worse health. For example: a population of which 80% had been consuming healthcare before the reform, with each one spending 10 euros. The average consumption if of 8€. Due to a reform, this share decreases to 60%, but the expenditure per individual increases to 12€. The average expenditure is then 7.20€. We would wrongly conclude that the reform has decreased the consumption of healthcare. In reality, it increased the expenditure among those who had already been consuming healthcare, but decreased the probability of consuming healthcare.

to measure the impact between age 60 and 66, and after age 78. The future potentail availability of other administrative data might be the opportunity to extend this result over the life cycle.

Conclusion

In this paper, I have used a two-stage least squares estimator in a two-part model to estimate the causal impact of retiring later on the consumption of healthcare at the extensive and intensive margins. I have focussed on a sample of men who worked in the private sector, aged from 66 to 76. I used the first French pension reform, which increased the claiming age, as an instrumental variable. This paper is the first to focus on the impact of retiring later on the consumption of healthcare among male retirees, rather than on the impact of the switch from employment to retirement. I show that a one quarter delay in retirement due to the reform decreases statistically significantly the probability of making at least one doctor visit, as well as the number of doctor visits among consumers. This result is consistent with previous findings. However, the result apply only on a specific population: men from the private sector who have contributed at age 60 between 131 and 160 quarters. These individuals are in better health that the average. Thus, this result cannot be extended to the whole French population. Two main potential mechanisms can explain the decrease of healthcare consumption. First, a part of the population could benefit from a positive health effect. This would be a validation of the *use-it-or-lose-it* hypothesis or a validation of worse health-related behaviour during retirement. Moreover, retiring later could lead to a decrease in investment in health during retirement. Income and price effects do not explain the decrease. Foregoing care does not explain it either.

The decrease in the consumption of healthcare due to the reform cannot lead to a conclusive statement regarding the financial gain for the governmental budget. Thus, the financial gain has to be balanced with what happened before retirement for those who delayed retirement. Moreover, it is impossible to draw a conclusion from a public policy perspective without any qualitative understanding regarding the underlying mechanism explaining this result and the potential heterogeneity. This paper shows the importance for more research in this field. If the decrease in the consumption of healthcare is associated with better health, through a confirmation of the *use-it-or-lose-it* hypothesis, public policy recommendations would be in favour of a policy that increases the incentives for retirees to maintain social, physical and cognitive activities. If the health improvement is through the investment in one's health during employment, public policy advice should be to increase incentives for investing in one's health during retirement. If there is no change in health due to delaying retirement, but a decrease in the use of preventive healthcare, public policy should increase incentives for investing in one's health during retirement.

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Appendix to

Does later retirement change one's consumption of healthcare?

A Institutional Framework

A.1 The 1993 Pension Reform

The pension is computed using the following formula: $P = \tau \times PC \times W_{ref}$ with τ the replacement rate; PC, the proratisation coefficient; and W_{ref} the reference wage, which is equal to the best N years of wages.

The replacement rate formula is: $\tau = 0.5 - \delta \times max[0; min(4 \times (65 - a); D - d)]$ with a, the claiming age; D, the number of contributed quarters required to benefit from a full replacement rate; d the number of quarters contributed; and δ, the minimization coefficient, equal to 1.25% per missing quarter.

The 1993 reform changes:

- D, the number of quarters required to benefit from a full pension:
  - For cohorts born before 1934, D equals 150 quarters
  - Each cohort born in 1934 and after has one added quarter compared to the previous cohort
  - From cohort 1943, D equals 160 quarters
- N, the number of best years of wages
  - Before 1993, N equals 10
  - N increases by one year every year
  - N equals 25 years from 2010
- Pensions are indexed on prices and not wages. In practice, this indexation applied already from 1987.

Thus, the change in the number of quarters required affects only a small share of individuals in each cohort, because all individuals with very short careers will leave at age 65 whatever the change in D, and individuals with very long careers will leave at age 60 whatever the change in D. The change in N affects each cohort in the same way. The change in indexation affects all cohorts in the same way. As a consequence, assuming that all individuals in each cohort are affected in the same way by the change in N and indexation, the difference between individuals affected and not affected by the change in D within each cohort captures only the effect of this part of the 1993 reform.

A.2 The Health Insurance System in France

In France, there is a public mandatory health insurance for almost all the French. The reimbursement rate is defined at the national level for each type of care, except in the region of Alsace-Moselle, where there is a higher coverage rate. Moreover, contribution varies according to the status on the labour market (student, worker, unemployed, retired...).

On average, this mandatory public coverage reimburses 78% of the expenditure on healthcare. However, there is heterogeneity in the reimbursement rate. In particular, individuals suffering from chronic diseases benefit from a 100% reimbursement of their expenditures associated with their chronic disease.

To cover expenditures which are not reimbursed by the National Health Insurance, individuals can subscribe to a private supplementary health insurance. This can be through an individual contract or a collective firm contract. Before 2016,[18] private sector employees can benefit from supplementary health insurance through a collective firm contract paid for by both the employees and the employer. The firm has to pay at least 50% of the insurance fees. In 2015, 51% of private sector firms offered a collective supplementary insurance (Lapinte and Perronnin, 2018), and 75% of private sector employees benefitted from collective supplementary insurance. At retirement, employees can keep on benefitting from this coverage but without any of the firm's previous contributions. Since the Evin Law (1989), the insurance has to apply the same fees for the first three years after retirement. Once these three years have passed, the fees of the supplementary insurance can change. However, on average, a major part of retirees are not affected by this price change because most of them change their health insurance at retirement. Thus, Franc et al. (2007) show that 51% of beneficiaries of mandatory collective firm contracts change their contract at retirement, 39% of beneficiaries of optional collective firm contracts change their supplementary insurance at retirement, 23% of new retirees with an individual supplementary health insurance change their contracts at retirement.

