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SUPPLEMENTAL HEALTH INSURANCE AND HEALTHCARE CONSUMPTION—A DYNAMIC APPROACH TO MORAL HAZARD

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ABSTRACT

We analyze the existence and persistence of moral hazard over time to test the assumption of pent-up demand. We consider the effects of supplemental health insurance provided by a private insurer when added to compulsory public insurance that is already supplemented by private insurance. Using original panel data from a French *mutuelle*, we study the influence of insurance on all of the dimensions of healthcare expenditures: (1) the probability of using health care, (2) the number of uses conditional on use, and (3) the per unit cost of care. To conduct this study, we control, to the extent possible, for endogeneity because of adverse selection using the characteristics of our panel data. Our study allows us to confirm a positive and significant effect of the extra complementary health insurance on healthcare consumption, primarily in terms of the probability of using care. More interestingly, our results show that these effects are principally transitory mainly for the probability of using dental care and optical care and depend on income. Finally, we show that individuals did not postpone health care before enrollment. Copyright © 2015 John Wiley & Sons, Ltd.

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1. INTRODUCTION

Economic theory predicts that by reducing the price of health care at the point of use, increased health insurance coverage encourages individuals to increase their consumption of care, assuming that health care is an ordinary good. Because we cannot perfectly observe individuals' actions and/or type, moral hazard and/or adverse selection may arise. Numerous empirical studies have estimated the effect of health insurance on inpatient and/or outpatient healthcare consumption trying to control for endogeneity bias that may occur as a result of adverse selection. Newhouse JP, Rand Corporation, Insurance Experiment Group (1993) obtained price elasticity values of approximately −0.2 for inpatient and outpatient care. Other studies use instrumental variables (Albouy and Crepon, 2007, Genier, 1998, Ettner, 1997) or observe the exogenous change in copayments in healthcare plans (Cherkin *et al*., 1989, Chiappori *et al*., 1998). Regardless of the strategy used to control for adverse selection, the effect of health insurance on healthcare consumption is not consensual in European countries, where voluntary health insurance is primarily complementary or supplementary to public health insurance (PHI). For example, Schokkaert *et al*. (2010) and Bolhaar *et al*. (2008) analyzed the influence of complementary health insurance (CHI) on hospitalization and outpatient care in Belgium and Ireland, respectively, and did not observe significant effects (except in dental care). These results appear to be consistent with the results of

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previous studies using French data (Caussat and Glaude, 1993, Chiappori *et al*., 1998, Genier, 1998, Buchmueller *et al*., 2004, Raynaud, 2005). Albouy and Crepon (2007), for instance, demonstrated that coverage through CHI has no influence on hospital care consumption but has a significant influence on the probability of using outpatient care. Different approaches have been adopted to analyze the relevance and magnitude of moral hazard by focusing on the level of expenditures conditional on utilization (for instance, in France; Caussat and Glaude, 1993) or the probability of initiating an episode and the frequency of episodes (Albouy and Crepon, 2007). Thus, it is accepted that the significance and magnitude of moral hazard may depend on the institutional context, the type of health insurance and the type of care.

Only few studies have analyzed the persistence of a potential increase in healthcare consumption over time (Keeler *et al*., 1982, Long *et al*., 1998, Newhouse *et al*., 1982). It is crucial to consider the effects of health insurance from a dynamic perspective because the fact that the effects of health insurance on consumption patterns may or may not be transitory enrich debates on the aims of public policies that are primarily directed toward access to needed care. The main assumption of the pent-up demand theory is that a strong, immediate, and temporary increase in healthcare expenditures occurs directly after enrollment and that the effect of health insurance decreases over time. Keeler *et al*. (1982) found relatively little evidence of a decrease in medical treatment after one year of enrollment, whereas Zweifel and Manning (2000) showed that dental care consumption decreases from the first to the second year of enrollment for individuals who experience an increase in medical coverage. These studies did not consider the dynamics of health care before subscribing, while the pent-up demand theory also assumes that newly insured individuals may have either postponed or avoided healthcare consumption immediately prior to obtaining a new plan. Even if empirical studies have failed to provide strong evidence of such postponing behavior (Long *et al*., 1998), Zweifel and Manning (2000) and Chandra *et al*. (2010) showed that insured individuals increase their healthcare consumption directly before a decrease in the level of health insurance coverage.

In France, healthcare expenditures are funded by a dual system of health insurance that comprises a universal PHI, which is compulsory and uniform for all individuals living legally in the territory, and a complementary voluntary health insurance system (CHI) that is provided through mutual organizations and private insurers. PHI only funds a percentage of the official healthcare expenditures, and this percentage varies depending on the type of treatment received and from whom. For instance, PHI normally pays for approximately 70% of official GP fees and 65% of prescribed medicines. Coinsurance rates, which are applied to all health services and drugs in the PHI benefits package, are often fully compensated by CHI, except for noncompliance with gatekeeping penalties[1] and nonrefundable fees.[2] In addition to these copayment rates, doctors and dentists may be allowed to charge extra fees—that is, to charge higher prices than the official fees—and these extra-billed amounts may or may not be covered by CHI (Buchmueller and Couffinhal, 2004). The sum of copayments and extra fees may be high, particularly for dental and optical care (Franc and Pierre, 2015). In France, CHI does not allow one to jump a queue for treatment, but it typically reimburses these copayments. CHI premiums, which are paid in addition to PHI contributions, depend on the insured's age and level of the coverage but do not typically consider the insured's state of health (particularly for *mutuelles* and nonprofit insurers).[3] Although CHI is not compulsory, more than 90% of individuals who were eligible for PHI in 2005 subscribed to a CHI plan (Dourgnon *et al*., 2012). Despite the heterogeneity of the coverage provided by CHI

[1]The French gatekeeping pathway was implemented in 2006 to encourage individuals from sixteen to choose a physician in charge to carry out primary care and refer to specialist care (Dourgnon *et al*., 2009). Direct access to specialist is not forbidden. However, to encourage compliance with the gatekeeping pathway, a CHI plan must not reimburse price increases related to noncompliance with the gatekeeping pathway to benefit from fiscal reductions.

[2]Independently of copayments that are potentially compensated by private insurers, 1€ (US$1.38) per consultation and 0.5€/US$0.69 per drug box have been nonrefundable since 2004; since 2008, all of these non-refundable copayments apply up to an annual ceiling of €100 (US$138).

[3]Insurers are not allowed to increase premiums because of a subscriber's poor state of health. When reviewing the premiums (each year), an insurer must apply a uniform increase/decrease to all clients on the same basis.

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plans (Garnero and Le Palud, 2013), most French studies have analyzed moral hazard by focusing on whether subscribers benefit from a CHI contract.

