ANALYSE DYNAMIQUE DE L'ANTI-SÉLECTION
DU RISQUE FINANCIER AU RISQUE SANTÉ

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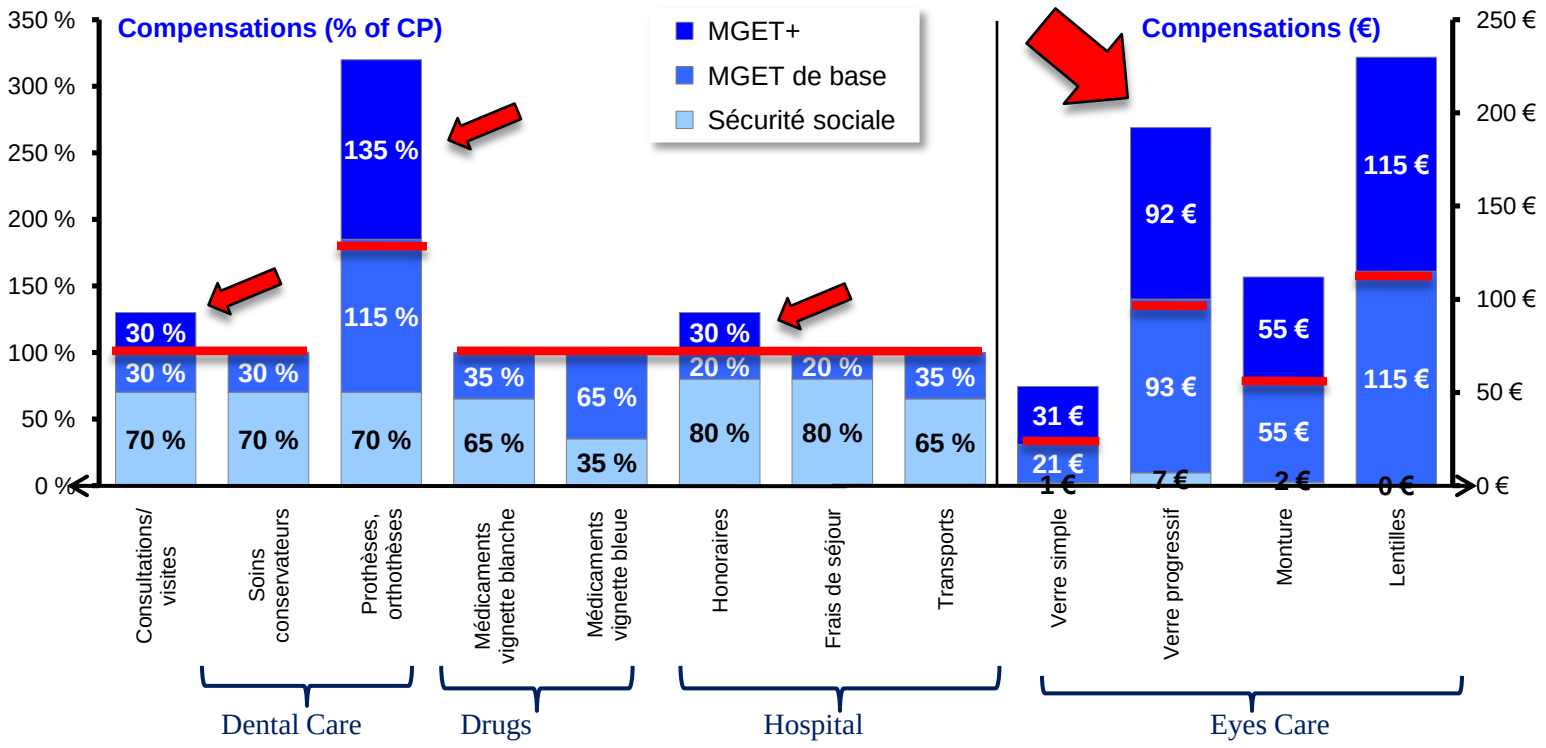
Context

This work has been done in collaboration with a *Mutuelle* MGET which administers the Mandatory Health Insurance PHI and Complementary health Insurance CHI for officials of the equipment and land, the Ministry of equipment and ecology and their dependents.

In July 2004, the *Mutuelle* decided to offer a supplemental health Insurance contract SHI that can be bought by only one or more individuals within the household for a fixed and uniform price.

Context

- The **PHI**, **CHI** and **SHI** (MGET+)



Issues

- According to theoretical and empirical results ☞ the aim of the study is to analyze
  - who has decided to buy SHI in addition to PHI+CHI, ie. if these individuals are also those who expected a high level of health care expenditure
    ☞ ***adverse selection assumption***
  - what kind of consequences of SHI on the level of health care expenditure
    ☞ ***moral hazard assumption***

… By controlling for traditional determinant of health insurance demand

(gender, age, economic status, health status…)

- ✋ As usual, buying SHI may correspond to an insurance demand due to a need of health care and thus SHI only promotes the consumption by allowing or favoring the access to the health care system (≠ moral hazard).

