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# Subscribing to Supplemental Health Insurance in France: A Dynamic Analysis of Adverse Selection

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## Abstract

Adverse selection, which is well described in the theoretical literature on insurance, remains relatively difficult to study empirically. The traditional approach, which focuses on the binary decision of “covered” or “not”, potentially misses the main effects because heterogeneity may be very high among the insured. In the French context, which is characterized by universal but incomplete public health insurance (PHI), we study the determinants of the decision to subscribe to supplemental health insurance (SHI) in addition to complementary health insurance (CHI). This work permits to analyze health insurance demand at the margin. Using a panelized dataset, we study the effects of both individual state of health, which is measured by age and previous individual health spending, and timing on the decision to subscribe. One striking result is the changing role of health risk over time, illustrating that adverse selection occurs immediately after the introduction of SHI. After the initial period, the effects of health risks (such as doctors’ previous health expenditures) diminish over time and financial risks (such as dental and optical expenses and income) remain significant. These results may highlight the inconsistent effects of health risks on the demand for insurance and the challenges of studying adverse selection.

**Keywords:** Supplemental health insurance, adverse selection, health insurance demand, longitudinal analysis.

**Codes JEL:** C23, D82, G22, I11.

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## Résumé

### **Souscrire une assurance complémentaire en France : une analyse dynamique de la sélection adverse**

La sélection adverse est décrite de manière détaillée dans la littérature théorique sur l'assurance mais reste assez difficile à analyser d'un point de vue empirique. L'approche traditionnelle consiste à se focaliser sur le choix d'être couvert ou non couvert. Cependant, en ignorant l'hétérogénéité potentiellement forte au sein des assurés, cette approche peut éluder l'essentiel de la sélection adverse. Dans le contexte français, qui est caractérisé par l'existence d'une couverture assurantielle publique (PHI) universelle mais incomplète, nous étudions les déterminants de la décision de souscrire une surcomplémentaire santé (SHI) complétant les remboursements d'un contrat de couverture complémentaire santé de base (CHI). Ce travail permet ainsi d'analyser la demande d'assurance à la marge. En utilisant des données panélistées, nous étudions l'effet de l'état de santé, mesuré par l'âge et par les dépenses de santé passées, et du temps dans la décision de souscrire la surcomplémentaire. Un résultat important est l'évolution au cours du temps du rôle du risque santé dans la décision de souscription, illustrant le fait que la sélection adverse survient immédiatement après l'introduction de la surcomplémentaire. Après la période de souscription, l'effet des variables de risque santé (telles que les dépenses passées en soins de médecins) diminuent au cours du temps alors que les variables de risque financier (telles que les dépenses en optique et en dentaire et le revenu) restent significatives. Ces résultats mettent en lumière l'instabilité de l'effet du risque santé sur la demande d'assurance et donc le défi que représente l'analyse de la sélection adverse.

**Mots-clés :** Surcomplémentaire santé, sélection adverse, demande d'assurance santé, analyse longitudinale.

**Codes JEL :** C23, D82, G22, I11.

## 1. Introduction

### French health insurance system

In France, the range of medical products and services covered by public health insurance (PHI) has always been very broad. However, there are copayments for any given service. Most statutory public copayments are computed as a percentage of the official tariff negotiated between PHI and the providers (for instance, 30% for outpatient visits, and 65% for “convenience drugs”). Another source of patients’ out-of-pocket payments is the difference between the actual market price of a service and the official negotiated tariff (Buchmueller and Couffinhal 2004). This difference may be particularly high for some medical products (dental prostheses, eyewear), and for the services of some physicians who are allowed to charge patients more than the ceiling price and PHI does not reimburse the statutory fee for hospitalization (18€ *per diem* in 2010).

Because public coverage is incomplete, more than 90% of citizens purchase complementary health insurance (CHI). The private contracts cover at least the copayments on the ceiling price and statutory fees for hospitalization and depending on the contract, private insurance may also provide reimbursements for over-billings for eyewear, dental prostheses and physician care. Although in France, additional private insurance is not typically purchased to avoid public sector queues or for direct access to specific providers (as in countries such as Switzerland and the UK), private insurance plays an expanding role in financial access to healthcare. Indeed, the PHI’s share in healthcare funding has decreased significantly in recent decades mainly for outpatient care. Meanwhile, the proportion of healthcare financed by private insurance increased to 13.7% in 2008, and proportion of individuals with private insurance experienced a sharp increase from 70% in the early 1980s to 88% in 2008. In addition, 6% of individuals receive public complementary health insurance (CMUC, see Figure 1). Today, about half of the population obtains private health insurance through employers while the other half voluntarily purchases individual insurance. Employer-provided contracts are community rated, so there is a perfect pooling between employees. In the individual market, insurers use several strategies to mitigate adverse selection. First, the premiums of most of contracts are age-adjusted, though health status is rarely taken into account (health questionnaires are usually prohibited for contracts that offer health guarantees). Moreover, insurers generally offer several levels of coverage, some of which impose an upper age limit<sup>1</sup>. A few non-profit “*mutuelles*” also provide a community rating contract and to attract low risk and avoid negative adverse selection. Finally, some other non-profit “*mutuelles*,” particularly those insuring civil servants, price the contracts in relation to the income of their beneficiaries.

