Affordability of Complementary Health Insurance in France:

A Social Experiment

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1. Context and aims of the study

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1. Context

- Despite the existence of the CMUC, 7% of the French population remains without complementary health insurance (CHI)

- This proportion is higher among households whose resources are just above the CMUC eligibility threshold and it strongly decreases with household income:
  - 19% of the first income decile
  - 14% of the second income decile

- In order to improve financial access to CHI and reduce the threshold effect induced by the CMUC
  - a CHI voucher has been introduced in 2005,
  - called **Aide à la complémentaire santé – ACS**

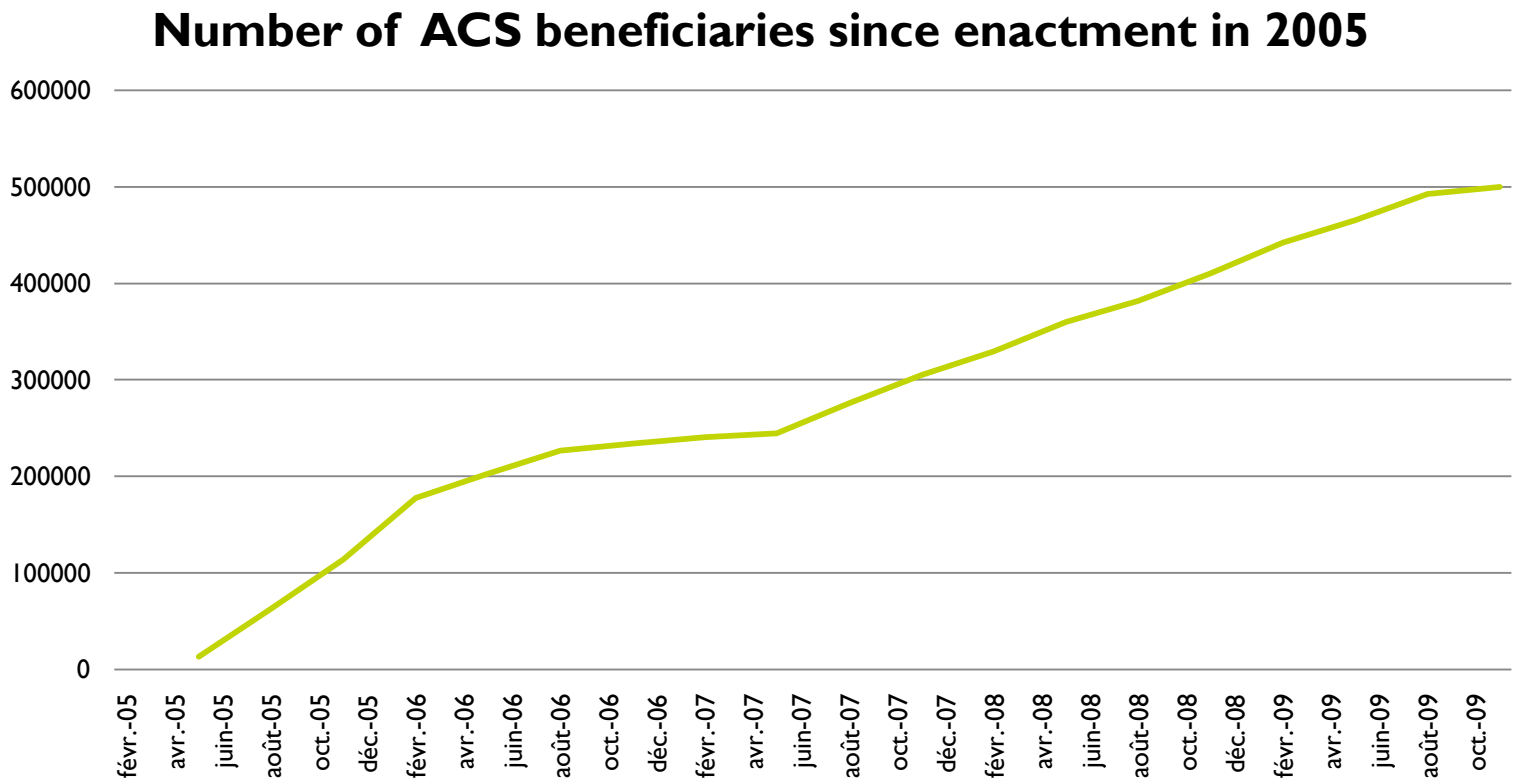
1. Context

- ACS is intended for people whose resources are between:
  - the CMUC eligibility threshold and (627€ for a single)
  - This threshold + 20% (752€)