Issues

- This natural experiment allows us to analyze *a posteriori* :
  - The determinants of the individual health insurance demand and especially by isolating adverse selection effects ;
  - The impact of health insurance on the decision to consume health care, to test the assumption of moral hazard.
- To answer these two issues, we have a panel of individual health care expenses during 4 years (2 years before and 2 years after the implementation of SHI).
- The study has been done in two steps
  - 1/ To model the probability to subscribe to SHI (who is going to decide to buy a SHI plan in addition to PHI + pooling CHI and when is the buyer going to decide to buy it…)
  - 2/ To model the *ex post* consumption of care

PLAN

1. Introduction
2. Data
3. Who decided to subscribe?
4. Method
5. Analyze of the adverse selection effects
   - Have or not finally decided to buy SHI ☛adverse selection assumption
   - Following a dynamic approach?
6. Discussion

Introduction

The insurance demand

- Health expenditures may be viewed as random shocks amputating disposable income of individuals.
  - Risk aversion ☞ purchase of an insurance contract and …
  - Following the model of perfect competition, one would prefer the actuarial complete contract.
  - ... The higher the risk, the higher the propensity to pay for insurance is high (relative risk scale).

- To dimension to describe the risk :
  - The Probability *p* that may correspond to the frequency of *the* disease and
  - The cost of the damage *D* that corresponds to the sum of the expenses (health care expenses)
- According to the theory developed by Arrow [1965], individuals are asking for health insurance because they are averse to **financial risk** of health spending. Then, they reduce this risk by subscribing a contract of insurance.
  - **Health risk** associated to the risk on the state of health (≠✋ expired risk such as *ALD*, eyes care…)
  - **Financial risk** associated with the expectation of future healthcare expenditure

Introduction

The insurance demand

- In the case of health insurance, there are some specificities…

  … for example, eyes care expenses are almost always predictable (the risk is no more random) and this kind of expenses may be quite correctly anticipated by both the insurer but also by the insured.

- The traditional determinant of the insurance demand that appears in the literature not always consensual (state of health) are proxies of :
  - … the probability *p* : age, gender, past health care expenses, income and CSP, etc.
  - … the future health care expenses *D* : state of health , health care provisions, demography of providers, physicians fees (sector 1or 2, those belonging to the 2nd sector are allowed to price extra fees)

Introduction

Adverse selection, empirical results

- Most commonly, empirical works try to measure adverse selection effects in situations such as “with” or “without” an insurance contract - for US ☞ Cutler et Zeckauser (2000)
  - Among salaries: “ who has decided to buy the group contract “ who has decided not to buy it”
  - Sometimes but more rarely, comparisons de between different contracts.

- In France, the context is particular in the sense that a complementary health insurance (CHI) is available to already supplement the public health insurance (PHI compulsory and universal) coverage that is rather low to allow an easy and equal access to the health system for all individuals. There is a high level of competition on the private insurance market even if the pricing on the risk basis is low due to the risk covered (mainly ambulatory)
  - Low adverse selection effects emphasized : among non-covered, many low risk individuals but also high risk ones ; difficulties to emphasize the effect of the state of health.
    - Buchmueller et al. (2004): having a CHI or not. No effect of the state of health ☞ “no adverse selection “