### Theoretical and empirical background on adverse selection

A number of theoretical papers have analyzed health insurance demand and how it is affected by information asymmetries (Rothschild and Stiglitz 1976, Arrow 1963). If insurers shared the same information as the insured about health and financial risks, they could charge a fair premium and people would opt for full coverage. Nevertheless, unlike the case of perfect competition, the insurer does not know the risk class of an

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1 A tax of 7% of the price of the contract incites insurers not to rate the contracts depending on individual health status.

individual or the treatment cost the individual is able to experiment. The first situation is problematic in the case of purely private voluntary insurance because it leads to adverse selection where insurers may apply a uniform premium that deters low risk to maintain coverage. This will result in a loss of utility to the non-insured, the non-fully-insured (assuming risk aversion), and to the insurer in comparison with a situation of perfect competition where risks are observable by the insurer.

Chiappori *et al.* (2006) raised a crucial question for health insurance: is there evidence of relevant information asymmetries on risk? According to Arrow (1963), risk-averse individuals purchase insurance to cover the various financial risks associated with health care services including those associated with an unforeseen deterioration in health status and those associated with known diminished health status. Although some health care needs (eye care services) may be easily predicted due to their persistence and regularity of expenses, uncertainty remains about other health care needs. Moreover, insurers do not typically have information about the frequency of health care utilization. Thus, the degree of information asymmetry may vary depending on the health services and the intensity of the adverse selection phenomenon is not straightforward.

In line with the theoretical results of Rothschild and Stiglitz (1976), individuals who voluntarily decide to purchase the most generous health insurance plans are typically found to have a higher-than-average health risk. Thus, there is a positive correlation between health risk and the level of health insurance coverage. Many studies have examined adverse selection in various countries. In their article on “*The Anatomy of Health Insurance*,” Cutler and Zeckhauser (2000) summarized the main findings for the US. Some authors showed that demand for insurance is very sensitive to health status and health care utilization. Ellis (1989) analyzed healthcare plan choice in a large firm and found that individuals who choose the highest coverage are older and have higher health costs than those who choose basic plans. Similarly, Altman *et al.* (1998) found that individuals with heavy health care utilization have a higher propensity to switch from an HMO to an indemnity plan.

Buchmueller and Feldstein (1997) and Cutler and Reber (1998), working, respectively, on the health plans of University of California and Harvard University employees, observed that the most generous options (PPOs) attracted only the sickest employees after employers decided to no longer compensate the price differential between plans.

However, individual health status does not appear as a significant and persistent factor in all studies. Ettner (1997) did not find a significant effect of health variables on the probability to purchase enhanced versus basic supplemental coverage (*Medigap*). Using semi-parametric analysis, Bajari *et al.* (2006) did not find significant differences in the latent self-assessed health distribution between the uninsured and various categories of the insured in the US (employer provided, individually purchased, and self employed). More recently, in a study of private complementary health insurance in Australia, Buchmueller *et al.* (2008) found a negative correlation between the predicted probability of hospitalization and the probability of purchasing private hospital insurance. In France, studies such as those of Buchmueller *et al.* (2004) and Albouy and Crépon (2008) rejected the assumption of adverse selection in the decision to purchase complementary health insurance.

Doiron *et al.* (2008) noted that two hypotheses have been advanced in the literature to justify the weakness or lack of the adverse selection effect. The first posits that insurers manage to favorably select customers, and the second argues that commonly-used measures of risk also capture variations in preferences, such as attitudes toward risk,

which may dominate the adverse selection effect. Doiron *et al.* (2008) and Buchmueller *et al.* (2008) provide results supporting the latter hypothesis. Moreover, as noted by Shokkaert *et al.* (2009), the institutional context plays a major role, particularly in terms of whether public health insurance is available so that private insurance only acts as a supplement, which is the case in France.

Moreover, most studies that examine adverse selection consider the binary individual situation, where “covered” or “not covered” describes the individual decision due to the difficulty of collecting precise data on coverage levels. This approach does not examine determinants of the decision at the margin and may not provide information about selection between contracts. This is especially the case in the French context, where analysis of the decision to be insured/uninsured in the French context may be limited because only 6% to 7% of the population is uncovered by CHI. Thus, heterogeneity between covered individuals is much higher than between covered and uncovered individuals. Following the study of Shokkaert *et al.* (2009)<sup>2</sup>, we examine the case of the choice to subscribe to supplemental health insurance (SHI) in addition to CHI and PHI starting from a situation where all insured are initially covered by PHI and a uniform CHI (see Figure 1). Through longitudinal analysis, we examine the determinants of the decision to purchase SHI and we study particularly the effects of past health care expenditures while controlling for a set of socio-demographic characteristics.

## 2. Data and methods

### Data context

To study adverse selection, we analyze the individual decision to buy SHI in addition to CHI, that was offered to the beneficiaries of a non-profit “*mutuelle*” (mainly civil servants and their relatives) from July 2003 to December 2005. Until mid-2003, the only offered contract was a pooling CHI with voluntary subscription. Individual premiums for the CHI depend on the civil servant salary alone. Any beneficiary of CHI had the opportunity to individually purchase SHI: within a household, only some of the individuals may decide to purchase SHI.

Table 1 presents the different additional reimbursements, respectively, provided by PHI, CHI and SHI. Compared to the French individual insurance market<sup>3</sup>, the CHI under study offered reimbursements for complex eyewear that were above the median but low reimbursements for basic eyewear and dental prostheses. As with the majority of individual contracts, the studied CHI did not reimburse extra-billing on physician’s fees. The copayments may limit adverse selection but also may not satisfy individuals with expensive health care or who are highly risk-averse.