In this paper, we study the content of the CHI contract effect by using an original dataset to analyze the existence and persistence of moral hazard over time. For the first time in the French health insurance context, we analyze the effects that an extra complementary health insurance (ECHI) contract provided by a private health insurer (*mutuelle*), in addition to the uniform and compulsory PHI and the basic complementary health insurance (BCHI) provided by this *mutuelle*, has on outpatient care utilization. While pent-up demand theory has mainly been measured in the USA after a change in the insurance coverage, we explore whether this is still relevant in the specific context of an extra complementary plan. By taking advantage of the introduction of ECHI, we study the short-term and long-term effects of an increase in health insurance coverage before and after enrollment using panel data.

To understand the manner in which healthcare expenditures are modified, we study the influence of an increase in insurance on all of the three dimensions of healthcare expenditures: (1) Do those insured by ECHI exhibit an increased probability of utilizing health care? (2) Do the ECHI insured increase their number of uses conditional on use? (3) Do the ECHI insured purchase more expensive care? To conduct this study, we control to the extent possible, for endogeneity because of adverse selection using the characteristics of our panel data.

Our study highlights a positive and significant effect of ECHI on healthcare consumption particularly on the probability of using care. More interestingly, our results demonstrate that these effects are transitory, particularly for the probability of using dental and optical care. In terms of the other two dimensions of consumption, number of uses, and cost per use, results vary depending on the type of care. To discuss the effects of ECHI overtime on healthcare consumption and in particular on the probability of using care in terms of moral hazard and or of access to previously unaffordable care, we compute our estimations of the effects of ECHI based on income level by roughly defining two subpopulations by median income.

This paper is organized as follows. In the second section, we present the data and the context. In the extensive third section, we present the economic model and the different residual assumptions that must be defined to ensure that adverse selection is controlled to the extent possible. The fourth section presents the results. In the final section, we discuss the results and conclude.

2. DATA

2.1. Context of the dataset

The dataset originates from the administrative records of a nonprofit *mutuelle* that insures civil servants and their relatives. This *mutuelle* manages both PHI and CHI. Until July 2003, this *mutuelle* only offered one uniform and BCHI contract, to which all of the civil servant households in our dataset subscribed. Since July 2003, in addition to BCHI, a voluntary ECHI contract has been offered on a voluntary and individual basis[4] without a specific underwriting process.

We provide a description of reimbursements offered by PHI, BCHI, and ECHI in the table presented as Supporting Information. The additional coverage provided by ECHI mainly concerns physicians' extra fees and copayments for dental and optical care.[5] The ECHI plan was community-rated, and the premium was set at 11€ per individual per month (with no charge for additional children beyond two) and remained unchanged during our observation period. Subscribing to ECHI had no effect on the BCHI contract, including the premium.

[4]Any BCHI enrollee has the opportunity to individually (within a household) purchase ECHI.

[5]For physician care, PHI + BCHI reimburse the regulated price (23€) and ECHI up to 7€ in case of extra fees, for dental prosthesis, PHI + BCHI reimburse 226€ and ECHI up to 113€. Finally, for the most common complex eyeglasses, PHI + BCHI reimburse 100€ and ECHI provides a maximal additional compensation of 92€.

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During the six months preceding the ECHI offer, an informational campaign was launched to spread awareness among the BCHI insured. Beginning in July 2003, any BCHI beneficiary could subscribe individually to ECHI whenever and for the period of time they wished. In our dataset, all of the ECHI insureds retained this additional contract until the end of the observation period (end of 2005).[6]

2.2. Sample and dataset

We analyze a sample of both PHI and BCHI beneficiaries that includes 154 703 individuals, corresponding to 101 000 BCHI contracts, covering households whose sizes did not change over the period (our population had been extracted by the *mutuelle* to build a balanced panel).

We observe all individuals for 10 semesters, from January 2001 to December 2005. By the end of our observation period (5 semesters after ECHI implementation), 20% of our population subscribed to the ECHI plan; among them, 42% enrolled immediately (during the first semester), and these subscribers are labeled 'first enrollees'. The remaining 58% of enrollees, labeled 'late enrollees', subscribed to ECHI at a decreasing rate: 23% enrolled during the second semester (first semester of 2004), 13% enrolled during the second half of 2004, 11% enrolled during the first semester of 2005, and 10% enrolled during the last semester of 2005. No subscribers gave up their ECHI plan during the observation period.

The dataset includes many individual sociodemographic characteristics that are known to influence health insurance demand, such as age, gender, labor market status, residence, insured status, and a proxy for income that corresponds to the national index that is used to calculate civil servants' incomes.[7] These characteristics are known for December 2005, and we assume that they did not change from January 2001 (except for age). This assumption could be challenged with respect to income, but a study conducted by the French National Institute for Statistics revealed that the average annual increase in income for this category of civil servants was only approximately +0.9% between 2002 and 2006 (Amar and Gombault, 2009). The dataset also provides detailed information on individual outpatient healthcare expenses from 2001 to 2005, including the date of utilization, the type of care (physician care, dental care, prescription drugs, and optical care),[8] and the entire cost of care that was partly reimbursed by PHI, BCHI, and eventually by ECHI. Tables Ia and Ib present the sociodemographic characteristics and healthcare consumption of our sample.[9]

3. ECONOMIC MODEL AND METHODS

3.1. The assumptions of pent-up demand

The pent-up demand theory assumes that the effect of health insurance on health expenditures does not remain constant over time. Long *et al*. (1998) argued that an increase in insurance coverage may have two types of consequences: 'postponing behavior' prior to enrollment and 'catching-up behavior' immediately after enrollment. Postponing behavior immediately prior to subscribing to health insurance results from an economic tradeoff: anticipating a future increase in health insurance coverage, individuals temporarily postpone nonurgent treatments to benefit from higher reimbursements. This short-term postponing

[6]In early 2006, due to the financial success of the ECHI contract, the *mutuelle* decided to adjust it to provide two different additional contracts.

[7]This index depends on civil servants' status; the base wage of any type of civil servants is obtained by multiplying the index by the value of one point of the index (53.9€ in December 2005).

[8]We focus on outpatient care and exclude hospital care data, which may be incomplete (several services provided during hospitalization are not reported in the *mutuelle* patients' files).

[9]We provide similar characteristics for late enrollees by semester of enrolment in the table as Supporting Information.