Introduction

Adverse selection

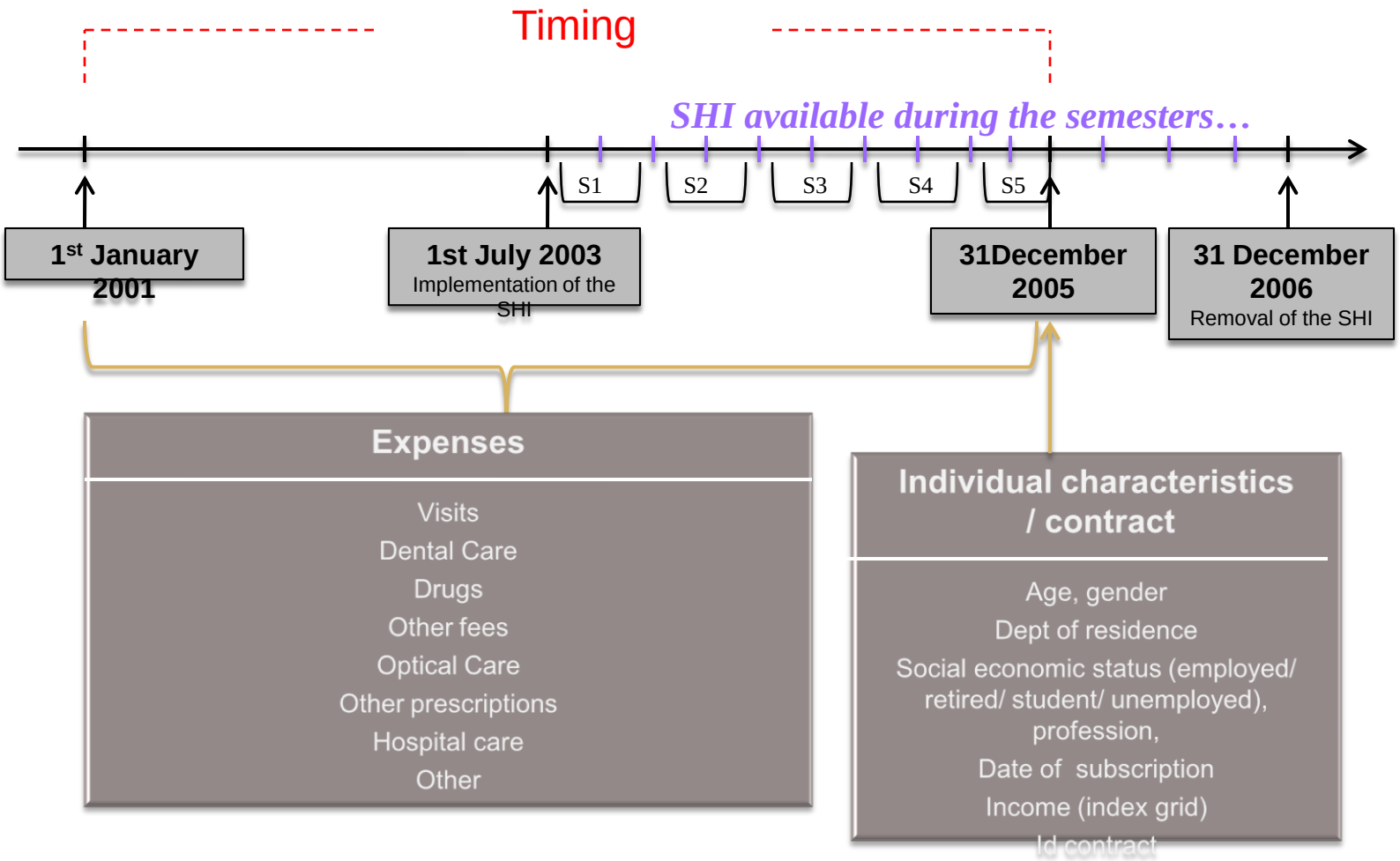
- Usually ☛ analyze of a population where individuals decided either to buy a contract either not and this approach may erase the potential heterogeneity between insured ones.
  - Analyze of the impact of the SHI added to PHI + a pooling CHI allows to measure rather ☛ precisely the marginal effect

here

- The assumption of adverse selection leads to a situation where
  - ☛ low risk individuals may be “excluded” from the market equilibrium or at least they may “receive” a partial contract;
  - ☛ potential exclusion of low income individuals (negative correlation between health and wealth) and the future insured must have a high income specially for high risk ones.