The supply of healthcare is highly regulated in France, following different rules for hospital inpatient care and out of hospital ambulatory care. Ambulatory care is provided by general practitioners[19] and specialists.[20] The standard regulated price for a visit to a general practitioner in France was 23€ in 2015. For a specialist, there is a higher variation, according to the speciality. Thus, the fees go from 25 to 150€. The National Health Insurance reimburses 70% of the regulated doctor fees, with a few exceptions. The healthcare pathway encourages patients to visit first a general practitioner, and if needed, benefit from a prescription to visit a specialist.[21] Following this healthcare pathway is highly encouraged since the reimbursement rate from the National Health Insurance is cut by 40% if the patient does not first visit a general practitioner. The fees for ambulatory care are regulated for both general practitioners and specialists.

Inpatient care is provided in a hospital, which can be private for-profit, private non-for-profit, or public. If an individual benefits from an administrative acknowledgement

[18] This supplementary coverage has been mandatory for private sector employees from 2016.

[19] Being a general practitioner is one of the French specialties of medicine. General practitioners provide primary care and ensure continuity of medical follow-up.

[20] In France, there are 26 main medical specialties, including oncology, rheumatology, dermatology, ophthalmology, cardiology, etc. Dentist are not one of the french medical speciality.

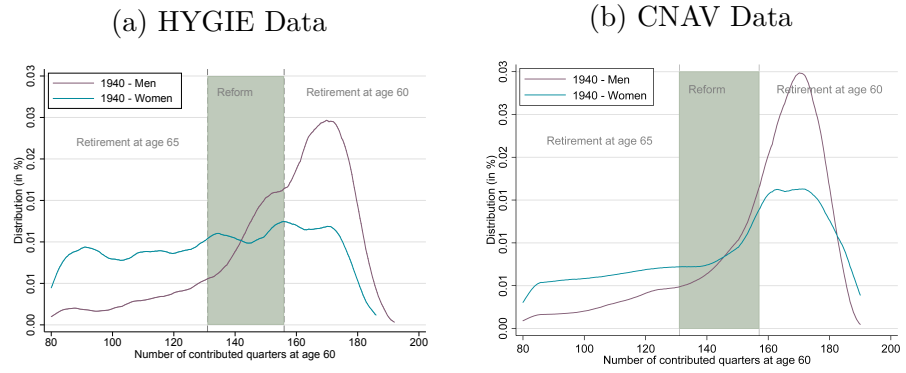
[21] This system was voted in 2004, and implemented beginning in July, 2005, through the Douste–Blazy law.

of a long-term care illness, its reimbursement rate is 100% for all medical care related to that long-term care illness. There are several other conditions for benefitting from a co-payment exemption: having an inpatient stay longer than 30 days or having a work accident, for example.

B Data Details

The Selection of Men. Figure B1 presents the distribution by contribution length at age 60. Figure B1a shows the distribution in the HYGIE data. Figure B1b shows the same picture using the exhaustive data from the private pension scheme (CNAV). The male distribution is similar in both datasets, which it not the case for women. HYGIE data do not include information on the additive quarters one may get. Since these additional quarters are mainly for childbirth, and for years when a parent has stopped working to raise children, the consequence is a wrong number of contributed quarters for women that benefit from these added quarters. I underestimate the number of contributed quarters for women in the HYGIE data, and in particular for women with a high number of contributed quarters at age 60. This is not a surprise for two reasons. First, women with a high number of contributed quarters at age 60 are those with the lowest level of education. In France, it is a group with on average more children (Davie and Mazuy, 2010) and therefore, more quarters for childbirth. Secondly, they may probably stop working to raise children more often and thus have associated contributed quarters I do not observe in the HYGIE data.

Figure B1: Distribution by Number of Contributed Quarters at Age 60



Note: Kernel density by number of contributed quarters at age 60 of individuals who had contributed between 80 to 200 quarters at age 60.
Source: Figure (a): HYGIE data. Sample of individuals born in 1940 who had contributed at least once in the private sector. Figure (b): CNAV 2017. Stock of individuals born in 1940. The CNAV data include all the French who had contributed at least once in the private sector. It shows the real distribution of number of contributed quarters at age 60.

The selection by year of birth and year of observation. I summarize in Table B1 the year of observation of each cohort at each age. The grey area is the observation I exclude in the main analysis. The Table B2 shows the same Table, highlighting by color

the sub-sample I have done to have results by three-years age groups. These results are presented in Appendix below.

Table B1: Main sample: Age of each Cohort per Wave

	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
1935	70	71	72	73	74	75	76	77	78	79	80
1936	69	70	71	72	73	74	75	76	77	78	79
1937	68	69	70	71	72	73	74	75	76	77	78
1938	67	68	69	70	71	72	73	74	75	76	77
1939	66	67	68	69	70	71	72	73	74	75	76
1940	65	66	67	68	69	70	71	72	73	74	75
1941	64	65	66	67	68	69	70	71	72	73	74
1942	63	64	65	66	67	68	69	70	71	72	73
1943	62	63	64	65	66	67	68	69	70	71	72

Note: The observations in grey are excluded from the analysis.