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Table Ia. Sample demographic characteristics in 2005

	Full sample	Not covered by the ECHI	Covered by the ECHI, overall	First enrollees	Late enrollees
Number of observations	154 703	123 156	31 547	22 924	8623
In %	*100%*	*79.6%*	*20.4%*	*14.8%*	*5.6%*
Age	49.6	48.1	55.6	58.7	47.2
gender					
Man	62.4%	62.4%	59.1%	59.3%	58.7%
Woman	38.2%	37.6%	40.9%	40.7%	41.3%
Wage index brackets (*in points*)					
<=1350€	6.3%	6.2%	7.0%	6.2%	9.1%
From 1350€ to 1790€	58.2%	59.5%	52.9%	52.3%	54.6%
From 1790€ to 2240€	20.0%	19.4%	22.4%	23.1%	20.6%
From 2240€ to 3110€	10.1%	9.9%	11.2%	11.5%	10.4%
>3110€	5.1%	4.8%	6.4%	6.9%	5.2%
Administrative situation					
Active	40.0%	39%	44.1%	38.6%	58.8%
Retired	31.3%	29.6%	37.9%	44.5%	20.4%
Student	1.4%	1.5%	0.9%	0.4%	2.1%
No professional activity	27.0%	29.6%	17.0%	16.4%	18.6%
Family situation					
CHI policyholder	65.3%	62.5%	76.2%	76.6%	75.0%
Spouse	15.3%	15.2%	15.8%	17.0%	12.5%
Child	19.2%	22.1%	8.1%	6.4%	12.5%
Number of pool CHI policies	101,080	77,785	23,295	17,119	6,176
Average number of beneficiaries per BCHI policy	1.53	1.58	1.35	1.34	1.40

Table Ib. Healthcare consumption of ECHI enrollees before and after subscription

	Covered by ECHI, overall		First enrollees		Late enrollees	
Average expenditure per semester (*in euros*)						
	Before	*After*	*Before*	*After*	*Before*	*After*
Outpatient care	666 (1.26)	904 (1.47)	730 (1.41)	970 (1.59)	498 (0.87)	729 (1.17)
Physician care	99 (1.28)	109 (1.33)	106 (1.36)	114 (1.39)	82 (1.05)	97 (1.18)
Dental care	71 (1.19)	128 (2.14)	76 (1.27)	120 (2.03)	59 (1.00)	147 (2.44)
Drugs	254 (1.32)	307 (1.32)	284 (1.49)	340 (1.47)	171 (0.86)	220 (0.92)
Optical care	41 (1.40)	65 (1.89)	43 (1.45)	65 (1.89)	38 (1.26)	67 (1.90)
Number of observations	31 547		22 924		8623	

Reading grid: Terms into brackets correspond to ratio with people who never enrolled. For first enrollees, the healthcare expenditure reach 730€ on the period before enrolment and 970€ after enrolment. Compared with the probabilities of using outpatient care for people who never enrolled (on the same period), it is respectively higher by a factor 1.41 and 1.59.

behavior reflects an intertemporal substitution of healthcare consumption to take advantage of lower prices. The long-term postponing behavior may also exist prior to the announcement of an increase in insurance and is associated with unaffordable care (unaffordable prior to subscription). Finally, these effects contribute to a catching-up behavior, which results in a sharp increase in health expenditures immediately after the issuance of the insurance coverage that decreases over time, ultimately leaving only the consumption of care that was previously considered unaffordable prior the enrollment and/or long-term moral hazard (Figure 1).

In this paper, we examine the pent-up demand assumption to decompose the overall insurance effect over time into a short-term catching-up effect and a persistent change in healthcare expenditures. This persistent change can be explained by a long-term moral hazard and/or by access to previously unaffordable care. Because we are unable to perfectly distinguish between these two effects, we compute our estimations of the effects of ECHI based on income level. The assumption is that the poorest individuals have a lower willingness to pay for care and therefore are more likely to postpone medical uses. Our

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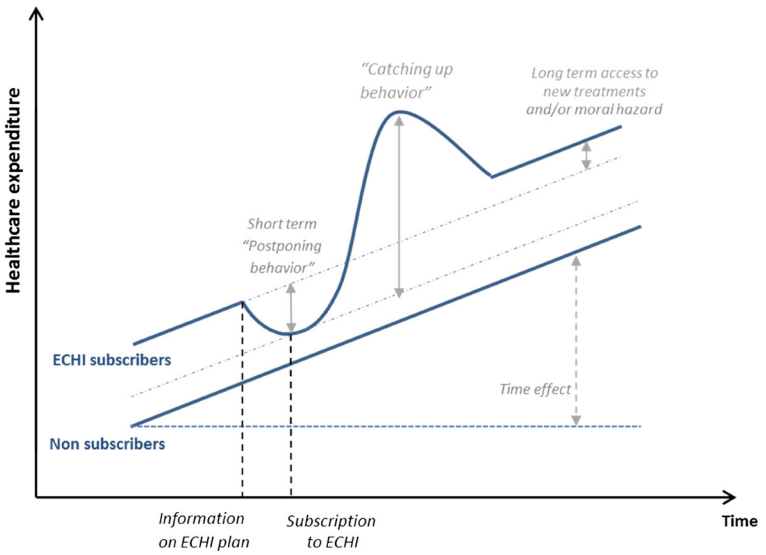

Figure 1. Variation of healthcare consumption according to the pent-up demand theory

decomposition of the consumption of health care into three dimensions and the analysis by type of care help us to discuss these effects.

3.2. Empirical strategy

3.2.1. Control for adverse selection. To measure the extent of the ECHI effects over time, we need to consider adverse selection bias. We extend our examination beyond the difference in healthcare consumption between subscribers and nonsubscribers to evaluate the ECHI effect because subscribers may have particular characteristics that could explain a higher level of healthcare consumption. In addition to conventional controls, like a common time trend and observable variables that are known to influence the demand for healthcare and insurance subscription, we use the richness of our panel dataset to account for adverse selection:

- First, we control for unobservable characteristics that remain constant over time between subscribers and nonsubscribers (such as risk aversion and the constant part of an individual's health status) by introducing a dummy variable that indicates whether an individual subscribed to ECHI over the observation period.
- Second, we take into account the fact that individuals who subscribed to ECHI might have, before the subscription, a different trend in healthcare consumption than nonsubscribers. For example, their health status may have deteriorated and their healthcare consumption may have increased faster than that of nonsubscribers. Thus, to measure postponing and moral hazard, our strategy consists of focusing on the subscribers' dynamics of healthcare consumption before and after enrollment: postponing is evaluated by considering the difference between the semester before the announcement of the ECHI plan and the semester of announcement of the ECHI plan; the immediate effect of ECHI (at the subscription) is evaluated by considering the evolution of healthcare consumption based on the trend before the subscription and its evolution during the semester of the subscription; catching-up is evaluated by considering the difference between the immediate ECHI effect and the evolution of healthcare consumption after the subscription.
- Third, we attempt to isolate potential biases from ECHI subscription that could occur because of unobservable variables that vary over time. Indeed, differences observed between healthcare consumption before and after subscribing could be the result of a health shock that can lead an individual to subscribe to

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ECHI and to consume more health care. Considering the date of ECHI subscription, one can assume that individuals who immediately subscribed (in July 2003) already needed to subscribe to it at the time of the announcement (in January 2003). For these individuals, we can observe the period of potential postponing behavior (the semester before ECHI implementation), and we can control for adverse selection by taking into account their consumption before the announcement of ECHI. By contrast, for later enrollees, we cannot observe the real period of potential postponing behavior, and one can assume that their enrollment stems from health shocks that occurred after the implementation of ECHI (July 2003). For these individuals, the effect of ECHI on healthcare consumption could be biased by adverse selection that we cannot control, and postponing seems to be less relevant because their care needs were not revealed at the announcement of the ECHI plan. Therefore, our strategy consists of studying the dynamics of healthcare consumption by distinguishing between the subscribers who enrolled in ECHI immediately (during the second semester of 2003) and those who enrolled later (between 2004 and 2005).