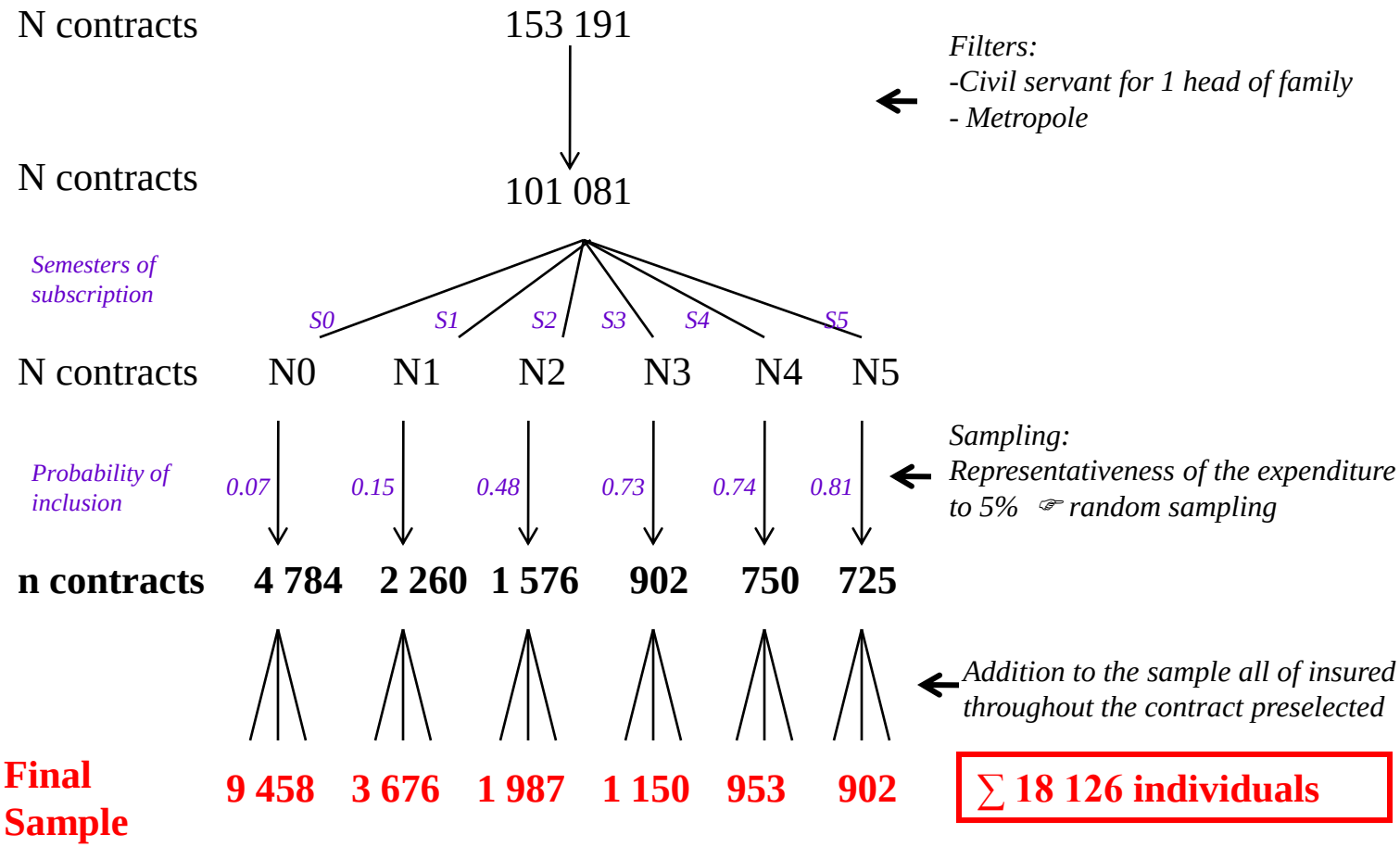
Data available

Administrative Data

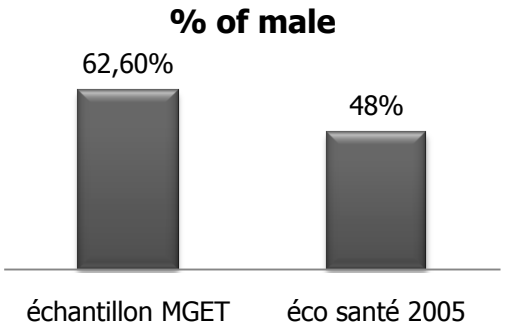


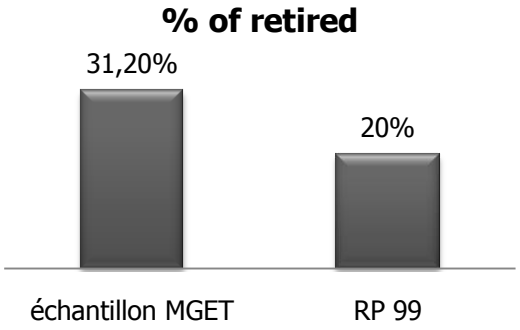
Sample

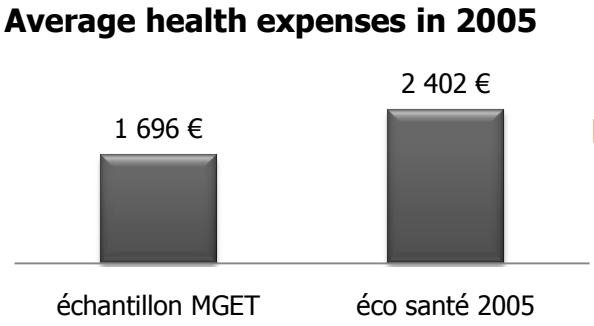
Drawing from the subscribers of the basic contract



Descriptive results



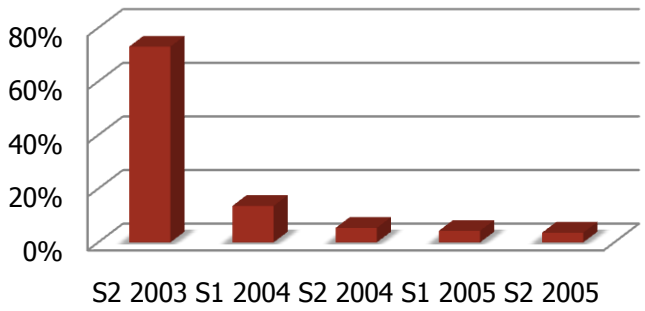




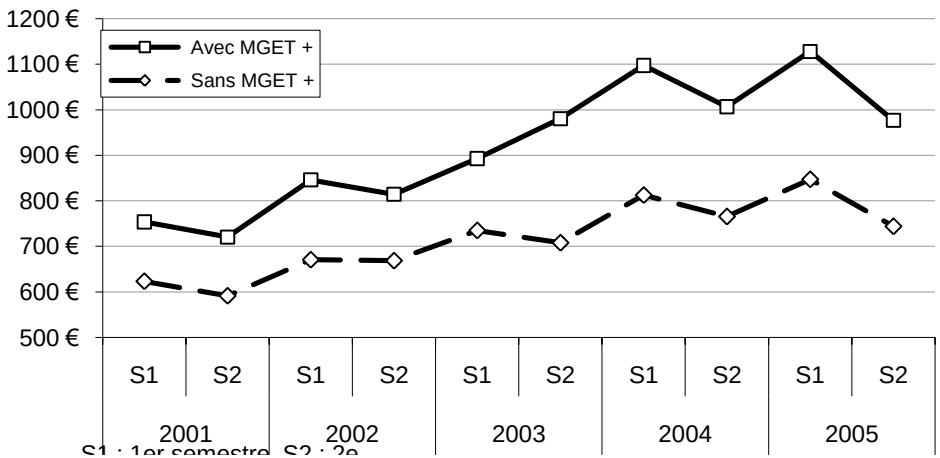
- Women represent less than 40% in our sample compared to 52% in the general population, this difference is due to our particular population (men more often work in the French local administration).
- 40,1% of salaried, 31,2% of retired, 1,5% of students, 27,3% of unemployed: high proportion of retired ; 47,5 years on average ie. A rather old population (vs 39,5 yrs in 2005 according to Insee) *(+préretraites?+ sélection sur ceux qui se sont assurés)*
- 65,3 % of « head of family »; ~2 persons per household (=contract)
- Close to the average health expenses emphasized in 2004 (ESPS-EPAS) that is 1704 € (where there was few hospital care, en institution, en fin de vie)

