Journée de la Chaire Santé

Valuing Life as an Asset, as a Statistic and at Gunpoint

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1. Introduction
Motivation and outline

Different valuation methods to evaluate the price of human life

- **Human capital life value** : Prejudice caused to society by the death/injury of an individual (occupational, end-users' wrongful death litigation)—Present value of the net cash flow associated with human capital (asset pricing view)

$$v_{h,t}^{j} = \mathrm{E}_t \sum_{s=0}^{T_m} \left(\frac{1}{1+r} \right)^s D_{t+s}$$

where D_{t+s} denotes the net dividend at time $t+s$—marketed labor income *minus* all expenses to maintain human capital.

- **Value of a statistical life** :
  - ✓ Based on individual Willingness-To-Pay (WTP) to avoid small increases in exposure to death risk
  - ✓ Aggregation of individual WTP $\Rightarrow$ Collective WTP to save one unidentified (i.e. statistical) life.
  - ✓ **Example** : Suppose a population of size n and a change $\Delta = 1/n$ in death risk exposure. All agents are individually willing to pay $v_i(\Delta) = 1'000$. The **empirical** VSL is the **collective** WTP :

$$v_s = \sum_{i=1}^{1000} v_i(\Delta) = \frac{v_i}{\Delta} = 1\text{MM\$}.$$

    On the other hand, the **theoretical VSL** is the negative of the MRS between the probability of death and wealth/the marginal willingness-to-pay and is not observable !

TABLE : Comparison HK value and VSL (in $)

	Average HK life value	Average VSL
Poor	249 532	2 719 261
Fair	318 865	5 126 530
Good	388 198	7 239 006
Very Good	457 531	9 518 831
Excellent	526 864	11 864 750
Mean	420 729	3 351 519
Median	457 731	8 803 507
	Empirical literature	
	$\in [300, 900]$K$ [Huggett and Kaplan, 2016]	$\in [4.2, 13.7]$M$ [Robinson and Hammitt, 2016]

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VSL is **10-20** times larger than the HK value of life !...How can we explain and assess this large discrepancy of valuation methods ?

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- ✓ Provide **common** theoretical framework for HK, WTP, GPV and VSL.
- ✓ **Closed-form solutions** for HK, WTP, VSL and GPV values of life to evaluate :
  - Role of preferences, technological, distributional parameters.
  - Role of wealth, human capital
  - Shape of WTP.
  - Aggregation issues.

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  - Shape of WTP.
  - Aggregation issues.
- ✓ **Structurally** estimate WTP, three values with **common** data set.

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✓ VSL is appropriate when computing a collective value on small *indiscriminate* reductions on mortality for which society will ultimately end up paying the costs (e.g., public's safety) ;

✓ HK and GPV appear the better alternatives for wrongful death litigation or curative *vs* terminal care decisions.

Road map

1. Introduction
2. A common framework for life valuation
3. Values of life
4. Structural estimation
5. Discussion
6. Conclusion

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Economic environment

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- Planning horizon is limited by a stochastic age at death T^m :

$$\lim_{h \to 0} \Pr\left[T_m \in (t, t+h] \mid T_m > t\right] = \lambda_m$$

such that the probability of death by age t (death risk exposure) is monotone increasing in λ_m :

$$\begin{aligned} \mathcal{P}(t) &= \Pr\left(T_m \leq t\right) \\ &= 1 - \exp\left(-\lambda_m t\right) \end{aligned}$$

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- Changes in death risk exposure $\mathcal{P} \Leftrightarrow$ changes in the instantaneous death intensity λ_m

- Law of motion H_t

$$\mathrm{d}H_t = \left[I_t^{\alpha} H_t^{1-\alpha} - \delta H_t\right] \mathrm{d}t - \phi H_t \mathrm{d}Q_{st}$$

where $\mathrm{d}Q_{st}$ is a Poisson depreciation (morbidity) shock with constant intensity λ_{s0} that further depreciates the health stock by $\phi \in (0, 1)$.

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where $\mathrm{d}Q_{st}$ is a Poisson depreciation (morbidity) shock with constant intensity λ_{s0} that further depreciates the health stock by $\phi \in (0, 1)$.

- Budget constraint and income : Individuals can trade in two risky assets to smooth out shocks to consumption—stock and insurance *against* health depreciation

$$\begin{aligned} dW_t &= [rW_t + Y_t - c_t - I_t] \mathrm{d}t + \pi_t \sigma_S [\mathrm{d}Z_t + \theta \mathrm{d}t] \\ &\quad + x_t [\mathrm{d}Q_{st} - \lambda_{s0} \mathrm{d}t], \\ Y_t &= y + \beta H_t, \end{aligned}$$

where π_t denotes the risky portfolio and x_t the units of an actuarially-fair insurance.