3.2.2. Notation and estimation strategy. To study precisely the effects of an increase in insurance coverage on healthcare consumption, healthcare consumption is divided into three dimensions:

$$E(exp) = p(use = 1) \times E(nbuse|use = 1) \times E(cost/unit)$$

Then, we tested for pent-up demand for outpatient care and for each type of care by studying the effects of ECHI using three models:

(1) the probability of using care: $p(use_{is} = 1)$,
(2) the conditional number of uses of care conditional on use: $E(nbuse_{is}|use_{is} = 1)$,
(3) the cost per use conditional on use: $E(ucost_{is})$,

where i ($i = 1,\ldots,N$) is the individual index and s ($s = 1,\ldots,10$) corresponds to a semester between January 2001 and December 2005.

Let sem_s be a time variable that captures the common trend of the temporal effect for subscribers and nonsubscribers.

Let $ECHI_i$ be a constant dummy variable over time that indicates whether individual i has subscribed to ECHI over the observation period.

For each ECHI subscriber, we define several dichotomous variables that correspond to the length of time before and after enrollment into ECHI, which individuals could subscribe to beginning in July 2003 (when $s = 6$). For instance, for an individual who subscribed in semester seven ($s = 7$), the length of enrollment will be three semesters at $s = 9$ ($L_{is}^{3} = 1$), four semesters at $s = 10$ ($L_{is}^{4} = 1$), and five semesters without ($L_{is}^{-5} = 1$).

$$L_{is} = \left(L_{is}^{-5},\ L_{is}^{-4},\ L_{is}^{-3},\ L_{is}^{-2},\ L_{is}^{-1}, L_{is}^{IECHI},\ L_{is}^{+1},\ L_{is}^{+2},\ L_{is}^{+3},\ L_{is}^{+4}\right)$$

Because our strategy consists of studying the dynamics of healthcare consumption by distinguishing between subscribers who immediately enrolled in ECHI (during the second semester of 2003, first enrollees denoted by L_{is}^{P}) and those who enrolled later (between 2004 and 2005, L_{is}^{L}), we define these dummy variables for each group of subscribers:

$$L_{is}^{I} = \left(L_{is}^{I-5},\ L_{is}^{I-4},\ L_{is}^{I-3},\ L_{is}^{P-2},\ L_{is}^{I-1}, L_{is}^{IECHI},\ L_{is}^{I+1},\ L_{is}^{I+2},\ L_{is}^{I+3},\ L_{is}^{I+4}\right)$$

$$L_{is}^{L} = \left(L_{is}^{L-9}, \ldots,\ L_{is}^{L-5},\ L_{is}^{L-4},\ L_{is}^{L-3},\ L_{is}^{L-2},\ L_{is}^{L-1}, L_{is}^{LECHI},\ L_{is}^{L+1},\ L_{is}^{L+2},\ L_{is}^{L+3}\right)^{10}$$

In each model, we introduce covariates that are linked to both health insurance demand and healthcare consumption: X_{is} represents a vector of age and age squared (for individual i at semester s); and Z_i represents a

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vector of individual fixed variables (gender, number of individuals within the same BCHI contract, wages of the subscribers to BCHI, labor market status,[10] and family situation and location).

For each model, (1), (2), and (3), we use random effect residuals that consider two levels of unobservable heterogeneity; the first refers only to individuals (v_i) and the second allows heterogeneity between individuals and semesters (ε_{is}).

Under all of these specifications, the three economic models are as follows:

Model (1) *the probability of using care*

$$\begin{aligned} use^*_{is} &= \alpha^1 + \gamma^1 X_{is} + \beta^1 Z_i + \lambda^1 ECHI_i + \delta^{1I} L^I_{is} + \delta^{1L} L^L_{is} + \eta^1 sem_s + v^1_i + \varepsilon^1_{is} \\ use_{is} &= 1 \quad \text{if} \quad use^*_{is} \geq 0 \\ use_{is} &= 0 \quad \text{if} \quad use^*_{is} < 0 \end{aligned}$$

Model (2) *the number of uses conditional on use*

$$nbuse_{is} = exp\left(\alpha^2 + \gamma^2 X_{is} + \beta^2 Z_i + \lambda^2 ECHI_i + \delta^{2I} L^I_{is} + \delta^{2L} L^L_{is} + \eta^2 sem_s + v^2_i + \varepsilon^2_{is}\right)$$

Model (3) *the cost per use*

$$ucost_{is} = exp\left(\alpha^3 + \gamma^3 X_{is} + \beta^3 Z_i + \lambda^3 ECHI_i + \delta^{3I} L^I_{is} + \delta^{3L} L^L_{is} + \eta^3 sem_s + v^3_i + \varepsilon^3_{is}\right)$$

Following all of these specifications, we assume that the vectors of residuals $\left(v^1_i, \varepsilon^1_{is}\right)$, $\left(v^2_i, \varepsilon^2_{is}\right)$ and $\left(v^3_i, \varepsilon^3_{is}\right)$ are independent in pairs. For instance, the decision to use care and the expenditures for a specific use is assumed to be independent. Thus, the equations can be estimated separately in a three-part model.[11]

We use the GEE method to estimate three-part models: this semiparametric method consists of minimizing the square of the generalized residuals (Liang and Zeger, 1986) and requires minimal assumptions.[12] For (1) (the probability of using care), we assume that $v^1_i + \varepsilon^1_{is}$ is normally distributed; for (2) and (3), we assume that f is exponential without making assumptions about v^2_i and ε^2_{is} and v^3_i and ε^3_{is}. Compared with parametric methods, GEE provides more robust but less efficient estimations.[13]

4. RESULTS

4.1. Effects of ECHI

As explained previously, we focus on the results for first enrollees for whom we correctly control for adverse selection. The effects of ECHI on the dimensions of healthcare consumption (1), (2), and (3) are presented in Table II.

[10]Employed, retired, unemployed, or student.

[11]Without this assumption, we would have had to use sample selection models that were adapted to the panel data (Wooldridge, 1995) and to identify independent variables to explain each equation separately.

[12]These residuals correspond to the differences between the explained variables and their expectancies conditional on the explanatory variables.

[13]We could have used a maximum-likelihood random effect model (RE-MLE) under stronger assumptions about the residuals. The GEE and RE-MLE methods provide similar estimations and standard errors, but RE-MLE method does not converge for all types of care in model (2). The results obtained using the RE-MLE methods are available upon request.