Descriptive results

- Subscription
  - 1 insured over 5 at the end of 2005
  - A very important subscription from the implementation



- Expenses

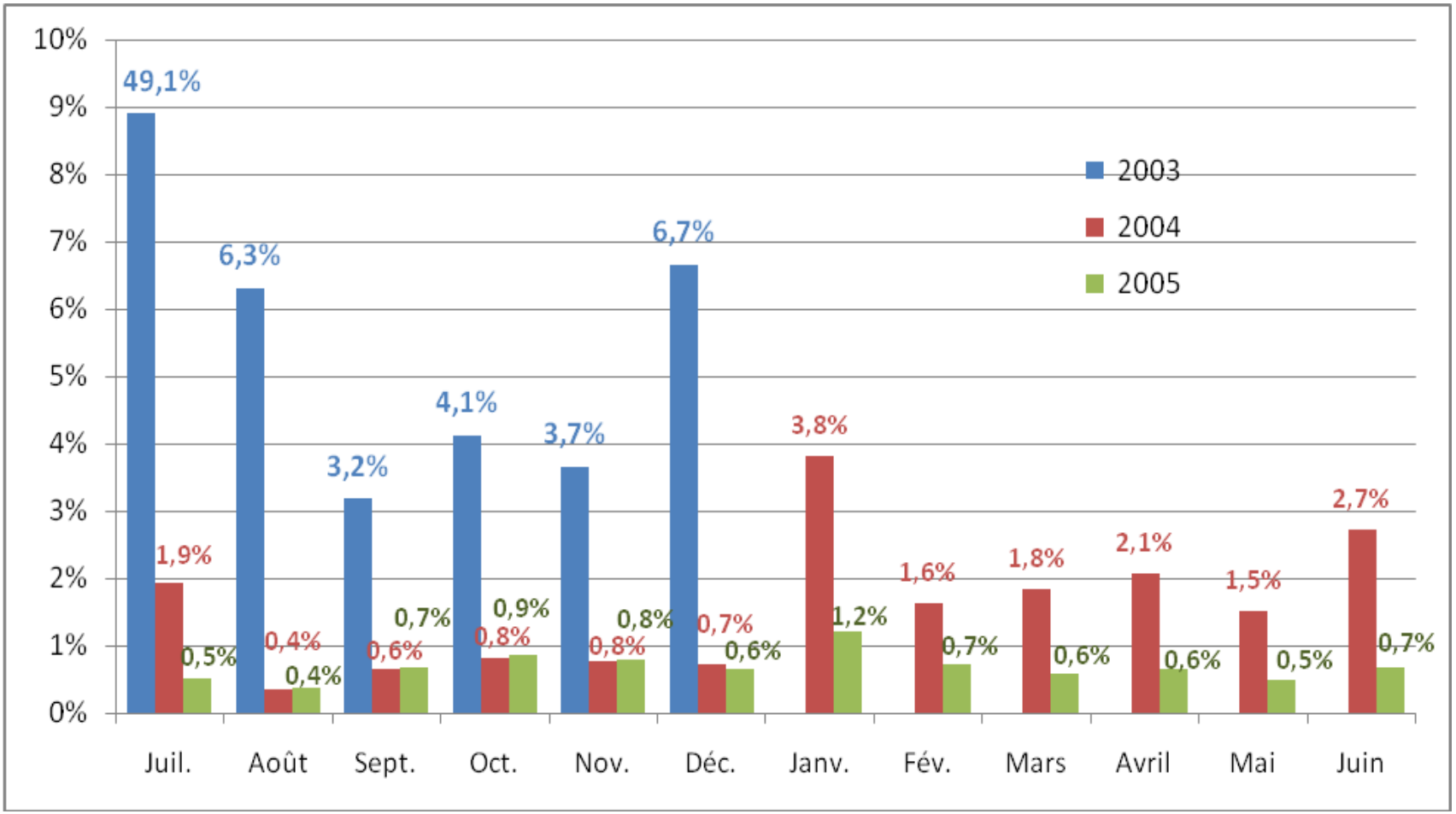


Adverse selection: do the high risk individuals subscribe much more SHI than other individuals?

Are the profiles of individuals who decide to subscribe the same over time?

Does adverse selection persists over the semesters?