The SHI plan was community rated: the premium was set at 11€ per individual per month (0€ for the third child and beyond) and remained unchanged from the introduction to its removal at the end of 2005.

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2 The authors studied the effects of supplemental insurance at the margin in Belgium, where the system is based on a compulsory public system as it is in France. However, the supplemental insurance mainly covers extra billings applied to patients who opt for an individual room in a hospital.

3 See Couffinhal and Perronnin (2004) and Arnould *et al.* (2007).

The introduction of the SHI plan enables us to analyze how individuals respond to a change in the offer at the margin regarding their health, their income and other characteristics known to influence the demand for insurance.

### Available data

The dataset used was extracted from an administrative file of all beneficiaries of the pooled CHI between 2001 and 2005 (2.5 years before and after the introduction of SHI). For each individual, the dataset provides the decision of whether to purchase SHI and, in the case of subscription, the date of underwriting. The dataset also provides a large number of individual socio-demographic characteristics: age, gender, administrative situation, residence, status of the insured (i.e. policyholder or eligible) and the CHI premium, which is determined from the policyholder's wage through the national wage index. This last variable provides a proxy of household financial resources. The administrative file also contains a dataset that provides detailed information about individual health care expenses from 2001 to 2005. For each expense, we observe the date of utilization, the type of care (doctors' fees, drugs, dental care, optical care, hospital care, etc.) and the entire cost of care that is reimbursed in part by PHI, CHI and SHI. The residual expenditure is borne by the user (copayment).

This panelized dataset is a rich source of information that allows us to study health insurance demand from a dynamic perspective (step by step) and enables us to test adverse selection effects on the health insurance market over time.

### Sample

Starting from a population of over 100,000 households living in the French metropolitan territory and representing over 150,000 individuals, we were able to generate a representative sample of our population containing 18,126 individuals<sup>4</sup>. Table 2 presents the main characteristics of the sample in 2005.

From July 2003 to December 2005, 20% of individuals subscribed to SHI: 73% subscribed in 2003, 19% in 2004 and 8% in 2005. Six months before the implementation of SHI, an information campaign was launched to educate CHI beneficiaries about SHI. This period enabled enrollees to calculate their marginal benefit of SHI. This may partly explain why most of the people who subscribed to SHI enrolled during the first semester. Furthermore, it is valid to assume that individuals who immediately enrolled are those with the best expectation of high expenditures or those who present a strong aversion to risk.

Women represent 36.6% of our sample, even though women are 52% of the French population. This difference is due to our population, which consists of civil servants working in equipment and land management. Nonetheless, women are overrepresented among the SHI enrollees (40.6% among SHI enrollees versus 36.6% among the sample). On average, individuals in the sample are 49.6 years old, and those who purchased SHI are much older than those who did not (56.3 yrs versus 47.7 yrs). Our sample is characterized by a high proportion of retired persons (31.2% versus 20% in the French population), and retired persons are also overrepresented among the SHI enrollees. Two-thirds of the individuals are CHI policyholders, 14.8% are spouses and 19.6% are children. This last category (children) is heavily underrepresented among SHI enrollees.

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<sup>4</sup> Details are available upon request.



The majority of individuals (57.8%) belong to households whose gross income (of the policyholder) is between 1350€ and 1790€ per month; this population is underrepresented among SHI enrollees, whereas higher wage index brackets are overrepresented. Interestingly, the lowest wage bracket (lower than 1350€ per month) is also overrepresented among SHI enrollees. On average, we count 1.52 insured individuals on each CHI contract (average household size), and this number is lower among SHI enrollees.

Finally, the individual expenditure over the five semesters before the implementation of SHI is equal to 3440€ on average (i.e., 688€ per semester). Compared to other individuals, SHI enrollees have a higher average overall health care expenditure and higher average expenditure per health service, except for hospital care.

### Econometric model

We assume that individuals make a sequential choice of whether to purchase SHI over time: at each semester from July 2003 to December 2005, individuals make their choice conditional on not having been enrolled during the previous semesters. At each point in time, this decision is the result of the tradeoff between the price of SHI and the individual willingness to pay for this additional level of coverage. In our economic model, we assume that the willingness to pay increases with perceived health risk but also depends on other characteristics such as income.

To observe the dynamic decision to subscribe, we run a sequential probit model: we estimate the probability to purchase SHI at semester  $s$  conditional of not having purchased it earlier. Explanatory variables may be sorted into three groups:

- Individual health risk, measured by both the detailed health care expenditures (for each type of service) aggregated over the last past five semesters (prior  $s$ ), and age and its combinations (squared and cubed age).
- The individual wage index as a proxy of household income.
- A set of covariates  $X_i$  (that do not vary over time) to control the effects of variables explaining health insurance demand and to isolate the health risk and the income effect: gender, administrative situation, status of the insured, number of individuals on CHI contract and residence.

Because the price is uniform we did not introduce price into the regressions<sup>5</sup>. With regard to these specifications, the econometric model is as follows:

$$\begin{aligned} enr_{is}^* &= \alpha_s + \gamma_s \cdot age_{is} + \delta_s \cdot sqage_{is} + \varphi_s \cdot he_{is} + \beta_s \cdot X_i + \varepsilon_{is} \\ \text{with } enr_{is} &= 1 \text{ if } enr_{is}^* > 0 \\ \text{and } enr_{is} &= 0 \text{ otherwise.} \end{aligned}$$

To highlight the supplemental information from considering subscription over time, we run a “standard” model: we regress the dummy of covered/not covered by SHI at the end of the period on the individual characteristics (we consider the age at the end of 2005) and the detailed health care expenditures aggregated from the first semester of 2001 to the first semester of 2003.