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4.1.1. The probability of using care. First, we show that the probability of using at least one type of outpatient care increases continuously over the previous semesters (from five semesters before to one semester before). This invalidates the short-term postponing behavior assumption. To test the robustness of our results, we also run all of our models using quarterly data, and the results still do not confirm a 'short-term postponing behavior'.[14] Second, we observe that the marginal effects increase much more sharply from the time of the subscription to ECHI and thus that there is an acceleration in the increase of the probability. For instance, the probability of using at least one type of outpatient care between the third and the second semesters before the ECHI subscription increases significantly by 0.54 points ($-0.8 + 1.34 = 0.54$), by 0.8 points between the second and the first semesters before the ECHI subscription and by 1.8 points during the semester of subscription. Third, we show that the marginal effects of ECHI appear to decrease significantly with the length of enrollment but remain highly significant throughout the four semesters, supporting the catching-up behavior assumption: +1.8 points during the semester of enrollment to +1.2 points during the second semester, +1.1 points during the third semester, and +0.1 points during the fourth semester (Table II). The probability of using at least one type of outpatient care during the fourth semester after ECHI subscription is no longer significantly different from the probability during the semester immediately prior to the subscription.

The analysis by type of care reveals that the magnitude and the persistence of the effects on the probability change significantly depending on the type of care. For physician care and drugs, there is no clear effect of ECHI. Even if the probability of consulting a physician is always higher after the subscription to ECHI than before, there is only a continuation of the previously observed trend (+0.88 points between the second and the first semester before the subscription and +0.90 points during the semester of subscription). The probability of using drugs follows a similar increasing trend before the subscription and tends to remain stable at a higher level after the subscription for three semesters, and finally, it significantly decreases at the end of our observation period (nonsignificantly different from the probability of using drugs directly before the subscription) (Figure 2).

By contrast, for dental and optical care for which ECHI provided important additional reimbursements, the effects are significantly higher during the first semester of enrollment and subsequently decrease from the second semester onward, which illustrating catching-up behavior. The probability of using dental care (optical care) increases by +4.27 points (+6.08 points) compared with the semester immediately prior to the subscription and then decreases by -1.54 points during the first semester immediately after subscription (-2.12 points) (Table II).

4.1.2. The number of uses conditional on use. The effect of ECHI on the number of uses of outpatient care conditional on use is positive, significant, and very high compared with the semester immediately prior to subscribing (+4.77% during the first semester), but it decreases significantly and very quickly during the second semester by 2.6% (4.77–2.22). There is no significant difference between the third and the second semesters.

With respect to the probability of using care, there is no clear effect of ECHI on the number of uses conditional on the use of physician care and drugs. Conversely, for dental and optical care, the impact of ECHI on the number of uses conditional on use is very high during the semester of subscription (+11.3% for dental care and +6.3 for optical care). The effect of ECHI on the optical care number of uses remains significantly higher than that observed prior to subscribing, whereas the effect on dental care is very transitory and appears to only last for two semesters. These findings illustrate the different patterns of consumption in the number of uses between optical care—a chronic need—and dental care (Figure 3).

[14]The results are available upon request.

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Table II. Effects of ECHI on healthcare consumption according to the length of enrollment

	(1) Probability of using			(2) Number of uses			(3) Cost per use		
	ME (points)	Pr (ME = 0)	Pr (ΔME = 0)	ME (%)	Pr (ME = 0)	Pr (ΔME = 0)	ME (%)	Pr (ME = 0)	Pr (ΔME = 0)
Outpatient care									
5 sem before	−2.27	***		−3.35	***		0.09	ns	
4 sem before	−1.80	***	ns	−0.87	ns	***	−0.90	ns	ns
3 sem before	−1.34	***	ns	−2.45	***	*	0.00	ns	ns
2 sem before	−0.80	**	*	0.71	ns	***	−1.17	*	*
1 sem before	*ref*	–	**	*ref*	–	ns	*ref*	–	*
ECHI subscription	1.80	***	***	4.77	***	***	10.85	***	***
1 sem after	1.54	***	ns	2.22	**	***	8.16	***	***
2 sem after	1.23	***	ns	1.81	*	ns	4.82	***	***
3 sem after	1.10	***	ns	0.37	ns	ns	6.19	***	*
4 sem after	0.14	ns	***	0.06	ns	ns	2.84	***	***
(*1*) (*2*) *and* (*3*) (*ref*)	*0.935*			*26.167*			*36.150*		
Physicians care									
5 sem before	−2.39	***		−2.13	***		0.19	ns	
4 sem before	−1.91	***	ns	−1.96	***	ns	0.48	*	ns
3 sem before	−1.51	***	ns	−1.55	*	ns	0.30	ns	ns
2 sem before	−0.88	**	*	−1.43	*	ns	0.05	ns	ns
1 sem before	*ref*	–	**	*ref*	–	*	*ref*	–	ns
ECHI subscription	0.90	**	**	0.45	ns	ns	0.88	***	***
1 sem after	1.59	***	*	−0.67	ns	ns	0.69	***	ns
2 sem after	0.58	ns	***	−1.07	ns	ns	0.30	ns	*
3 sem after	1.29	***	*	−1.10	ns	ns	0.30	ns	ns
4 sem after	0.21	ns	***	−3.53	***	***	−0.19	ns	**
(*1*) (*2*) *and* (*3*) (*ref*)	*0.881*			*5.221*			*24.491*		
Drugs									
5 sem before	−2.72	***		−3.00	***		−1.44	**	
4 sem before	−1.93	***	**	−0.38	ns	***	−1.32	**	ns
3 sem before	−1.74	***	ns	−1.44	*	ns	−0.75	ns	ns
2 sem before	−0.23	ns	***	1.30	*	***	0.14	ns	*
1 sem before	*ref*	–	ns	*ref*	–	*	*ref*	–	ns
ECHI subscription	0.87	**	**	0.98	ns	ns	−1.26	**	**
1 sem after	0.97	**	ns	1.77	**	ns	−1.04	*	ns
2 sem after	1.23	***	ns	2.03	***	ns	−0.06	ns	*
3 sem after	0.92	**	ns	0.07	ns	***	−0.52	ns	ns
4 sem after	0.05	ns	**	1.11	ns	ns	−1.01	ns	ns
(*1*) (*2*) *and* (*3*) (*ref*)	*0.882*			*11.158*			*27.959*		
Dental care									
5 sem before	−1.27	***		−3.44	**		3.64	ns	
4 sem before	−1.45	***	ns	−5.30	***	ns	1.69	ns	ns
3 sem before	−1.35	***	ns	−4.60	***	ns	0.44	ns	ns
2 sem before	−1.23	***	ns	−2.91	*	ns	0.86	ns	ns
1 sem before	*ref*	–	***	*ref*	–	*	*ref*	–	ns
ECHI subscription	4.27	***	***	11.29	***	***	26.62	***	***
1 sem after	2.73	***	***	5.04	***	***	26.62	***	ns
2 sem after	1.17	**	***	0.74	ns	***	18.89	***	***
3 sem after	1.28	***	ns	0.52	ns	ns	19.72	***	ns
4 sem after	0.13	ns	**	−1.74	ns	ns	13.66	***	**
(*1*) (*2*) *and* (*3*) (*ref*)	*0.290*			*2.371*			*116.368*		
Optical care									
5 sem before	1.05	***		−0.30	ns		−0.86	ns	
4 sem before	0.77	*	ns	0.62	ns	ns	−1.58	ns	ns
3 sem before	0.85	**	ns	−0.77	ns	ns	2.59	ns	*
2 sem before	0.37	ns	ns	1.33	ns	ns	2.96	ns	ns
1 sem before	*ref*	–	ns	*ref*	–	ns	*ref*	–	ns
ECHI subscription	6.08	***	***	6.25	***	***	11.52	***	***