Descriptive results



Method

- « Nested Probit »

$$Pr(Y=1) = \Phi(\alpha.S+\beta.W+\gamma.X)$$

  - $Pr(Y = 1)$ corresponds to the probability that the individual subscribes to the SHI
  - S : corresponds to the matrix of proxies of the state of health that are
    - Past health expenses,
    - Age and its combination (age^2, age^3)
  - W : corresponds to the income (grid wage index)
  - X : corresponds to the matrix of variables determining "more traditionally" the health insurance demand
    - Age, gender
    - Dept of residence
    - Social economic status (employed/ retired/ student/ unemployed), profession,
    - Size of the household…

First Step :
having or not opted for SHI (end of 2005)

- Adverse selection: did the high risk individuals subscribed much more SHI than other individuals?
- Did the high income individuals subscribed much more SHI than other individuals?

- Approached by the "stock"…

First Step :
having or not opted for SHI (end of 2005)

avoir souscrit la MGET+ (EM / ref. = 0,19)	dy/dx	Pr	dy/dx	Pr
Genre (ref. hommes)				
Femmes	6,095	0,000	4,051	0,000
Age	0,015	0,916	-0,273	0,063
age au carré	0,001	0,375	0,003	0,011
tranches d'indice salariale (ref. moins de 300)				
de 301 à 400	-3,865	0,009	-4,272	0,004
401 à 500	0,073	0,963	-0,857	0,575
501 à 695	1,347	0,464	-0,249	0,887
plus de 695	1,354	0,521	-0,395	0,843
Statut par rapport à l'emploi du fonctionnaire (ref. actifs)				
Retraités	-0,976	0,288	-0,323	0,729
Etudiants	2,501	0,417	3,405	0,273
sans profession	-1,610	0,250	-0,944	0,505
MP1 fonctionnaire				
AD conjoint	-2,161	0,060	-0,659	0,582
AD enfant	-9,591	0,000	-12,305	0,000
nombre de personnes	-2,995	0,000	-2,732	0,000
dépenses totales	0,015	0,001		
Consultations			0,327	0,000
Dentaire			0,405	0,000
Autres honoraires			0,157	0,013
Pharmacie			0,013	0,444
Optique			1,083	0,000
Autres prescriptions			-0,029	0,105
Hôpital			-0,005	0,626
Autre			-0,020	0,575

Health risk variable

- low effect of the age
- a positive effect of past health expenses
  - → Visits
  - → Dental care
  - → Other fees
  - → Optical care

Income

- Income effect low and mainly non significant : equity in the access to SHI?

Other determinants on insurance demand

- a higher demand for women
- a decreasing demand with a higher size of the household (within the PHI contract) → higher sensitivity on price effect

Second Step :
on the dynamic point of view…

- *Are the profiles of individuals who decide to subscribe the same over time?*

(probit séquentiel (pondéré) de la décision de SHI)

Step 1 : Subscription to SHI during the second semester of 2003

Step 2 : Subscription to SHI during the first semester of 2004

Step 3 : Subscription to SHI during the second semester of 2004

Step 4 : Subscription to SHI during the first semester of 2005

Step 5 : Subscription to SHI during the second semester of 2005

Second Step : S1

on the dynamic point of view…

independant variables x	Step 1 dprob/dx	p-value
Gender (ref: man)		
woman	3,37796	0,000
Age	-0,93281	0,001
Age^2	0,03078	0,000
Age^3	-0,000213	0,000
Wage index brackets (ref: ≤ 300)		
From 301 to 400	-0,47815	0,719
From 401 to 500	1,84607	0,217
From 501 to 695	3,02472	0,085
> 695	2,26955	0,252
Professional activity of policyholder and family status of other beneficiaries (ref : policyholder in activity)		
Retired	-2,92223	0,000
Student	6,30311	0,531
MGETb beneficiary : policyholder's spouse	-2,7986	0,000
MGETb beneficiary : policyholder's child	-1,50801	0,593
number of insured on MGETb contract	-1,8147	0,000
Physician care(per 100 €)	0,365	0,000
Dental care (per 100 €)	0,136	0,000
Other fees (per 100 €)	0,045	0,373
Prescription drugs (per 100 €)	0,007	0,678
Optical care (per 100 €)	0,34	0,000
Other prescriptions (per 100 €)	-0,0266	0,094
Hospital care (per 100 €)	-0,0121	0,369
Other types of care (per 100 €)	0,02	0,493

Health risk variable

-low effect **(-)** of age but significant

- positive effect of past health expenses
☛Visits, Dental care, Other fees, Optical care

Income

- **Income effect non significant** :
equity in the access to SHI?

Other determinants

- much higher demand for women
- lower demand for "household larger than 1 person" (within the PHI contract) → higher sensitivity on price effect

Second Step : S2

on the dynamic point of view…

independant variables x	Step 2 dprob/dx	p-value
Gender (ref: man)		
woman	0,8513	0,000
Age	-0,28853	0,006
Age^2	0,00827	0,000
Age^3	-0,000067	0,000
Wage index brackets (ref: ≤ 300)		
From 301 to 400	-2,00313	0,000
From 401 to 500	-0,98024	0,006
From 501 to 695	-0,69019	0,126
> 695	-0,72202	0,098
Professional activity of policyholder and family status of other beneficiaries (ref : policyholder in activity)		
Retired	-0,83296	0,000
Student	3,11649	0,338
MGETb beneficiary : policyholder's spouse	-1,14043	0,000
MGETb beneficiary : policyholder's child	-2,10665	0,000
number of insured on MGETb contract	-0,33649	0,008
Physician care(per 100 €)	0,0777	0,000
Dental care (per 100 €)	0,0295	0,014
Other fees (per 100 €)	0,0293	0,074
Prescription drugs (per 100 €)	-0,0157	0,005
Optical care (per 100 €)	0,138	0,000
Other prescriptions (per 100 €)	-0,00238	0,576
Hospital care (per 100 €)	-0,00518	0,297
Other types of care (per 100 €)	-0,00465	0,662