Table B2: Additional sample: by age range

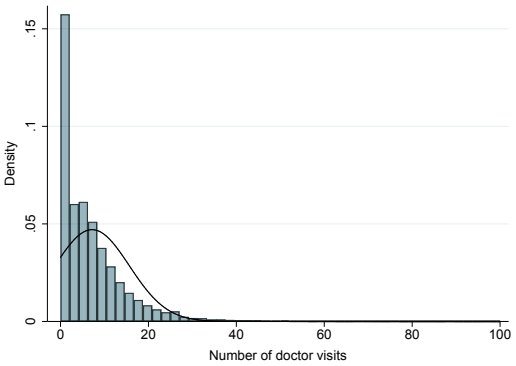
	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
1935	70	71	72	73	74	75	76	77	78	79	80
1936	69	70	71	72	73	74	75	76	77	78	79
1937	68	69	70	71	72	73	74	75	76	77	78
1938	67	68	69	70	71	72	73	74	75	76	77
1939	66	67	68	69	70	71	72	73	74	75	76
1940	65	66	67	68	69	70	71	72	73	74	75
1941	64	65	66	67	68	69	70	71	72	73	74
1942	63	64	65	66	67	68	69	70	71	72	73
1943	62	63	64	65	66	67	68	69	70	71	72

Note: In blue, observations selected in the analysis between ages 66 and 68. The selection is shifted by one year. This leads, three times later, to the selection in red of individuals aged between 69 to 71 years old, until the group of those aged between 74 and 76 years old, in orange in the table.

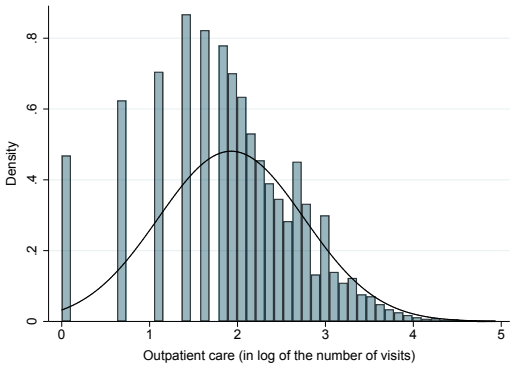
Distribution of Consumption of Healthcare. The following figures show the number of doctor visits and expenditure for doctor visits both without and with log transformation. As reiterated by Lumley et al. (2002), the assumption of normality is a strong one in the empirical strategy I planned to use. The skewness of the healthcare distribution forbids this assumption (Figure B2a and B2c). This skewness is because the data are both left-censored and have a long right-tailed distribution. Using a logarithm transformation among the consumers resolves the long right-tail issue (Figure B2b and B2d).

Figure B2: Healthcare Distribution

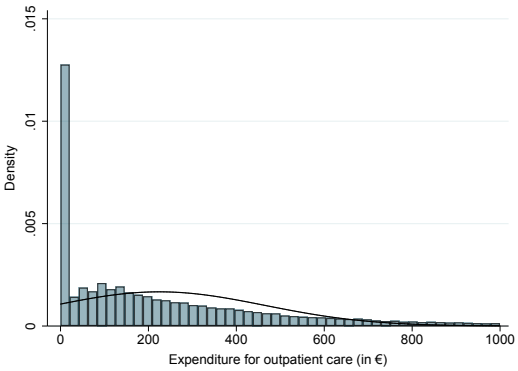
(a) Number of Visits



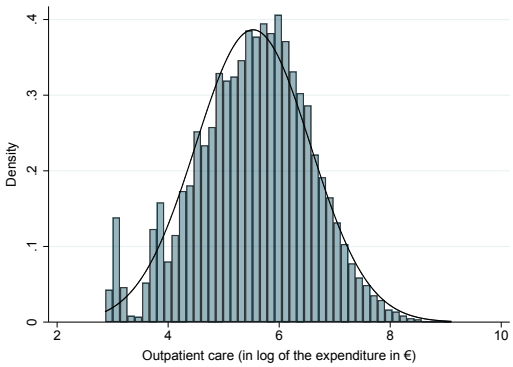
(b) Number of Visits (in log)



(c) Expenditure for Ambulatory Care



(d) Expenditure for Ambulatory Care (in log)



Note: This graph shows the density of the number of doctor visits (a) and the log of the number of doctor visits among the consumers (b). It also shows the expenditure for doctor visits (c) and the log of expenditure among consumers (d).
Sample: Men who had contributed at least once in the private sector and had contributed at age 60 between 131 and 160 quarters, retired before age 67.
Source: HYGIE 2005-2015.

C Robustness Check

C.1 Sample Selection on Number of Contributed Quarters

In the main analysis, I selected individuals who had contributed between 131 and 160 quarters by age 60. All individuals who had contributed between 131 and 151 quarters were affected by the reform. Those who had contributed between 152 and 159 quarters were not all affected, depending on their birth year. In a difference-in-difference design, I have to include at least one contributed quarter where nobody is affected by the reform. Thus, I can include all individuals who have contributed fewer than 130 quarters and those who have contributed more than 160. However, I cannot include both because those who have contributed fewer than 130 quarters leave with a full replacement rate from age 65 while those who have contributed more than 160 leave at age 60. I include as a control group those who have contributed 160 quarters and more. This choice is more logical since the affected are those who would have been retired at age 60 but have to retire later due to the reform. As a consequence, it makes less sense to compare it to the group of

individuals who leave at age 65 than to the group who leave at age 60.