(*Continues*)

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Table II. (Continued)

	(1) Probability of using			(2) Number of uses			(3) Cost per use		
	ME (points)	Pr (ME = 0)	Pr (ΔME = 0)	ME (%)	Pr (ME = 0)	Pr (ΔME = 0)	ME (%)	Pr (ME = 0)	Pr (ΔME = 0)
1 sem after	3.96	***	***	5.41	***	ns	10.14	***	ns
2 sem after	1.98	***	***	4.08	***	ns	9.88	***	ns
3 sem after	2.82	***	*	3.70	***	ns	9.68	***	ns
4 sem after	1.52	***	***	3.26	**	ns	6.07	***	*
(*1*) (*2*) *and* (*3*) (*ref*)	*0.126*	***		*2.317*			*161.962*		

Reading Grid: For any of the three models (1), (2) and (3): 1/The first column presents the marginal effects (ME) of ECHI expressed in percentage points for (1) and as a percentage for (2) and (3). 2/The second column indicates the significance of the ME. 3/The third column indicates the significance of the marginal effect of ECHI for a semester compared with the previous semester; for instance, the probability of using outpatient care between the third and the second (respectively, the second and the first) semesters before the ECHI subscription; increased significantly from +0.54 points [(−0.8–(−1.34)] at 5% (respectively, +0.8 at 1%).
***Significant at the 0.1% level;**Significant at the 1% level;*Significant at the 5% level.

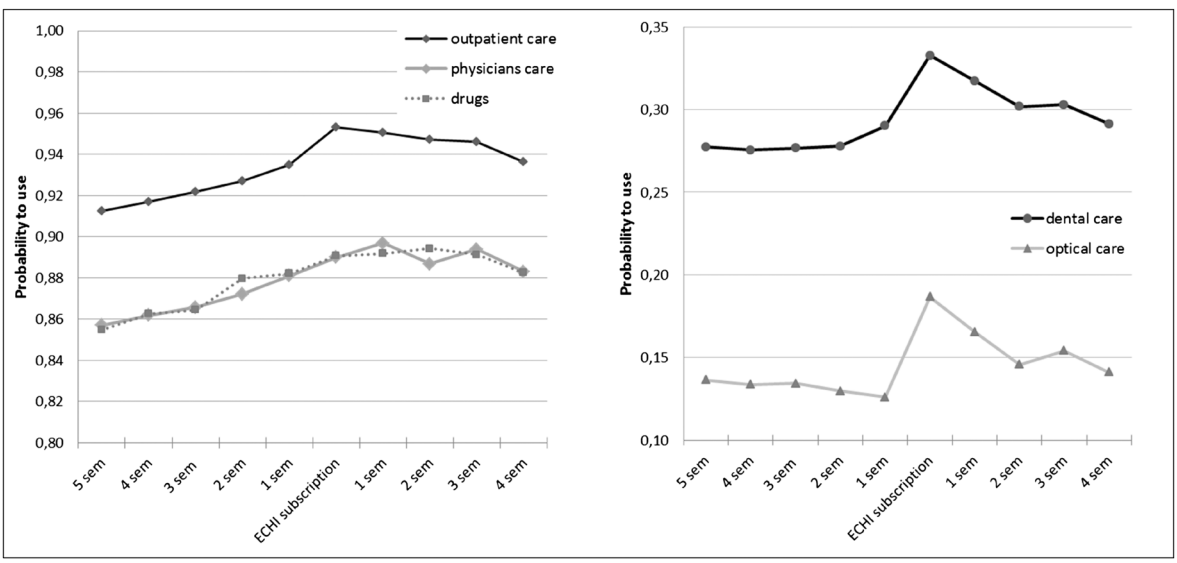

Figure 2. Variation of the probability to use health care over time

4.1.3. The cost per use conditional on use. ECHI significantly affects the cost per outpatient care treatment, particularly during the two first semesters (+10.8% and +8.2%), and the effect remains positive and significant over the three following semesters even if ECHI effect vanishes at the end of the observation period (Figure 4). The effect of ECHI on the cost per use is primarily driven by its effects on dental and optical care. For dental care, ECHI significantly increases the cost per unit compared with the semester before subscription (+26.6% for the first semester and the second semester). This increase remains very high, although the cost seems to decrease at the very end of our observation period. Similarly, the cost per unit for optical care increases by nearly 12% after ECHI subscription, and this increase slows down by half after four semesters to reach +6% compared with the cost during the semester before ECHI subscription (Figure 4).

4.2. Effects of other covariates

The main covariate effects are as expected, and the table of these effects is provided in Table S3 in the Supporting Information.

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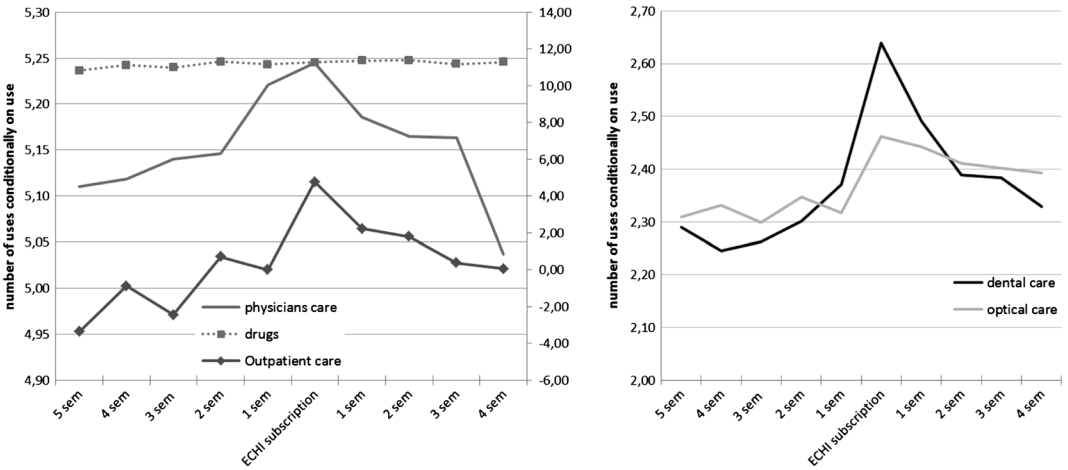

Figure 3. Variation of the number of uses conditionally on use over time

Age has a significant standard effect on the probability of using care, the number of uses, and the cost per use. Similarly, gender also has an expected effect, whereby being a woman significantly increases the probability of using care, regardless of the type of care. However, the gender effect on the number of uses and the cost per use varies according to the type of care.