- The voucher :
  - is delivered by mandatory health insurance offices
  - entitles to a price reduction for individual health insurance take-up
  - covers, in average, 50% of the health insurance price

- Estimated ACS- eligible population: 2 millions

1. Context


Number of ACS beneficiaries since enactment in 2005
600000
500000
400000
300000
200000
100000
0
févr.-05
avr.-05
juin-05
août-05
oct.-05
déc.-05
févr.-06
avr.-06
juin-06
août-06
oct.-06
déc.-06
févr.-07
avr.-07
juin-07
août-07
oct.-07
déc.-07
févr.-08
avr.-08
juin-08
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oct.-08
déc.-08
févr.-09
avr.-09
juin-09
août-09
oct.-09

1. Aims of the study

- Despite a regular increase in uptake, 5 years after being set up the program concerns only a little under 500,000 people.

- Three main hypotheses may be proposed to explain the weakness of the efficacy of this subvention:
  1. Unaffordability of health insurance despite this financial aid
  2. Lack of information (application process & program itself)
  3. Voluntary trade-off between private consumption and health coverage.

- In order to evaluate these hypotheses, we have developed an experiment with the National Health Insurance Fund.

1. Context & aims of the study

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2. Potential Outcome Model

- Interested in estimating the ***causal effect*** of participating in some treatment on future outcomes
- ***Treatment*** is very broadly defined: it might refer to an actual intervention, choice variable, individual behavior, endogenous variable

- **Counterfactual framework** (Rubin, 1974):
  - Each individual has two potential outcomes, Y_{i1} with treatment and Y_{i0} without treatment
  - Only one potential outcome is observed. The unobserved outcome is the ***counterfactual outcome***
  - For an individual the effect of participating in the treatment equals
    - $\Delta_i = Y_{i1} - Y_{i0}$
  - Δ_i is always unobserved because only one of the variable is observed
  - Let's define T an indicator for receiving treatment:
    - $T_i = 1$ if individual received treatment, 0 otherwise

2. Potential Outcome Model

- **3 parameters of interest:**
  - Average Treatment Effect **(ATE):**
    - $\Delta_{ATE} = E[Y_{i1} - Y_{i0}]$
  - Average Treatment Effect on the Treated **(ATET):**
    - $\Delta_{ATET} = E[Y_{i1} - Y_{i0} \backslash T_i = 1]$
  - Average Treatment Effect on the Untreated **(ATEU):**
    - $\Delta_{ATEU} = E[Y_{i1} - Y_{i0} \backslash T_i = 0]$

- **In practice:** $\Delta_N = [\bar{Y}_i \backslash T_i = 1] - [\bar{Y}_i \backslash T_i = 0]$
  - **Main problem:** treatment participation is often not independent of the potential outcomes, individuals self-select into treatment
  - Individuals with positive Δ_i are more likely to participate
  - If there is self-selection:
    - $E[Y_{i0}] \neq E[Y_{i0} \backslash T_i = 0]$ & $E[Y_{i1}] \neq E[Y_{i1} \backslash T_i = 1]$
  - Furthermore, we cannot estimate: $E[Y_{i0} \backslash T_i = 1]$ & $E[Y_{i1} \backslash T_i = 0]$

2. Potential Outcome Model

- **Several methods have been developed to take into account this bias, in particular:**
  - **Experimental design method**
    - Treatment is randomly assigned across individuals
    - So treatment is statistically independent of potential outcomes $(Y_{i0}, Y_{i1}) \perp T_i$
    - Random assignment solves the self-selection problem
      - $E[Y_{i0}] = E[Y_{i0} \backslash T_i = 0] = E[Y_{i0} \backslash T_i = 1]$ &
      - $E[Y_{i1}] = E[Y_{i1} \backslash T_i = 1] = E[Y_{i1} \backslash T_i = 0]$
    - This implies: $\Delta_N = \Delta_{ATE} = \Delta_{ATET} = \Delta_{ATEU}$
    - The *causal effect/treatment impact* can then be estimated by difference in means between treated and untreated groups.