Lastly, note that the identification strategy relies on the fact that those who are affected are similar to those who are not affected. This is true when considering individuals who have contributed 159 quarters compared to those who have contributed 160 quarters. However, it is probably wrong when comparing those with 159 quarters with those with 180 quarters. Thus, the empirical strategy becomes probably less precise, or wrong, with the inclusion of individuals with a very large number of contributed quarters.

Figure C1 shows the results while changing the number of contributed quarters in the sample. The dashed line separates the cases where the treated are compared to the non-treated who leave at age 65 (all points to the left of the line) and the case where the treated group is compared to the non-treated group who leave at age 60 (points to the right of the line). As expected, it shows that the main sample (131 to 160 quarters) provides results not statistically different from those using close contribution length thresholds.

Figures C1(a) and (b) show the impact of the reform on the claiming age. The points the most on the left of these figures show smaller average impacts. This is expected since the more the dot is to the left, the more individuals not affected by the reform and leaving at age 60 are included.

Figure C1(c) shows the impact of delaying retirement by one quarter due to the reform on the probability to consume. The effect found is not statically different from the adjacent samples. However, adding a large number of individuals not affected by the reform that leave at age 65 (thus, later than the affected) leads to a non-significant impact or, in three cases out of eight, a positive significant impact very close to zero. Adding individuals with very long careers, who leave at age 60 and are not affected by the reform leads to a smaller effect but still significant, except for the three last samples tested (those with individuals who started working close to age 16).

Figure C1(d) shows the impact of one quarter more due to the reform on the number of doctor visits (in logs). The impact is never statistically different when adding individuals who leave at age 65. It is not statistically different for the two samples with individuals who leave at age 60 and that are the closest to the main estimation. However, once one adds a large number of individuals not affected by the reform, who leave at age 60, the effect turns non-significant. Note that it is probable that the individuals with between 170 and 180 contributed quarters at age 60 have different health conditions than those between 150 and 160 contributed quarters and thus are not very comparable.

I never consider individuals with more than 180 quarters. Individuals with more than 180 quarters are those who started working before age 16. These individuals exist only for the cohorts born before 1943 (beginning in 1959, full time employment before age 16 has been forbidden by law). In my sample, these individuals are rare and I consider these individuals as atypical compared to the rest of the sample.

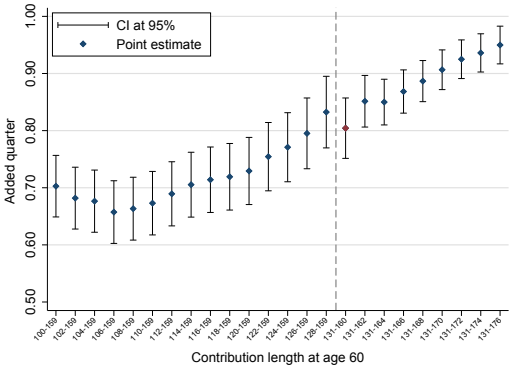
Table C1: Individuals Affected and not Affected in the Sample

Contrib. length at age 60		**Claiming age**	**Started working at age**
[0; 130]	Not affected (NT)	65 y.o.	27,5 y.o. and later
[131; 151]	Affected (T)	btw 60 and 65 y.o.	between 22,25 and 27,25 y.o.
[152; 159]	NT + T	btw 60 and 65 y.o.	between 20,25 and 22 y.o.
[160; 180]	Not affected (NT)	60 y.o.	between 16 and 20 y.o.

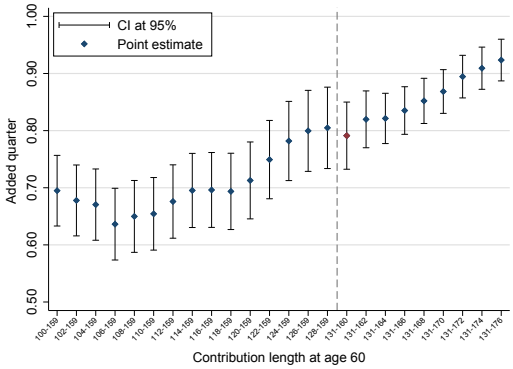
Note: Individuals who contributed between 0 and 130 quarters at age 60 are not affected by the reform, they retire from age 65 at the full replacement rate, and started working at age 27.5 years old if they had a continuous career.

Figure C1: Sensitivity to Selecting on Number of Contributed Quarters

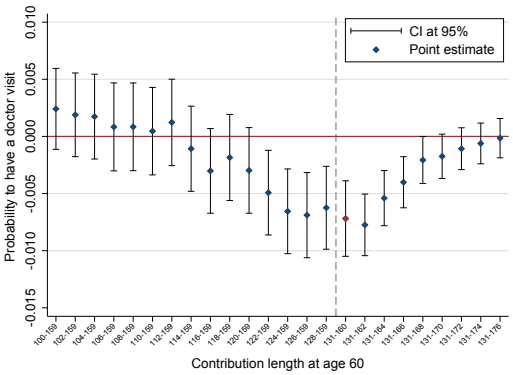
(a) Impact of the Reform on Claiming age (1st stage) – All



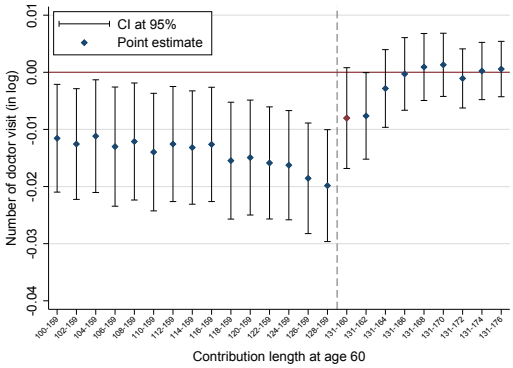
(b) Impact of the Reform on Claiming age (1st stage) – Consumers



(c) Impact of Retiring Later on Probability of Visiting a Doctor (2nd Stage) – All



(d) Impact of Retiring Later on the Number of Doctor Visits (2nd Stage) – Consumers



Note: Point estimates of the impact of retiring later on doctor visits. The red dot is the point estimate of our main sample.
Sample: Men who had contributed at least once in the private sector and had contributed at age 60, retired before age 67.
Source: HYGIE 2005-2015.