The probability of using at least one type of outpatient care varies with income following an inverse U shape; compared with the poorest individuals in the population (<1,350€ per month), the probability of using care is significantly higher for all the rest of the population: for those in the second income bracket by 5.1 points, in the fourth income bracket by 3 points and by 2.6 points for those in the highest income bracket.

An inverse U shape is also observed for the number of uses conditional on use for outpatient care, physician care, and drugs. Note that income has no significant effect on the number of uses conditional on use for dental and optical care. Particularly, for these types of care, the probability of using care is increasing with income. While for optical care and physician care, the cost per use increases with income; it decreases with income for drugs and dental care.

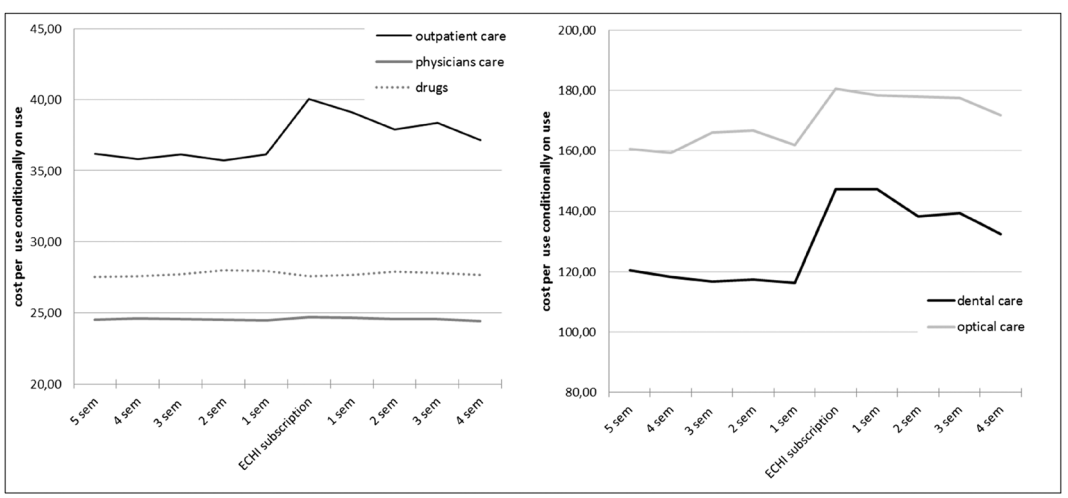

Figure 4. Variation of the cost per use conditionally on use over time

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4.3. Further analysis: the effects of ECHI based on income level

Beyond the measurement of the magnitude and persistence of the ECHI effects on healthcare consumption, it is important to better understand the nature of the effects (moral hazard and or access to previously unaffordable care) because their implications in terms of equity are different. The strong positive effect on the probability of using care observed immediately after subscription to ECHI among first enrollees (Section 4.1) is consistent with catching-up behavior. Thus, we reasonably assumed that a portion of subscribers consumed health care that they could not afford before enrollment. To investigate this hypothesis, we estimate the effects of ECHI depending on the level of income by adding an interaction variable between the ECHI dummy and the wage index bracket. This approach is based on the fact that low-income people have a lower willingness to pay for health care and thus should be more prone to have postponed such consumption. Because of the high concentration of our sample in two intermediate income brackets (Table Ia), we consider two groups of quite similar size: the first group includes individuals whose income is lower than 1790€ per month (as close as possible to the median income) and the second group includes individuals with higher income. We compute the estimations of the ECHI effects based on income level for the probability of using care (1),[15] the model for which the pent-up demand assumption is particularly relevant. Table III presents the results for the two subpopulations.

We show that lower income is associated with both a higher effect of ECHI directly after enrolment (+1.26 points) and a more persistent effect during the following semesters. Focusing on the different types of care, we observe that the effect of ECHI on the probability of using physician care follows the same pattern. Similar tendencies are observed for drugs and dental care, but the gaps between the two subpopulations are relatively small and sometimes insignificant. In contrast, for optical care, the differences in the effect according to income are small and not significant, although the effect itself is very high for the two subpopulations.

Thus, our results suggest that ECHI has improved access to healthcare in particular to physician care for low-income individuals and that, in terms of dental and optical care, ECHI did not close the gap between low- and high-income individuals.

5. DISCUSSION

In this paper, we estimate the marginal effect of additional health insurance coverage on healthcare consumption. More interestingly, we examine the dynamics of moral hazard over a five-year period by analyzing the evolution of the consumption of outpatient care prior to and after enrollment and by separating healthcare consumption into three dimensions: the probability of using care, the number of uses conditional on use, and the cost per use. This decomposition allows us to finally understand what types of structural changes in care consumption are observed. The marginal effect of insurance is particularly relevant in France, where public insurance is universal but leaves copayments and where more than 90% of individuals have purchased a complementary health insurance contract in a very heterogeneous market.

Our paper presents several findings. First, we highlight that ECHI has an immediate and positive effect on the three dimensions of outpatient care consumption for nearly all types of care, the magnitude of which varies strongly depending on the type of care. Second, as in Long *et al*. (1998), our results do not confirm the short-term postponing behavior assumption despite the ECHI's promotion campaign during the first semester of 2003. Third, our analyses indicate that although health insurance has a positive effect on outpatient consumption, this effect significantly decreases over time, thus supporting the catching-up behavior assumption (Long *et al*., 1998).

[15]The results for models (2) and (3), which both imply analyses conditional on using care, are nonsignificant.

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Table III. Comparison of ECHI effects on the probability of using between low and high and income