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5 Strictly speaking, the SHI premium may be null because the contract is free for the third enrolled child. Nevertheless, this situation pertains to less than 1% of our study population.

### 3. Result

We successively analyze the results of the standard model, which only considers the decision at the end of the period with the dummy “has decided to subscribe SHI” or “not,” and then, the sequential model, which considers the same decision at each period conditional upon previous non-subscription. All of the results are presented in Table 3.

#### Health status proxies

Age plays an interesting and significant role regardless of the approach (standard or dynamic). Because of the cubic form, a graphic representation leads to a better interpretation of the effect of age (Graphs 1 and 2). Under the standard approach, age has a cubic impact on the demand for SHI. This result illustrates the known relationship between age and health care use: the risk to use health care is higher for young children than adults until the age of 30, then risk increases with increasing age until age 80 and finally decreases beyond 80 (Graph 1). The decrease in health care costs that seems to appear after 80 years is because we consider all health care spending associated with the out-patient sector; aside from the per-diem fee (which corresponds to less than 5% of hospital costs), almost all hospital costs are paid directly by PHI. The same effect also appears in the dynamic approach, but mainly during the first period of the model (S2 2003). For the following periods, the effect of age becomes negative (Graph 2): thus, an older individual who has chosen not to subscribe during the first period (S2 2003), is less likely to buy SHI later than a younger individual.

Remind that past health expenditures are valued differently in the two models. In the standard model, past individual health expenditures are evaluated based on the health consumption observed during the five semesters preceding the introduction of SHI. In the dynamic model, the analysis is more precise because it assesses past health care spending over the five semesters preceding the decision to subscribe to SHI. Regardless of the approach, the significant effects are similar: higher health expenditure during a semester (i.e., a greater use of health care) increases the probability of purchasing SHI in the following semester.

The standard approach highlights high and significant effects of health expense items on which SHI provides a marked improvement in reimbursements and thus a marked decrease in out-of-pocket residual cost: doctors' fees, optical care, dental care and other fees. In the dynamic approach, the same health expenditure items appear, but their respective impact on the decision to subscribe to SHI is not persistent over the time. The results of the dynamic approach for the first period are similar to those of the standard approach. For example, the items of doctors' fees and optical and dental expenses over the past six months are determinants of subscribing to SHI in both models. During the following semesters, however, the same health expenditure items are significant but their respective effects seem to diminish, especially with regard to dental fees. For optical care, a person who has not yet purchased SHI is more likely to subscribe to SHI when past optical expenditures are high. Although the effect of this particular item diminishes over the semesters, it persists until the first half of 2005.

#### Income effect

In the standard model, we find the counterintuitive result that lower-paid workers are more likely to subscribe to SHI than those one wage ranges higher. There does not seem

to be any income effect on SHI subscription in the standard model. Thus, being highly-paid does not seem to be a significant determinant of insurance demand in the standard model. Note that this result may also be caused by the fact that for the basic contract, premiums are computed according to the wage: the wealthier you are, the higher the premiums you pay. Thus, even if the premium of the SHI contract is uniform, the total cost of private health insurance (CHI + SHI) is higher for the richest.

For the first step of the dynamic approach, income has no effect. However, for the following periods, as with variables characterizing the health risk, the income effect appears to be similar to the one obtained in the standard model: during the second period, the lowest paid individuals are most likely to subscribe to SHI, although this effect is only significant for the lower wage classes (less than 1350 Euros per month).

### **Other determinants**

Consistent with prior studies, gender is a significant determinant of health insurance demand. Whether the model is standard or dynamic, women have a significantly higher probability to opt for SHI than men. This effect is traditionally explained by adverse selection: women, who are known to consume more health care than men, anticipate higher health care consumption and subscribe to a higher level of insurance.

The probability to buy SHI decreases when the number of insured on the CHI contract increases. One interpretation of this finding is that when family size increases, covering the same with SHI as with CHI is costlier. This effect is very important in the standard model, but although it follows the same logic in the dynamic model, the effect appears to diminish over the time.

## **4. Discussion**

The dynamic approach, which was the major innovative contribution of this study, provides additional evidence on the effects of variables that may characterize the impact of individual health status on health insurance demand. Because most enrollees subscribed immediately, results obtained in the first step of the dynamic approach are very similar to those obtained in the standard approach. The contribution of our research is that after considering early subscribers, who have a demand function that has already been described in previous studies, we observe new outcomes concerning the assumption of adverse selection. One striking result is the evolution of the influence of health variables on SHI subscription over time.

Adverse selection occurs significantly and immediately after the implementation of SHI. Indeed, immediate subscription increases with age, health care expenditures of ambulatory care in general and for physicians' care, optical care and dental care in particular. The influence of these types of expenses, for which SHI provides a very high additional reimbursement, reflects the traditional finding: expected health expenditures lead to a higher demand for health insurance coverage, which corresponds to the adverse selection phenomenon. Thus, the results obtained from the standard model and from the first period of the dynamic model are in line with those of Ellis (1989) and Altman *et al.* (1998): the effect of variables representing the insured individuals state of health (age and past health expenses) is significant and acts in the expected manner.