C.2 Results Using Other Econometric Specifications

To test the robustness of the econometric specification, I provide in Table C2 results using alternative econometric specifications. I measure the impact of retiring later on the probability of consuming healthcare using probit regression and using Poisson regression.

I measure the impact of retiring later on the number of doctor visits among consumers, using a semi-parametric specification using discrete transformation of healthcare variables, in a generalized method of moments (GMM) (Hansen, 1982). It also shows similar results.

Table C2: Impact of Later Retirement on Healthcare Consumption using Alternative Models

	Probability to consume				Level of consumption	
	Main estimate	iv-probit	iv-reg GMM	iv-poisson GMM	Main estimate	iv-poisson GMM
General practitioner visit	-0.00828***	-0.00750***	-0.00828***	-0.00752***	-0.00522	-0.00419 **
	(0.00217)	(0.00209)	(0.00217)	(0.00214)	(0.00476)	(0.00173)
Specialist practitioner visit	-0.00724***	-0.00713***	-0.00722***	-0.00464***	-0.00797	-0.00685
	(0.00254)	(0.00257)	(0.00269)	(0.00265)	(0.00680)	(0.00473)
Any type of practitioner visits	-0.00815***	-0.00960***	-0.00998***	-0.00679***	-0.0114**	-0.00560***
	(0.00209)	(0.00253)	(0.00266)	(0.00210)	(0.00501)	(0.00183)
Dental visit	-0.000332	-0.000265	-0.000227	-0.000584	-0.00252	-0.0205
	(0.00165)	(0.00166)	(0.00163)	(0.00189)	(0.00514)	(0.0411)
Prescription drugs	-0.00599***	-0.00789***	-0.00803***	-0.00472***	-0.0138*	-0.00224 ***
	(0.00203)	(0.00255)	(0.00264)	(0.00199)	(0.00772)	(0.00047)
Hospital stay	-0.000433	-0.000308	-0.000247	-0.000518	-0.00661	-0.0218
	(0.00166)	(0.00162)	(0.00164)	(0.00183)	(0.0144)	(0.0291)
Any of the previous care	-0.00516***	-0.00709***	-0.00722***	-0.00386***	-0.0236***	-0.00346 ***
	(0.00200)	(0.00257)	(0.00263)	(0.00198)	(0.00739)	(0.000655)
N	66,698	66,698	66,698	66,698	See below	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: All coefficients are marginal effects. Retire one quarter later due to the reform leads to an average increase in the probability to have a generalist practitioner visit by 0.7 percentage point, estimated using a probit model. In the last column, only consumers are included in each regression. The number of observations is (from top to bottom): 48,324 ; 34,040; 50,488 ; 7,396 ; 51,855 ; 8,008 ; 48,468.
Sample: Men who had contributed at least once in the private sector and had contributed at age 60 between 131 and 160 quarters, retired before age 67.
Source: HYGIE 2005 – 2015.

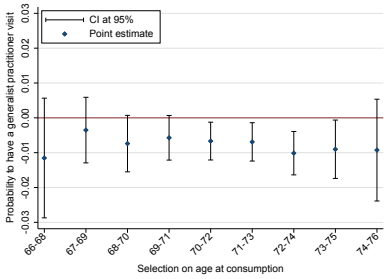
D Additional Results

D.1 Results for Alternative Samples

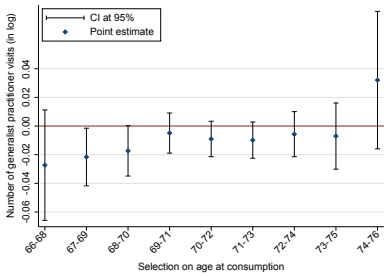
Results for Sub-sample of Three-years Age Groups. Figure D1 shows the main results for sub-group of individuals in the same age-ranges (ages 66-68, ages 67-69, etc until ages 74-76). The difference between these age groups cannot be interpreted as an age effect since the point estimate are measured for different sample: different cohort, observed at different year, and having different treatment intensity (see Table B2).

Figure D1: Impact of Later Retirement on Healthcare use by Age Range

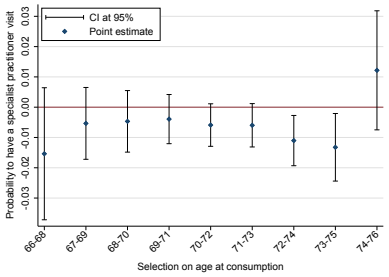
(a) Effect on the Probability to Have a General Practitioner Visit



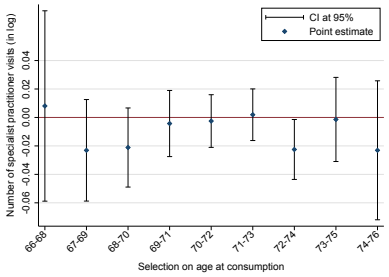
(b) Effect on the Number of General Practitioner Visits (among Consumers)