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3. Experiment design

- A sample of 5,000 eligible households, according to their recorded resources, living in urban area in North of France (Lille city) and which were not previously benefiting from the ACS, has been randomly assigned into three groups:
  1. ***Control group*** benefiting from the current financial aid
  2. ***First treated group*** benefiting from a 50% voucher increase
  3. ***Second treated group*** benefiting from a 50% voucher increase and a social take-up support

- Proposed voucher amounts depend of the household composition:

Groups	- 25 years	25 – 59 years	60 years & +
Control	100€	200€	400€
Treated 1 & 2	175€	350€	650€

3. Experiment design

- The 3 groups received a letter explaining their eligibility to ACS and the amount of the voucher
- The 2nd treated group has been invited, one week later, to an information meeting provided by a social worker
- These households were followed-up during 6 months (Jan-July 09) and we recorded:
  - How many application forms were sent back
  - How many of them entitled to ACS
- We also obtained administrative data from the National Health Insurance Fund office in Lille (health insurance coverage, health care consomptions and expenditures, sexe, age, … of the experimented population)
- Today's presentation is based on these data

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4. Determinants of the demand for ACS

- **Descriptive statistics of the experimented population:**
  - Homogeneity between groups (random assignment)
  - Equal proportions of men and women
  - 80% are between 25 and 59 years old and 10% are under the age of 25
  - One month before experiment start, 1 insured person of 3 isn't cover by a CHI,
  - while 50% of the insured family spend more than 1000€ in 2008 (500€ per persons)

4. Determinants of the demand for ACS

- First outcome variable: Proportion of returned application forms
  1. Impact of the 50% voucher increase

Groups	Number of returned application forms	Total number of individuals	%
Control	241	1679	**14.4**
Treated 1	281	1685	**16.7**
Treated 2	229	1683	**13.6**
Total	**751**	**5047**	**14.9**

  - The proportion in the first treated group is significantly higher than in the control group (5% level)
  - Elasticity of the subvention increase is equal to 0.22

4. Determinants of the Demand for ACS

- **First outcome variable: Proportion of returned application forms**
  1. Impact of the 50% voucher increase
     - This result provides some support on the effect of financial incentives on health insurance demand
     - It is consistent with previous studies that have shown the relevance of financial constraint to explain health insurance demand (Bundorf et Pauly, 2006 ; Saliba and Ventelou, 2007 ; Grignon and Kambia-Chopin, 2009 ; Jusot, Perraudin, Wittwer, 2009)
     - But the proportion in the 2nd treated group is significantly lower than in the 1st treated group (pvalue = 0.01): and is not significantly different from the proportion in the control group (pvalue=0.532)
     - One explanation may be that some individuals have considered the information meeting as a compulsory step to get ACS

4. Determinants of the demand for ACS

- **First outcome variable: Proportion of returned application forms**
  2. Effect of the meeting participation

Treated 2 group	Number of returned forms	Total number of individuals	%
Went to the meeting	37	142	**26.1**
Did not go to the meeting	192	1541	**12.5**
Total	**229**	**1683**	**13.6**

- People who attended the meeting, more often returned an application form
- This result needs further analysis, in particular, we might have to control for self-selection issues

4. Determinants of the demand for ACS

- **Second outcome variable: Proportion of ACS notifications**

  1. ACS notifications and refusals
     - Sample of the experimented individuals were identified according to their recorded resources in 2007
     - However assessment of ACS eligibility is based on the resources twelve months preceding the application.
     - As the experiment started in Jan 2009, their resources might have change since Dec 2007

  ➔ Therefore, it exists two reasons for ACS refusal

     - Resources < ACS threshold ⇨ CMUC notification
     - Resources > ACS upper limit ⇨ ACS & CMUC refusals
     - Note that individuals cover by group-contract were not count in the amount of application forms studied

4. Determinants of the demand for ACS

- **Second outcome variable: Proportion of ACS notifications**

2. ACS notifications

Groups	Number of ACS approval	% (total individuals)	% (total application forms)
Control	112	6.7	46.5
Treated 1	160	9.5	56.9
Treated 2	131	7.8	57.2
Total	**403**	**8.0**	**53.7**