Health risk variable

-low effect **(-)** of age but significant

- Low effect **(-)** of past health expenses

☛Visits, Dental care, Optical care

- Low effect **(+)** of Drugs

Income

- Negative effect for low income

Other determinants

- much higher demand for women
- lower demand for "household larger than 1 person" (within the PHI contract) → higher sensitivity on price effect

Second Step : S3

on the dynamic point of view…

independant variables x	Step 3 dprob/dx	p-value
Gender (ref: man)		
woman	0,33387	0,005
Age	-0,17555	0,000
Age^2	0,00316	0,000
Age^3	-0,0000223	0,000
Wage index brackets (ref: ≤ 300)		
From 301 to 400	-0,82935	0,000
From 401 to 500	-0,44013	0,004
From 501 to 695	-0,67377	0,000
> 695	-0,51482	0,002
Professional activity of policyholder and family status of other beneficiaries (ref : policyholder in activity)		
Retired	-0,2345	0,047
Student	8,73554	0,006
MGETb beneficiary : policyholder's spouse	-0,30603	0,016
MGETb beneficiary : policyholder's child	-1,68462	0,000
number of insured on MGETb contract	-0,12824	0,041
Physician care(per 100 €)	0,0122	0,168
Dental care (per 100 €)	-0,00017	0,973
Other fees (per 100 €)	0,0281	0,000
Prescription drugs (per 100 €)	-0,00127	0,530
Optical care (per 100 €)	0,0287	0,025
Other prescriptions (per 100 €)	-0,000463	0,777
Hospital care (per 100 €)	-0,00326	0,037
Other types of care (per 100 €)	-0,013	0,107

Health risk variable

-low effect **(-)** of age but significant

- positive effect of past health expenses
☛Dental care, Optical care (predictable)

Income

- Income effect (-) and significant :

Other determinants

-higher demand for women
- lower demand for "household larger than 1 person" (within the PHI contract) → higher sensitivity on price effect

Second Step : S4

on the dynamic point of view…

independant variables x	Step 4 dprob/dx	p-value
Gender (ref: man)		
woman	0,17872	0,035
Age	-0,20178	0,000
Age^2	0,00379	0,000
Age^3	-2,59E-05	0,000
Wage index brackets (ref: ≤ 300)		
From 301 to 400	-1,14231	0,000
From 401 to 500	-0,68824	0,000
From 501 to 695	-0,66659	0,000
> 695	-0,60119	0,000
Professional activity of policyholder and family status of other beneficiaries (ref : policyholder in activity)		
Retired	-0,22367	0,020
Student	3,03384	0,108
MGETb beneficiary : policyholder's spouse	-0,14541	0,293
MGETb beneficiary : policyholder's child	-1,4668	0,000
number of insured on MGETb contract	-0,15839	0,008
Physician care(per 100 €)	-0,00509	0,570
Dental care (per 100 €)	0,0107	0,022
Other fees (per 100 €)	0,00512	0,485
Prescription drugs (per 100 €)	0,00141	0,356
Optical care (per 100 €)	0,0251	0,038
Other prescriptions (per 100 €)	0,000119	0,926
Hospital care (per 100 €)	-0,00225	0,159
Other types of care (per 100 €)	0,00481	0,288

Health risk variable

-Very low effect **(-)** of age but significant

- Very low effect of past health dental care and optical care

Income

- Higher **Income effect (-) and significant**

Other determinants

- much higher demand for women
- lower demand for "household larger than 1 person" (within the PHI contract) → higher sensitivity on price effect

Second Step : S5

on the dynamic point of view…

independant variables x	Step 5 dprob/dx	p-value
Gender (ref: man)		
woman	0,23387	0,006
Age	-0,19677	0,000
Age^2	0,00356	0,000
Age^3	-0,00002	0,000
Wage index brackets (ref: ≤ 300)		
From 301 to 400	-0,57253	0,010
From 401 to 500	-0,31762	0,040
From 501 to 695	-0,28162	0,086
> 695	-0,47708	0,000
Professional activity of policyholder and family status of other beneficiaries (ref : policyholder in activity)		
Retired	-0,19419	0,037
Student	48,33116	0,039
MGETb beneficiary : policyholder's spouse	-0,17863	0,165
MGETb beneficiary : policyholder's child	-1,47002	0,000
number of insured on MGETb contract	-0,05861	0,176
Physician care(per 100 €)	0,0106	0,114
Dental care (per 100 €)	0,00237	0,549
Other fees (per 100 €)	0,0115	0,103
Prescription drugs (per 100 €)	-0,00118	0,422
Optical care (per 100 €)	0,0144	0,136
Other prescriptions (per 100 €)	0,000521	0,394
Hospital care (per 100 €)	-0,00288	0,086
Other types of care (per 100 €)	-0,00198	0,629