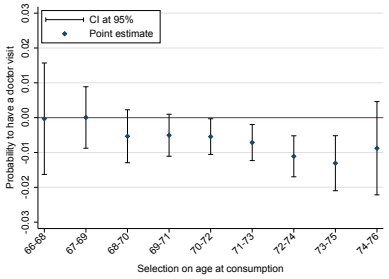
(c) Effect on the Probability to Have a Specialist Practitioner Visit



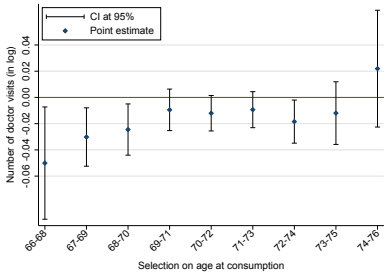
(d) Effect on the Number of Specialist Practitioner Visits (among Consumers)



(e) Effect on the Probability to Have a Doctor Visit



(f) Effect on the Number of Doctor Visits (among Consumers)



Note: Point estimates of the impact of retiring later on the probability of having a visit to a general practitioner (Figure a), a specialist (Figure c), and any doctor visit (Figure e). It shows a significant decrease among individuals aged between 68 to 70, and all older groups, in the probability of having a visit to a general practitioner. Figure (b), (d) and (f) respectively show, among consumers, the impact of retiring later on the number of doctor visits (general, specialist, all).
Sample: Men who contributed at least once in the private sector and contributed at age 60 between 131 and 160 quarters, retired before age 67.
Source: HYGIE 2005–2015.

Impact among Individuals with Chronic Condition. To test if the effect is driven by individuals with particular healthcare consumption, I observe the impact of retiring later on the probability to consume doctor visits and on the level of consumption among individuals who had or have a chronic condition. I identify those with a chronic condition through the variable "Have an administrative recognition of a chronic condition". Table D1 shows that among individuals with chronic condition, a one quarter increase in claiming age due to the reform decreases significantly the probability to have a doctor visit by 1.46 percentage point and the number of doctor visits by 1.80% among consumers. The decrease is slightly higer than the main result.

Table D1: Results among the Healthcare Consumers with Chronic Condition

		Probability	**Number of**	**Expenditure for**	**Price for**
General practitioner visits	Claiming age	-0.0138***	-0.0103	-0.0103*	-0.0000628
		(0.00250)	(0.00637)	(0.00606)	(0.00232)
	N	29,323	23,546	23,546	23,546
Specialist practitioner visits	Claiming age	-0.0155***	-0.0126	-0.0293***	-0.0167**
		(0.00369)	(0.00884)	(0.0101)	(0.00779)
	N	29,323	17,429	17,429	17,429
Any type of practitioner visits	Claiming age	-0.0146***	-0.0180***	-0.0300***	-0.0119**
		(0.00239)	(0.00668)	(0.00829)	(0.00434)
	N	29,323	24376	24,376	24,376
Dental visits	Claiming age	-0.00128	-0.000441	-0.0125	-0.0121
		(0.00258)	(0.00673)	(0.0302)	(0.0297)
	N	27,317	3,524	3,524	3,524
Prescription drugs	Claiming age	-0.0122***	n.a.	-0.0261***	n.a.
		(0.00229)	n.a.	(0.00917)	n.a.
	N	29,323	n.a.	24,773	n.a.
Hospital stays	Claiming age	-0.00210	-0.0267*	-0.0294**	-0.00266
		(0.00260)	(0.0220)	(0.0236)	(0.0162)
	N	29,323	4,428	4,428	4,428
Any of the previous type of care	Claiming age	-0.0121***	n.a.	-0.0307***	n.a.
		(0.00224)	n.a.	(0.00899)	n.a.
	N	29,323	n.a.	23,218	n.a.

Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: One quarter later retirement significantly decreases by 1.46 percentage point the probability to consume a doctor visit and decreases the number of doctor visits by 1.80% among the consumers.
Sample: Men who had contributed in the private sector and had contributed at age 60 between 131 and 160 quarters, retired before age 67, and have after age 65 an administrative recognition of a chronic condition.
Source: HYGIE 2005 – 2015.

Impact among Individuals with Co-payment Exemption. To test the potential price-sensitivity effect, I focus on the subsample of those who benefit from a co-payment exemption. Those who Can benefit from this exemption in the sample are individuals who need care associated with work accident and occupational illness, and individuals with long-term illness. Table D2 shows the impact of retiring later on the probability to consume and the level of healthcare consumption. It shows that delay retirement by one quarter due to the reform significantly decreases by 0.740 percentage point the probability to consume a doctor visit and decreases the number of doctor visits by 1.30% among the consumers. These results are not statistically different from the main sample, meaning that the effect is not driven by a price elasticity effect.