However, beginning with the second period in the dynamic model, adverse selection no longer seems to matter. The age and past health expenditures variables no longer have the same effect on the probability to purchase SHI. Doctors' fees are still relevant in the second period following the introduction of SHI (S1 2004) (i.e., among those who had not yet subscribed to SHI, individuals who spent more on doctors' fees are more likely to subscribe). However, this effect disappears during all following semesters and only optical and, to a lesser extent, dental expenditures remain influential. The optical and dental items represent greater financial risks than health risks in the sense that their costs are generally known in advance. Thus, insured individuals who subscribed to SHI later probably do not know accurately their health risk aside from their optical care risk. Moreover, the weakness of adverse selection among late subscribers may reveal a high health insurance value regardless of health status, and thus reveal an important risk aversion as well. In fact, even if their risks do not reveal a real need for SHI, they choose to subscribe to it. The results obtained for the second and later periods in the dynamic model are more in line with the findings of Ettner (1997), Bajari *et al.* (2006), Buchmueller *et al.* (2004) and Albouy and Crépon (2008), who rejected the assumption of adverse selection in the decision to purchase complementary or supplementary health insurance.

Note that the choice of past health care spending before subscribing to SHI as a proxy of individual care needs merits discussion. Indeed, it is possible that some individuals, especially poor individuals, have had to forego care for financial reasons. In that case, past health care spending would underestimate health needs and therefore would bias the results on adverse selection. Thus, adverse selection may not be as weak for later subscribers as it appears. Nevertheless, various arguments suggest that our assumptions and findings are valid. First, the age effect on the probability to subscribe becomes negative. In other words, the older an individual is, the less likely the individual is to subscribe to SHI. The age effect, which is known to be an observable risk factor strongly linked with health needs, supports the assumption of no adverse selection for later subscribers. Second, the income effect during the periods following the implementation of SHI (beginning with the semester S1 2004) also supports our interpretation: the lowest paid employees are more willing to subscribe to SHI. As previously noted, these subscriptions also result from the anticipation of known and high expenses, which take up a greater share of household budgets when income is low. Clearly, lower-paid employees are more willing to purchase SHI, which can be explained by a greater absolute risk aversion. Nevertheless, they differ in the timing of their subscription to SHI due to the weight of the price of SHI in their budget.

Another limitation of our model is that we analyze individuals insured by a particular provider. We assume that the particularity of our sample mainly affects the income variable in that the wages of civil servants benefit from a specific method of payments and that the variability of wages is lower than in the private sector. Therefore, we assume that the results concerning income are probably very specific to our study sample. Note that the results discussed above concerning adverse selection may not be strongly affected by this specificity if civil servants do not differ substantially from the population as a whole in terms of health expenditures or unobservable characteristics (such as risk aversion) linked with the decision to purchase health insurance and the observable variables. However, civil servants may have chosen to work for the public sector due to its safety (from unemployment), which could imply a higher risk aversion.

Due to our dynamic approach, we are able to highlight a unique result: the effects of health risks on insurance demand (for supplemental insurance in our study) diminish over time. It is interesting to note that those health expenses that constitute a greater financial risk (dental and optical expenses) remain significant over time, while pure

health risk does not. This finding appears to be particularly true in the French context, where the financial risks associated with optical and dental care (statutory copayments) are rather high. Access to these types of care requires assistance from complementary health insurance, particularly for the poorest. This reason is why the government has provided a contract for complementary insurance for the poorest individuals since 2000.

## 5. Conclusion

This study makes several contributions to our understanding of the effect of health risk and income on the demand for SHI in a context where basic health insurance is provided. The study analyzes the demand for a marginal increase in coverage among individuals already insured by a uniform basic CHI contract. Our results are consistent with those from previous studies because we emphasized the significant role of rather well-known determinants of health insurance demand, such as gender, income, health risk that is approximated by both age and individual past health spending.

However, our dynamic approach allows us to better understand how these determinants affect the demand for insurance. In this sense, the results we obtain from the sequential model differ from those of previous studies that typically compared the binary situation of “covered”/“not covered” by a CHI. These traditional studies found a positive effect of income but no consistent effect of health status or health risks on the demand for insurance. In our study, the decision to subscribe to SHI appears to depend strongly on individual health risk and weakly on income. By analyzing sequences conditional on an individual not having previously purchased SHI, we are able to emphasize the results of previous studies: during the first period, the effect of the insured individual’s state of health is significant and acts in the expected manner (Ellis, 1989 and Altman *et al.*, 1998), but from the second period, this effect tends to diminish until it disappears (Ettner 1997, Bajari *et al.* 2006, Buchmueller *et al.*, 2004 and Albouy and Crépon 2008), and an income effect appears and get stronger over the periods.

Thus, this research provides important information on the decision process to subscribe to SHI over time. People who purchase the contract immediately seek to cover health risks (corresponding to adverse selection), whereas later enrollees are more likely to cover a financial risk (past optical spending). These later enrollees are also characterized by low income. Thus, their demand for SHI coverage seems to be governed by a higher risk aversion, but they may have postponed their enrollment as their likely postponement of previous health expenses.

These results illustrate the dynamic of effects that may exist in the demand for health insurance by describing the interactions between different effects. Doiron *et al.* (2008) proposed two hypotheses to justify the weak or nonexistent of adverse selection effect. Our results allow us to formulate an alternative hypothesis to explain the inconsistency of the health effect on the insurance demand and the difficulty of models to highlight adverse selection. Indeed, a study of adverse selection over a period of one year in our analysis does not provide the same results that an analysis over a longer period. While in the first period, health risk dominates all other effects, income effects are important in later periods, and the effect of health status is greatly reduced over time.