Health risk variable

-low effect **(-)** of age but significant

-No more effect of past health expenses

Income

- Income effect (-) and significant

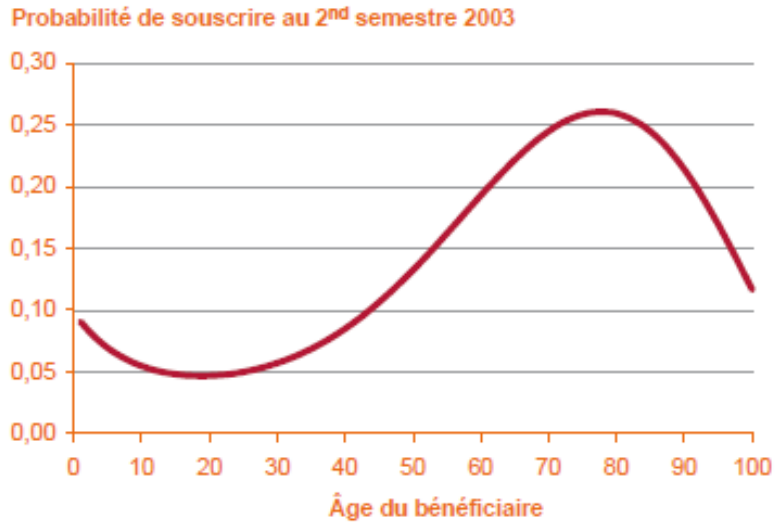
Other determinants

- much higher demand for women
- lower demand for child in a household → higher sensitivity on price effect ?

Discussion

- **Health Risk :** *the impact of age*

G2 Probabilité de souscrire la MGET+ au second semestre 2003, en fonction de l'âge

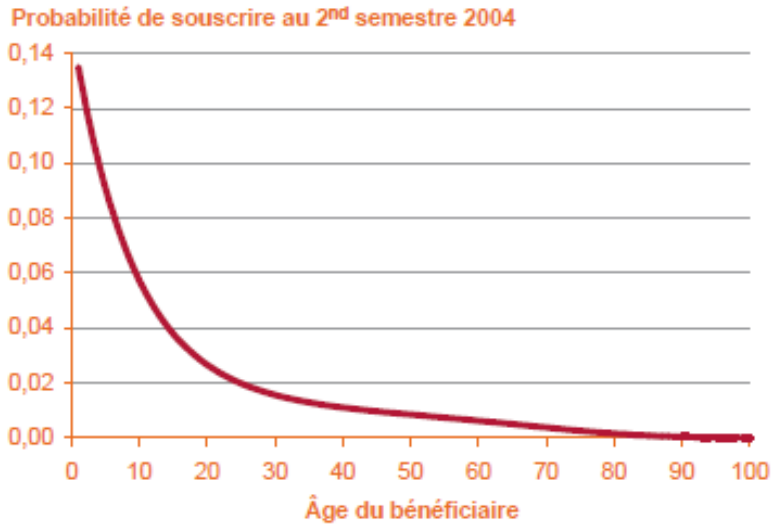


Guide de lecture : La probabilité qu'un assuré de 20 ans souscrive la MGET+ au second semestre 2003 est de 5% contre 13,1% pour un assuré de 50 ans.

Données : MGET.

La référence de calcul étant différente en 2003 et 2004, les probabilités ne sont pas comparables entre les graphiques 2 et 3.

G3 Probabilité de souscrire la MGET+ au second semestre 2004, en fonction de l'âge



Guide de lecture : La probabilité qu'un assuré de 20 ans souscrive la MGET+ au second semestre 2004 sachant qu'il ne l'a pas souscrite avant est de 2,7 % contre moins de 1 % pour un assuré de 50 ans.

Données : MGET.

La référence de calcul étant différente en 2003 et 2004, les probabilités ne sont pas comparables entre les graphiques 2 et 3.

Discussion

- In our context where all individuals benefit from a uniform coverage PHI + pooling CHI ☞ adverse selection effects rather significant particularly for individuals who decided to subscribe to SHI immediately.

- The effects of adverse selection change over time, 2 main profiles of subscribers are emphasized by the model:
  - **Immediate subscriptions**
    - Optical care, dental care, Physicians visits **+** (care included in the SHI basket)
    - Age **+**
  - **Further subscriptions**
    - Optical care **+ + +**
    - Age **--**
    - Poorest individuals

High health risk

Optical care expenses: financial risk

Higher price sensitivity; subscription to favor a required access to the health system

Discussion

- The income effect is non common with what is usually found in the literature: non significant for at least immediate subscription… Later, the effect is such that:
  - Lower income individuals have a higher probability to subscribe
  - Higher income individuals who not decided to buy it immediately will not buy it later.

- Health risk through age and past health expenses play both a role immediately but also over the different periods. However the respective roles are decreasing.

- **What are the effects of the SHI on the *ex post* health expenses ?**