Table D2: Results among the Healthcare Consumers with Co-payment Exemption

		Probability	Number of	Expenditure for	Price for
General practitioner visits	Claiming age	-0.00822***	-0.00625	-0.00460	0.00165
		(0.00172)	(0.00513)	(0.00516)	(0.00185)
	N	47,365	42,911	42,911	42,911
Specialist practitioner visits	Claiming age	-0.00784***	-0.00947	-0.0176**	-0.00809
		(0.00302)	(0.00740)	(0.00859)	(0.00642)
	N	47,365	30,161	30,161	30,161
Any type of practioner visit	Claiming age	-0.00740***	-0.0130**	-0.0178***	-0.00484
		(0.00136)	(0.00544)	(0.00675)	(0.00355)
	N	47,365	44,705	44,705	44,705
Dental visits	Claiming age	-0.000730	-0.0000767	0.00554	0.00561
		(0.00214)	(0.00548)	(0.0250)	(0.0247)
	N	43,525	6,149	6,149	6,149
Prescription drugs	Claiming age	-0.00416***	n.a.	-0.00889***	n.a.
		(0.00110)	n.a.	(0.00819)	n.a.
	N	47,365	n.a.	45,846	n.a.
Hospital stays	Claiming age	-0.000167	-0.00757	-0.00522	0.00235
		(0.00225)	(0.0164)	(0.0175)	(0.0132)
	N	47,365	7,140	7,140	7,140
Any of the previous care	Claiming age	-0.00285***	n.a.	-0.0224***	n.a.
		(0.000949)	n.a.	(0.00781)	n.a.
	N	47,365	n.a.	42,567	n.a.

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Delay retirement by one quarter due to the reform significantly decreases by 0.740 percentage point the probability to consume a doctor visit and decreases the number of doctor visits by 1.30% among the consumers.
Sample: Men who had contributed at least once in the private sector and had contributed at age 60 between 131 and 160 quarters, retired before age 67, and benefit from a co-payment exemption.
Source: HYGIE 2005 – 2015.

D.2 Results for Alternative Outcomes

Results on the Probability to Have a Chronic Condition After Age 65. Table D3 show that delayed retirement by one quarter leads to no significant changes in the probability to have a chronic condition after age 65. This non significant result holds in all age-group subsample testes (Figure D2). All the same, there is no significant change in the probability of having a co-payment exemption.

Table D3: Impact on the Probability to Have a Chronic Condition after Age 65 and Co-payement Exemption

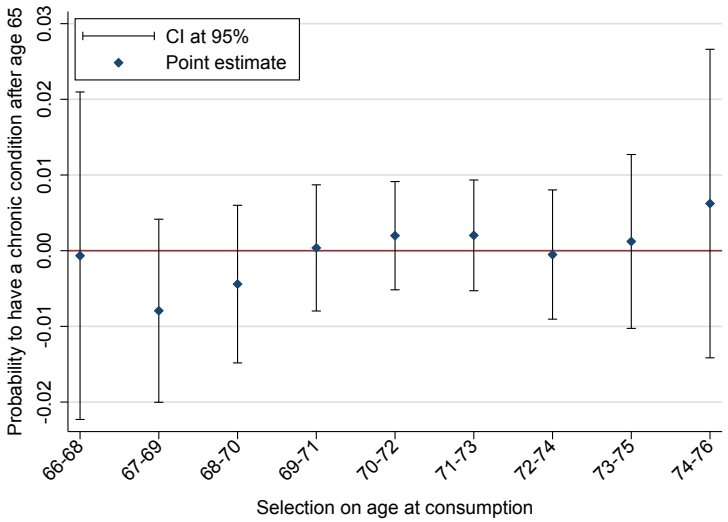
	Chronic Condition	Co-payment exemption
Claiming age	0.00209	-0.00224
	(0.00261)	(0.00223)
N	66,698	66,698

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Delayed retirement by one quarter leads to an increase in the probability to have a chronic condition after age 65 by 0.209 percentage points. Delayed retirement by one quarter leads to a non significant decrease in the probability to benefit from a co-payment exemption by 0.224 percentage points.
Sample: Men who had contributed at least once in the private sector and had contributed at age 60 between 131 and 160 quarters, retired before age 67.
Source: HYGIE 2005 – 2015.

Figure D2: Impact of Later Retirement on the Probability to Have a Chronic Condition after Age 65



Note: This graph shows the average impact of retiring later on the probability to have a chronic condition after age 65, by age range. Confidence Intervals at 95%.
Sample: Men who had contributed at least once in the private sector and had contributed at age 60 between 130 and 180 quarters, retired before age 67.
Source: HYGIE 2005 – 2015.

D.3 Additional details concerning main results

Tables below are: i) the main results with the following additional informations for the first-stage results: Adjusted R^2, F-stat of the instrumental variable and of the model; ii) The reduced-form an naive analysis for the extensive margin and intensive margin.