Our work clearly shows that health insurance demand is specific to each level of guarantees. In fact, individuals are sensitive to the range of coverage that is offered and to rating practices. Further study would analyze health insurance choices among a continuous range of coverage to understand how health insurance demand is structured according to the level of coverage.

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**Table 1: PHI, Pooling CHI and SHI: warranties for different types  
of health care expenses**

Health services	PHI	CHI	SHI
<b>Physician care (consultations/visits/medical acts)</b>	70% of CP	30% of CP	+ 30% of CP
<b>Dental care</b>			
<i>preservative dentistry</i>	70% of CP	30% of CP	/
<i>dental prostheses / orthodontia</i>	70 % of CP	115% of CP	+ 135% of CP
<b>Other fees (surgical acts, radiology procedures)</b>	70% of CP	30% of CP	+ 30% of CP
<b>Prescription drugs</b>			
<i>white vignette drugs</i>	65% of CP	35% of CP	/
<i>blue vignette drugs</i>	35% of CP	65% of CP	/
<b>Optical</b>			
<i>eyeglasses</i>	65% of CP	865% to 900% of CP	+ 31€ to + 92€
<i>frame</i>	65% of CP	55 €	+ 61€
<i>contact lenses</i>	0 €	115 €	+115€
<b>Other prescriptions (auxiliary care, laboratory procedure, orthopedia)</b>	60% of CP	40% of CP	/
<b>Hospitalizations</b>			
<i>Hospitals that have not concluded RHF agreement:</i>			
<i>medical practitioners fees</i>	80% or 100% of CP	20% or 0% of CP	+ 30% of CP
<i>stay costs</i>	80% or 100% of CP	20% or 0% of CP	/
<i>per diem copayment (10€ for psychiatric hospitalization and 14€ otherwise)</i>	/	Full reimb	/
<i>Hospitals that have concluded the RHF agreement (all kind of cost)</i>	negociated tariff	negociated tariff	negociated tariff
<b>Other types of care</b>			
<i>Medical transportation</i>	65% of CP	35% of CP	/
<i>Spa care</i>	65% or 70% of CP	35% of 30% of CP	/

Note: CP = Social security ceiling price

White/Blue vignette : indicator permitting drug classification. White vignette denotes medical utility drugs. Blue vignette denotes moderate medical utility drugs

**Table 2: Sample characteristics in 2005**

	Full sample	covered by the SHI	not covered by the SHI
Age	49.5	56.3	47.7
<b>Gender</b>			
Man	62.6%	59.4%	63.4%
Woman	37.4%	40.6%	36.6%
<b>wage index brackets (in points)</b>			
<= 1350€	6.1%	7.5%	5.7%
From 1350€ to 1790€	57.8%	51.9%	59.3%
From 1790€ to 2240€	20.5%	22.6%	19.9%
From 2240€ to 3110€	10.2%	11.6%	9.8%
> 3110€	5.5%	6.5%	5.2%
<b>administrative situation</b>			
Active	40.1%	43.7%	39.1%
Retired	31.2%	38.5%	29.3%
Student	1.5%	0.9%	1.6%
Without professional activity	27.3%	16.9%	29.9%
<b>family situation</b>			
SHI policyholder	65.6%	76.0%	63.0%
Spouse	14.8%	16.7%	14.3%
Child	19.6%	7.3%	22.8%
<b>residential location (grouping of regions)</b>			
Ile-de-France (IdF = Paris region)	7.8%	10.4%	7.1%
Parisian basin regions (excluded IdF)	16.8%	15.1%	17.3%
Northern regions	4.4%	4.5%	4.4%
Eastern regions: Alsace-Lorraine	6.0%	9.2%	5.2%
Eastern regions: Franche-Comté	2.6%	2.6%	2.6%
Western regions	16.9%	12.7%	18.0%
Southwestern regions	15.4%	15.6%	15.3%
Center-Eastern regions	11.7%	12.8%	11.5%
Mediterranean regions	14.3%	13.1%	14.6%
<b>sum of health care expenditures from January 1st, 2001 to June 30th 2003</b>			
Entire expenditure	3 440 €	4 027 €	3 288 €
Physician care	408 €	500 €	384 €
Dental care	319 €	380 €	303 €
Other fees	247 €	317 €	228 €
Prescription drugs	1 006 €	1 277 €	936 €
Optical care	159 €	203 €	147 €
Other prescriptions	518 €	568 €	506 €
Hospital care	666 €	661 €	668 €
Other types of care	118 €	121 €	117 €
Number of observations	18126	8668	9458
Number of pooled CHI policies	12173	6780	5393
Average number of beneficiaries per pooled CHI policy	1.52	1.42	1.56