	(1) Probability of using					
	MElow (points)	Pr (MElow = 0)	MEhigh (points)	Pr (MEhigh = 0)	(ΔME = 0)	Sign ΔME
Outpatient care	*p(ref) = 0.932*		*p(ref) = 0.939*			
5 sem before	−2.44	***	−1.97	***	−0.47	ns
4 sem before	−1.74	***	−1.84	***	0.10	ns
3 sem before	−1.45	***	−1.16	**	−0.29	ns
2 sem before	−0.82	*	−0.73	ns	−0.09	ns
1 sem before			*ref*			
ECHI subscription	2.32	***	1.06	**	1.26	**
1 sem after	2.06	***	0.72	ns	1.34	**
2 sem after	1.85	***	0.3	ns	1.55	**
3 sem after	1.64	***	0.29	ns	1.35	*
4 sem after	0.69	ns	−0.71	ns	1.40	*
Physicians care	*p(ref) = 0.880*		*p(ref) = 0.882*			
5 sem before	−2.69	***	−1.94	***	−0.75	ns
4 sem before	−1.85	***	−1.98	***	0.13	ns
3 sem before	−1.46	***	−1.56	**	0.10	ns
2 sem before	−0.79	ns	−1.05	*	0.26	ns
1 sem before			*ref*			
ECHI subscription	1.53	***	−0.04	ns	1.57	*
1 sem after	2.13	***	0.78	ns	1.35	*
2 sem after	1.41	***	−0.75	ns	2.16	***
3 sem after	1.69	***	0.68	ns	1.01	ns
4 sem after	0.75	ns	−0.62	ns	1.38	ns
Drugs	*p(ref) = 0.268*		*p(ref) = 0.319*			
5 sem before	−2.89	***	−2.36	***	0.16	ns
4 sem before	−1.76	***	−2.00	***	1.10	ns
3 sem before	−1.65	***	−1.81	***	0.35	ns
2 sem before	−0.1	ns	−0.41	ns	0.27	ns
1 sem before			*ref*			
ECHI subscription	1.30	***	0.31	ns	1.03	ns
1 sem after	1.38	***	0.43	ns	1.06	ns
2 sem after	2.09	***	0.01	ns	1.85	**
3 sem after	1.85	***	−0.33	ns	2.16	***
4 sem after	0.68	ns	−0.87	ns	1.06	*
Dental care	*p(ref) = 0.885*		*p(ref) = 0.878*			
5 sem before	−1.46	**	−0.95	ns	−0.51	ns
4 sem before	−1.61	***	−1.11	ns	−0.50	ns
3 sem before	−1.34	**	−1.42	*	0.08	ns
2 sem before	−1.22	*	−1.16	*	−0.06	ns
1 sem before			*ref*			
ECHI subscription	4.81	***	3.62	***	1.19	ns
1 sem after	3.15	***	2.15	***	1.00	ns
2 sem after	1.95	***	0.18	ns	1.77	*
3 sem after	1.40	**	0.98	ns	0.42	ns
4 sem after	0.65	ns	−0.44	ns	1.08	ns
Optical care	*p(ref) = 0.120*		*p(ref) = 0.133*			
5 sem before	0.88	*	1.24	*	−0.36	ns
4 sem before	1.15	**	0.25	ns	0.90	ns
3 sem before	0.62	ns	1.16	*	−0.54	ns
2 sem before	−0.02	ns	0.91	ns	−0.93	ns
1 sem before			*ref*			
ECHI subscription	5.88	***	6.41	***	−0.53	ns
1 sem after	3.83	***	4.16	***	−0.33	ns
2 sem after	1.83	***	2.25	***	−0.42	ns
3 sem after	2.47	***	3.35	***	−0.88	ns
4 sem after	1.66	***	1.47	**	0.19	ns

Reading Grid: 1/The first column presents the ME of ECHI compared with the consumption during the semester immediately preceding the ECHI subscription for low income (≤1790€), and the second column indicates the significance of the ME. 2/The third column presents the marginal effects (ME) of ECHI compared with the consumption during the semester immediately preceding the ECHI subscription for low income (>1790€), and the fourth column indicates the significance of the ME. 3/The fifth column named (ΔME = 0) indicates the gap estimated between the two populations estimated of the marginal effect of ECHI, and the last column presents the significance of the difference.

***Significant at the 0.1% level;**Significant at the 1% level;*Significant at the 5% level.

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Note that the catching-up effect is particularly relevant for the probability of using optical and dental care. For these types of care, ECHI also strongly and positively influences the number of uses and the cost per use conditional on use. The magnitude of all of these effects reflects the high copayments that often remain after reimbursements from both public and complementary health insurance. For physician care, although ECHI has no impact on the probability of using care and the number of uses, the cost per use is significantly higher after subscription. This effect may be because of switching behavior: in benefiting from higher reimbursements for doctors' extra fees, individuals may have decided to consult specialists (who more often charge extra fees) rather than GPs.

Even if the catching-up effect has been emphasized for some types of care, we show that the level of consumption at the end of the period does not generally reach the level that would have resulted from the initial trend (the trend observed before subscription). Thus, once the catching-up behavior has been exhausted, the remaining effect should correspond to long-term access to new treatments and/or moral hazard. Indeed, the increase in insurance coverage may permit sustainable access to previously unaffordable health care that could be associated with long-term postponing behavior. Second, by modifying the relative prices of goods, the increase in insurance coverage may favor the consumption of more expensive care either to improve quality (assuming that the price per unit is a proxy of the quality of dental prostheses, for instance) or to fit preferences for more expensive goods (optical frames). The analysis of the ECHI effects depending on income reinforces the idea that in the medium term, our findings are associated more with access to care than with moral hazard. Indeed, low-income individuals appear to benefit much more from ECHI in terms of access to care than high-income individuals. In particular, for low-income individuals, ECHI leads to a sharp and rather persistent increase in the probability of using physician care, while the effect of ECHI on the probability for rich individuals is nonsignificant. Finally, the remaining effect could also be explained by the length of our observation period, which may be too short to observe the convergence of ECHI healthcare consumption on the consumption trend that began before subscription and to take into account the seasonality of some expenses.

Our research remains limited in some respects. Using the richness of our panel data and excluding late subscribers, we paid careful attention to controlling any bias associated with the ECHI effect caused by adverse selection. Indeed, for late enrollees, unobservable health shocks may have occurred, and we cannot rigorously define the length of the potential postponing period. However, it is also possible that they delayed their subscription for reasons that did not bias the ECHI effect.[16]

Otherwise some unobservable effects may have increased households' income despite the stability and predictability of civil servants' income; indeed, note that the proxy we use only concerns the civil servant in the household. By testing our models on individuals under 55 years old in 2005 only (that is, individuals who could not retire during the period of observation), we observe that the ECHI and income effects are very close to those obtained for the overall population.

Another limitation of our study concerns the observed population (i.e., civil servants and their relatives), which is not perfectly representative of the general population, primarily in terms of gender and age. However, these characteristics should not significantly affect the estimations and the trends in the results because there is no reason to believe that the observed population would exhibit a particular type of behavior in terms of healthcare consumption from ECHI enrollment. Moreover, our dataset does not allow us to identify individuals from the same household, which prevents us from examining subscriptions to ECHI plans at the household level, even though the decisions could be made jointly (adults with children and/or spouses). Computing regressions on the total sample including spouse and children in addition to policyholders may be debatable because of the intrahouseholds correlation and the decision process for subscribing to ECHI that could be different for children and for adults. We thus ran regression with policyholders only and found similar results.[17]

[16]Running all of our models, we observed no positive trend before subscription and the effects of ECHI appear to be much higher than for first enrollees (particularly for dental care). The results are available upon request.
[17]The results are available upon request.

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Finally, we observe the effect of a shift from one specific health insurance plan to another over time, and we demonstrate that an increase in health insurance coverage has transitory positive and significant effects on access to some type of care, such as dental and optical care and physician care. To proceed further, future research could analyze the effect of any shift in insurance coverage to precisely estimate price elasticities per type of care. This study highlights the importance of considering the dynamics of the consumption of care over a sufficiently long period prior to and after any increase in health insurance coverage to assess the issue of moral hazard.

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