Table D4: Impact of the Reform on Claiming Age

			(1) Main sample	(2) Co-payment exemption	(3) Chronic condition	(4) Chronic condition*
Had at least once during the year:	**All**	Reform	0.859***	0.850***	0.874***	0.925***
			(0.0317)	(0.0352)	(0.0423)	(0.0422)
		N	66,698	47,365	29,323	29,323
		adj. R^2	0.304	0.308	0.287	0.247
		F-stat of the IV	733.8	582.5	425.7	479.7
		F-test of the model	189.3	150.3	.	188.1
	General practitioner visit	Reform	0.844***	0.840***	0.880***	0.910***
			(0.0349)	(0.0364)	(0.0464)	(0.0462)
		N	48,324	42,911	23,546	23,546
		adj. R^2	0.308	0.306	0.308	0.269
		F-stat of the IV	585.0	532.5	359.7	387.7
		F-test of the model	152.6	137.2	.	167.9
	Specialist practitioner visit	Reform	0.796***	0.786***	0.837***	0.816***
			(0.0413)	(0.0423)	(0.0550)	(0.0551)
		N	34,040	30,161	17,429	17,429
		adj. R^2	0.310	0.310	0.311	0.271
		F-stat of the IV	372.5	345.7	231.7	218.8
		F-test of the model	111.1	99.80	.	128.7
	Any type of practitioner visit	Reform	0.839***	0.833***	0.874***	0.893***
			(0.0343)	(0.0359)	(0.0461)	(0.0459)
		N	50,488	44,705	24,376	24,376
		R^2adj	0.310	0.308	0.308	0.270
		F-stat of the IV	597.2	537.1	359.4	377.9
		F-test of the model	161.0	143.5	.	175.9
	Dental visit	Reform	0.830***	0.816***	0.866***	0.782***
			(0.0903)	(0.0954)	(0.119)	(0.120)
		N	7,396	6,149	3,524	3,524
		adj. R^2	0.335	0.335	0.373	0.329
		F-stat of the IV	84.47	73.09	53.16	42.38
		F-test of the model	32.10	27.31	.	38.10
	Prescription drugs	Reform	0.863***	0.860***	0.891***	0.904***
			(0.0341)	(0.0358)	(0.0460)	(0.0457)
		N	51,855	45,846	24,773	
		adj. R^2	0.315	0.312	0.312	0.275
		F-stat of the IV	640.3	577.4	375.8	391.8
		F-test of the model	169.3	150.4	.	184.6
	Hospital stay	Reform	0.813***	0.787***	0.688***	0.621***
			(0.0823)	(0.0844)	(0.111)	(0.113)
		N	8,008	7,140	4,428	
		adj. R^2	0.307	0.303	0.299	0.259
		F-stat of the IV	97.41	86.89	38.48	30.34
		F-test of the model	29.24	26.37	.	33.94
	Any of the previous care	Reform	0.858***	0.854***	0.891***	0.905***
			(0.0339)	(0.0356)	(0.0458)	(0.0455)
		N	52,463	46,317	24,943	
		adj. R^2	0.315	0.312	0.312	0.275
		F-stat of the IV	640.9	575.9	378.7	396.0
		F-test of the model	171.0	151.7	.	185.3

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Impact on the claiming age of the number of added quarters required due to the reform.
Sample: Men who contributed at least once in the private sector and had contributed by age 60 between 131 and 160 quarters, and retired before age 67. Column (1): Estimation in the main sample. Column (2): Estimation in the sub-sample of individuals with a co-payment exemption. Column (3): Estimation in the sub-sample of individuals with a chronic condition. Column (4): Estimation in the sub-sample of individuals with a chronic condition. This estimation is without control for department. It complements column (3) where the F-stat of the model cannot be computed because the covariance-variance matrix is not full rank. The first line is with all individuals following the selection criterion of the column, the second line is among individuals who visit at least once during the year a general practitioner, the third line, a specialist practitioner, and the last line is among individuals who either have visited a doctor at least once (whether general, specialist, or dentist), or stayed in a private hospital, or consumed prescription drugs.
Source: HYGIE 2005-2015.

Table D5: Reduced form and naive analysis – Probability of consuming

	(1) **Reduced form**	**(2)** **Naive analysis**
Dependant variable	*Number of added quarters*	*Claiming age*
General practitioner visit	-0.00711***	-0.00263***
	(0.00185)	(0.000247)
N	66,698	66,698
Specialist practitioner visit	-0.00622***	-0.000483*
	(0.00217)	(0.000279)
N	66,698	66,698
Any type of practioner visit	-0.00700***	-0.00124***
	(0.00178)	(0.000234)
N	66,698	66,698
Dental visit	-0.000285	0.000518***
	(0.00142)	(0.000200)
N	61,567	61,567
Prescription drugs	-0.00514***	0.000377*
	(0.00173)	(0.000221)
N	66,698	66,698
Hospital stay	-0.000372	-0.000207
	(0.00143)	(0.000179)
N	66,698	66,698
any of the previous care	-0.00443***	0.000444**
	(0.00170)	(0.000218)
N	66,698	66,698

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Column (1) shows the coefficient estimated of the OLS regression of the number of added quarters on healthcare consumption. Column (2) shows the coefficient estimated of the OLS regression of the claiming age on healthcare consumption.
Sample: Men who contributed at least once in the private sector and had contributed by age 60 between 131 and 160 quarters, and retired before age 67.
Source: HYGIE 2005-2015.

Table D6: Reduced form and naive analysis – Level of consumption

	(1) **Reduced form**	(2) **Naive analysis**
Dependant variable	*Number of added quarters*	*Claiming age*
General practitioner visits	-0.00440	-0.00759***
	(0.00403)	(0.000562)
N	48,324	48,324
Specialist practitioner visits	-0.00635	-0.00196***
	(0.00543)	(0.000745)
N	34,040	34,040
Any type of practitioner visits	-0.00956**	-0.00786***
	(0.00422)	(0.000587)
N	50,488	50,488
Dental visits	-0.00209	-0.000296
	(0.00429)	(0.000631)
N	7,396	7,396
Prescription drugs	-0.0119*	-0.0112***
	(0.00669)	(0.000973)
N	51,855	51,855
Hospital stays	-0.00537	-0.00303*
	(0.0118)	(0.00166)
N	8,008	8,008
Any of the previous care	-0.0203***	-0.0105***
	(0.00636)	(0.000919)
N	48,468	48,468

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Column (1) shows the coefficient estimated of the OLS regression of the number of added quarters on healthcare consumption. Column (2) shows the coefficient estimated of the OLS regression of the claiming age on healthcare consumption.
Sample: Men who contributed at least once in the private sector and had contributed by age 60 between 131 and 160 quarters, and retired before age 67. Line (1) includes only individuals having at least once a year a generalist doctor visit.
Source: HYGIE 2005-2015.