**Table 3: Determinants of the decision to buy the SHI**

	Standard model	Dynamic model				
	At the end of 2005	S2 2003	S1 2004	S2 2004	S1 2005	S2 2005
Independent variables x	dprob/dx (in points)	dprob/dx (in points)	dprob/dx (in points)	dprob/dx (in points)	dprob/dx (in points)	dprob/dx (in points)
<b>Gender and Age</b>						
Man	ref.	ref.	ref.	ref.	ref.	ref.
Woman	4.467***	3.378***	0.851***	0.334**	0.179*	0.234**
Age	-2.139***	-0.933***	-0.289**	-0.176***	-0.202***	-0.197***
Age <sup>2</sup>	0.047***	0.031***	0.008***	0.003***	0.004***	0.004***
Age <sup>3</sup>	-0.0003***	-0.0002***	-0.0001***	-0.00002***	-0.00003***	-0.00002***
<b>Wage index brackets</b>						
<= 1350€	ref.	ref.	ref.	ref.	ref.	ref.
From 1350€ to 1790€	-5.190***	n.s.	-2.003***	-0.829***	-1.142***	-0.573**
From 1790€ to 2240€	n.s.	n.s.	0.98**	-0.440**	-0.688***	-0.316*
From 2240€ to 3110€	n.s.	n.s.	n.s.	-0.674***	-0.667***	n.s.
> 3110€	n.s.	n.s.	n.s.	-0.515**	-0.601***	-0.477***
<b>Professional activity of policyholder</b>						
Working policyholder	ref.	ref.	ref.	ref.	ref.	ref.
Retired	-4.222***	-2.922***	-0.833***	-0.235*	-0.224*	-0.194*
Student	71.312***	n.s.	n.s.	8.736**	n.s.	48.331*
Policyholder's spouse	-4.351***	-2.799***	-1.140***	-0.306*	n.s.	n.s.
Policyholder's child	-15.638***	n.s.	-2.107***	-1.685***	-1.467***	-1.470***
<b>Number of insured by CHI</b>	-2.445***	-1.815***	-0.336**	-0.128*	-0.158**	n.s.
<b>Past health care expenses (per 100€)</b>						
Physician care	0.441***	0.365***	0.078***	n.s.	n.s.	n.s.
Dental care	0.143***	0.136***	0.03*	n.s.	0.011*	n.s.
Other fees	0.148*	n.s.	n.s.	0.028***	n.s.	n.s.
Prescription drugs	n.s.	n.s.	-0.016*	n.s.	n.s.	n.s.
Optical care	0.505***	0.34***	0.138***	0.029*	0.025*	n.s.
Other prescriptions	-0.0473*	n.s.	n.s.	n.s.	n.s.	n.s.
Hospital care	n.s.	n.s.	n.s.	-0.003*	n.s.	n.s.
Other types of care	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Prob. of enrollment of the average individual	0.1876	0.1289	0.0274	0.0102	0.0077	0.0067
Observed rate of enrollment	0.2051	0.1497	0.0328	0.0133	0.0108	0.0098
Number of subscribers (unweighted)	8,668	3,676	1,987	1,150	953	902
Number of observations	18,126	18,126	14,450	12,463	11,313	10,360

Standard model: probability to be covered by SHI on December 31<sup>st</sup>, 2005.

Dynamic model: for each semester, probability to subscribe to SHI conditional on not having previously subscribed.

In the dynamic model, for each year, S1= first semester S2 = second semester

dprob/dx measures the marginal effect on the probability to buy SHI. Variations in the probability are expressed in points: A marginal effect of 4.467 pts indicates that the probability to buy SHI increase by 0.0467.

An individual who had medical expense fees of 100 € more than that of a reference individual has a 0.441 points higher probability of having subscribed to SHI at the end of 2005.

\*\*\* denotes significance at the 0.1% level \*\* denotes significance at the 1% level \* denotes significance at the 5% level.