- The proportion of households benefiting from the ACS in the two treated groups is significantly higher than in the control group (pvalue =0.015)

4. Determinants of the demand for ACS

- **Second outcome variable: Proportion of ACS notifications**

3. Cases of ACS refusal

Groups	CMUC approval			Resources > upper limit		
	Nb	% (total)	% (forms)	Nb	% (total)	% (forms)
Control	27	1.6	11.2	102	6.1	42.3
Treated 1	28	1.7	9.9	96	5.5	33.1
Treated 2	22	1.3	9.6	76	4.5	33.2
Total	**77**	**1.5**	**10.3**	**271**	**5.4**	**36.1**

Probits for the probability of the demand for ACS: returned application forms (Marginal effects)

VARIABLES	Total	Control	Treated 1	Treated 2
Groups				
Control	ref	-	-	-
Treated 1	0.021*	-	-	-
Treated 2	-0.009	-	-	-
Age				-
- 25 years	-0.069***	-0.07**	-0.073**	-0.072**
25 – 59 years	-0.001	0.013	-0.051*	0.029
60 years & +	ref	ref	ref	ref
Is a woman	-0.025**	-0.026	-0.038*	-0.013
CHI status in 2008				
Not cover	ref	ref	ref	ref
CMUC	0.113**	-0.041	0.136	0.216*
cover	0.012	-0.000	0.006	0.028*

Variables	Total	Control	Treated 1	Treated 2
Insured family type				
Single adult	ref	ref	ref	ref
Single adult with children	-0.026***	0.015	-0.041*	-0.052***
Couple	0.083**	0.136**	0.018	0.117*
Couple with children	0.002	0.128	-0.012	0.005
ALD cares in 2008	0.049***	0.038	0.045*	0.061**
Health expenditures in 2008 (average per individuals)				
< =200€	-0.068***	-0.092***	-0.045	-0.06***
200€ - 500€	-0.051***	-0.049**	-0.037	-0.066***
500€ - 1300€	-0.027**	-0.032	-0.005	-0.042*
>= 1300€	ref	ref	ref	ref

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5. Determinants of meeting participation

- Probit for the probability of meeting participation (treated 2)

Variables	mfx	Variables	mfx
Age		**Insured family type**	
- 25 years	-0.064***	Single adult	ref
25 -59 years	-0.031	Single adult with children	0.025
60 years & +	ref	Couple	0.054
Is a woman	-0.011	Couple with children	0.053*
CHI Status in 2008		**Health care expenditures in 2008 (average per individuals)**	
Not cover	ref	<=200€	-0.051***
CMUC	-0.039	200€ – 500€	-0.058***
cover	-0.028*	500€ - 1300€	-0.024
		>= 1300€	ref

5. Impact of meeting on the demand of ACS

- **Object**: How to estimate the causal impact of meeting participation on the demand for ACS?

- Treatment is here define as meeting participation

- **First method: Matching (Rubin, 1974)**
  - Find two 'identical' individuals, one in the treated group and the other in the untreated group.
  - **Assumptions**:
    - Conditional independence: $(Y_{i0}, Y_{i1}) \perp T_i \backslash X_i$
    - Selection on observables
    - Common support: $0 < PR(T_i = 1 \backslash X_i) > 1$
  - Matching is most often used to estimate average treatment effect on the treated

5. Impact of meeting on the demand of ACS

- Suppose: N_1 individuals with treatment and N_0 without treatment :

$$ATET = \frac{1}{N_1}\sum_{i=1}^{N_1}\left(Y_{i1} - \sum_{j=1}^{N_0} W(i,j)Y_{j0}\right)$$

- W(i,j) is the weighting that compares individual i in the treatment group to individual j in the control group
- **Nearest-neighbor matching**:
  - W(i, j)=1 si j = $arg = min_{j \ldots N_0}(X_i - X_j)' \sum^{-1} (X_i - X_j)$
- **Propensity score matching** (Rosenbaum & Rubin, 1983):
  - Instead of matching on all X, we can match on p(X)

$$p(X_i) = PR(T_i = 1 \backslash X_i)$$

5. Impact of meeting on the demand of ACS

- **Propensity score matching** (Rosenbaum et Rubin, 1983):
  - Estimate propensity score nonparametricaly or with a logit
  - As shown by Irano, Imbens and Ridder, 2003:

$$ATE = \frac{1}{n}\sum_{i=1}^{n}\frac{T_i Y_i}{\hat{p}(X_i)} - \frac{(1-T_i)Y_i}{1-\hat{p}(X_i)}$$

$$ATET = \frac{\sum_{i=1}^{n}\hat{p}(X_i)\left(\frac{T_i Y_i}{\hat{p}(X_i)} - \frac{(1-T_i)Y_i}{1-\hat{p}(X_i)}\right)}{\sum_{i=1}^{n}\hat{p}(X_i)}$$

Probit for the probability of the demand for ACS (returned forms)			
Variables	mfx	Variables	mfx
Meeting	**0.1047*** **		
Age		**Insured family type**	
- 25 years	-0.066**	Single adult	ref
25 -59 years	-0.032	Single adult with children	-0.054***
60 years & +	ref	Couple	0.108
Is a woman	-0.129	Couple with children	0.001
CHI Status in 2008		**Health care expenditures in 2008 (average per individuals)**	
Not cover	ref	<=200€	-0.055**
CMUC	0.228*	200€ – 500€	-0.061***
cover	0.031*	500€ - 1300€	-0.039**
		>= 1300€	ref

Matching: Nnmatch: ATE= **0.086*** ** ATET=**0.107*** ** ATU=**0.084*** ** **△=0.136*** **

Psmatch: ATE= **0.089*** ** ATET= **0.108*** ** ATU=**0.087*** **

5. Impact of meeting on the demand of ACS

- **Second method: bivariate probit**
  - In order to take into account the **endogeneity** of the meeting variable
  - Two latent variables: Y_1^* for meeting participation and
  - Y_2^* for the demand for ACS

$$\begin{cases} Y_1^* = X_1\beta_1 + \varepsilon_1 \\ Y_2^* = X_2\beta_2 + \alpha Y_1 + \varepsilon_2 \end{cases}$$

  - The error terms follow a joint normal distribution function:

$$\begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \end{pmatrix} \rightarrow N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_1^2 & \rho\sigma_1\sigma_2 \\ \rho\sigma_1\sigma_2 & \sigma_2^2 \end{pmatrix}\right]$$

  - $Y_2^* = X_2\beta_2 + \alpha Y_1 + \rho\frac{\sigma_2}{\sigma_1}(Y_1^* - X_1\beta_1) + u$

5. Impact of meeting on the demand of ACS

- **Third method: endogenous switching probit**
  - In order to take into account the **selection bias** (observables and unobservables) and estimate ATE, ATT and ATU
  - This model parameterizes the potential outcomes:
  - $$Y_{i1} = X_{i1}\beta_1 + U_{i1}$$
    $$Y_{i0} = X_{i0}\beta_0 + U_{i0}$$
  - An individual can only be in one regime, determined by a selection equation: $T_i^* = Z_i\alpha + V_i$
  - With $T_i = I(T_i^* > 0)$
  - The error terms follow a joint normal distribution function:

$$\begin{bmatrix} U_{i0} \\ U_{i1} \\ V_i \end{bmatrix} \sim N\left(0, \begin{bmatrix} \sigma_0^2 & & \rho_0\sigma_0 \\ & \sigma_1^2 & \rho_1\sigma_1 \\ \rho_0\sigma_0 & \rho_1\sigma_1 & 1 \end{bmatrix}\right)$$

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Conclusion

- The amount of the voucher and the information meeting have a significant impact on the demand for ACS
- However the proportion of households who returned an application form to get ACS is globally low.
- This is consistent with previous studies that have shown the weak impact of subvention on health insurance purchases (Auerbach & Ohri, 2006 ; Marquis & Long, 1995 ; Thomas, 1995)
- Limits:
  - We don't know how many individuals do finally use the voucher
  - We only have information on reimbursed care and CHI coverage (AMELI) recorded by the National health insurance fund.
- Next steps:
  - Impact of the meeting: Control for potential selection bias on unobservables (by using information of survey data)
  - Approximate voucher use by analyzing CHI cover rate after the experiment

Thank you for your attention!