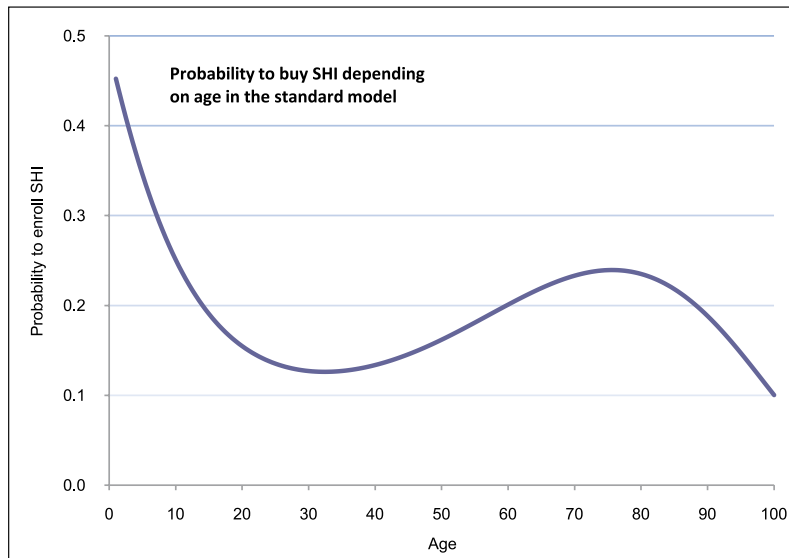
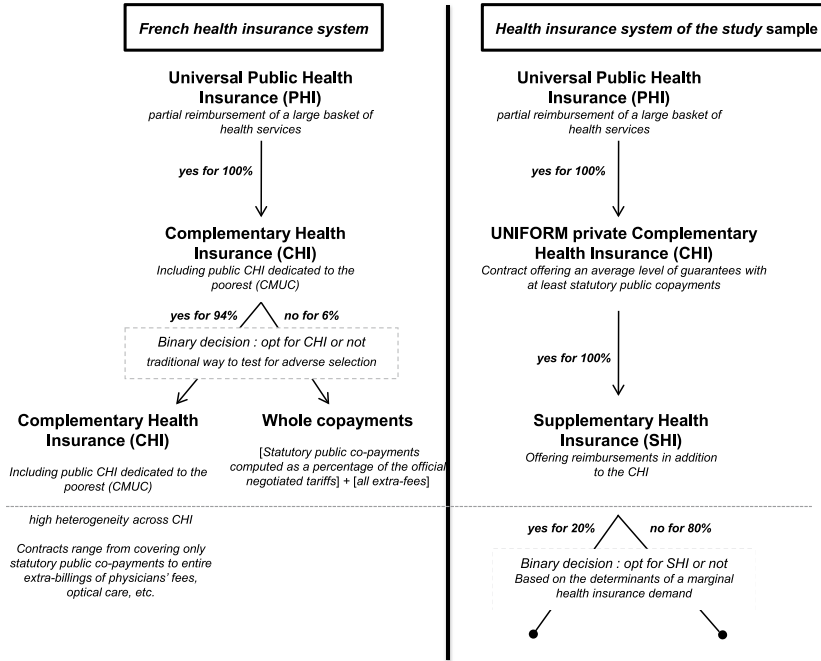
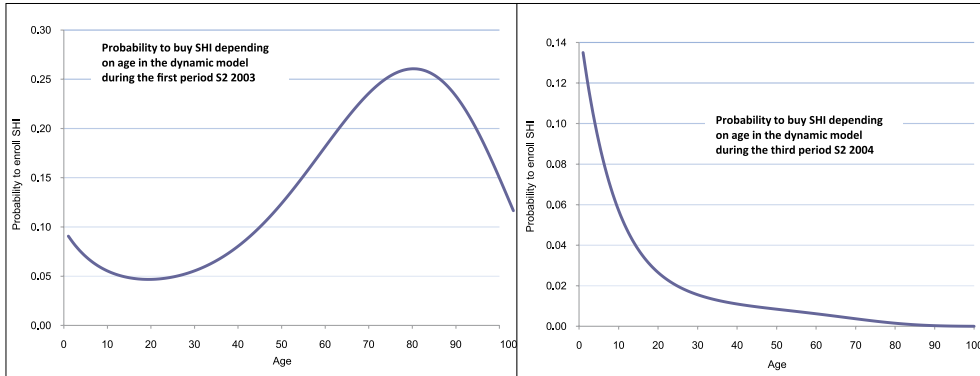


Figure 1: Structure of the health insurance system in France



Graph 1: The effect of age on the probability to enroll in the standard model



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## **Subscribing to Supplemental Health Insurance in France: A Dynamic Analysis of Adverse Selection**

Carine Franc (Cermes, Inserm U988, CNRS UMR8211, Irdes), Marc Perronnin (Irdes), Aurélie Pierre (Irdes)

Adverse selection, which is well described in the theoretical literature on insurance, remains relatively difficult to study empirically. The traditional approach, which focuses on the binary decision of “covered” or “not”, potentially misses the main effects because heterogeneity may be very high among the insured. In the French context, which is characterized by universal but incomplete public health insurance (PHI), we study the determinants of the decision to subscribe to supplemental health insurance (SHI) in addition to complementary health insurance (CHI). This work permits to analyze health insurance demand at the margin. Using a panelized dataset, we study the effects of both individual state of health, which is measured by age and previous individual health spending, and timing on the decision to subscribe. One striking result is the changing role of health risk over time, illustrating that adverse selection occurs immediately after the introduction of SHI. After the initial period, the effects of health risks (such as doctors’ previous health expenditures) diminish over time and financial risks (such as dental and optical expenses and income) remain significant. These results may highlight the inconsistent effects of health risks on the demand for insurance and the challenges of studying adverse selection.

## **Souscrire une assurance complémentaire en France : une analyse dynamique de la sélection adverse**

Carine Franc (Cermes, Inserm U988, CNRS UMR8211, Irdes), Marc Perronnin (Irdes), Aurélie Pierre (Irdes)

La sélection adverse est décrite de manière détaillée dans la littérature théorique sur l’assurance mais reste assez difficile à analyser d’un point de vue empirique. L’approche traditionnelle consiste à se focaliser sur le choix d’être couvert ou non couvert. Cependant, en ignorant l’hétérogénéité potentiellement forte au sein des assurés, cette approche peut éluder l’essentiel de la sélection adverse. Dans le contexte français, qui est caractérisé par l’existence d’une couverture assurantielle publique (PHI) universelle mais incomplète, nous étudions les déterminants de la décision de souscrire une surcomplémentaire santé (SHI) complétant les remboursements d’un contrat de couverture complémentaire santé de base (CHI). Ce travail permet ainsi d’analyser la demande d’assurance à la marge. En utilisant des données panélisées, nous étudions l’effet de l’état de santé, mesuré par l’âge et par les dépenses de santé passées, et du temps dans la décision de souscrire la surcomplémentaire. Un résultat important est l’évolution au cours du temps du rôle du risque santé dans la décision de souscription, illustrant le fait que la sélection adverse survient immédiatement après l’introduction de la surcomplémentaire. Après la période de souscription, l’effet des variables de risque santé (telles que les dépenses passées en soins de médecins) diminuent au cours du temps alors que les variables de risque financier (telles que les dépenses en optique et en dentaire et le revenu) restent significatives. Ces résultats mettent en lumière l’instabilité de l’effet du risque santé sur la demande d’assurance et donc le défi que représente l’analyse de la sélection adverse.