Preferences

Stochastic Differential Utility (Duffie and Epstein, 1992) :

- Disentangle risk aversion γ from intertemporal elasticity of substitution ε ;
- Minimum subsistence consumption a ;
- Preference for life over death ;
- $V^m \equiv 0$;

$$U_t = E_t \int_t^{T_m} \left(f(c_\tau, U_\tau) - \frac{\gamma |\sigma_\tau(U)|^2}{2 U_\tau} \right) \mathrm{d}\tau,$$

where the age of death T_m is the first occurrence of a Poisson process with constant intensity λ_m and the Kreps-Porteus aggregator is :

$$f(c_t, U_t) = \frac{\rho\, U_t}{1 - 1/\varepsilon} \left(\left(\frac{c_t - a}{U_t} \right)^{1 - \frac{1}{\varepsilon}} - 1 \right).$$

Optimal allocation V, c, l, π, x

Theorem

Optima closed-form allocations are given by :

$$c_t = a + A(\lambda_m)N(W_t, H_t)$$

$$\pi_t = \frac{\theta}{\gamma\sigma_S}N(W_t, H_t)$$

$$x_t = \phi P(H_t)$$

$$l_t = \left(\alpha^{\frac{1}{1-\alpha}} B^{\frac{\alpha}{1-\alpha}}\right) P(H_t)$$

$$V_t(W_t, H_t, \lambda_m) = \Theta(\lambda_m)N(W_t, H_t)$$

- ✓ $N(W, H) = \underbrace{W}_{\text{Fin. Wealth}} + \underbrace{(y-a)/r}_{\text{NPV of fixed inc. stream}} + \underbrace{P(H)}_{\text{Shadow value} = \text{BH}}$
- ✓ Marginal value of N : $\Theta(\lambda_m) = \tilde{\rho}A(\lambda_{m0})^{\frac{1}{1-\varepsilon}} \geq 0$
- ✓ MPC : $A(\lambda_m) = \varepsilon\rho + (1-\varepsilon)\left(r - \lambda_m + 0.5\theta^2/\gamma\right) \geq 0$

3. Values of life
Human capital value of life

Proposition

The HK value of life $v_{h,t} = v_h(W_t, H_t, \mathcal{P}_0)$ *is the expected discounted present value over stochastic horizon* T_m *of labor revenue flows, net of investment costs,*

$$\begin{aligned} v_{h,t} &= E_t \int_0^{T^m} m_{t,\tau} \left[Y(H^*_\tau) - I^*_\tau \right] \mathrm{d}\tau \\ &= E_t \int_0^{T^m} m_{t,\tau} \left[y + (\beta H^*_\tau - I^*_\tau) \right] \mathrm{d}\tau \end{aligned}$$

where $m_{t,\tau} = m_\tau / m_t$ *with* $m_t = \exp\left(-rt - \theta Z_t - 0.5\theta^2 t\right)$*, and writes*

$$v_h(H, \lambda_m) = C_0 \frac{y}{r} + C_1 P(H)$$

$$\text{with} \quad C_0 = \frac{r}{r + \lambda_m} \quad \text{and} \quad C_1 = \frac{r - (\alpha B)^{\frac{\alpha}{1-\alpha}}}{r + \lambda_m - (\alpha B)^{\frac{\alpha}{1-\alpha}}}.$$

Willingness to pay

Definition

The willingness to pay $v = v(W, H, \mathcal{P}_0, \Delta)$ to avoid a permanent change $\Delta \in [\mathcal{P}_0, 1 - \mathcal{P}_0]$ in death risk exposure $\mathcal{P}$ solves

$$V(W - v, H, \mathcal{P}_0) = V(W, H, \mathcal{P}_0 + \Delta).$$

- ✓ $\Delta > 0$: Indifference between paying the equivalent variation $v > 0$ at base risk and not paying but facing higher death risk
- ✓ $\Delta < 0$: Indifference between receiving compensation $-v > 0$ and foregoing lower death risk exposure.

Proposition

The willingness to pay to avoid an admissible change $\Delta \in \mathcal{A}_m$ is :

$$v(W, H, \lambda_m, \Delta) = \left[1 - \frac{\Theta(\lambda_m^\star)}{\Theta(\lambda_m)}\right] N(W, H)$$

an increasing and concave function of Δ that is bounded by :

$$\inf_{\Delta \in \mathcal{A}_m} v(W, H, \lambda_m, \Delta) = \left[1 - \frac{\Theta(0)}{\Theta(\lambda_m)}\right] N(W, H)$$

$$\sup_{\Delta \in \mathcal{A}_m} v(W, H, \lambda_m, \Delta) = N(W, H)$$

with $\lambda_m^\star = \lambda_m + \delta$.

Value of a statistical life

Proposition

The value of a statistical life $v_s = v_s(W, H, \mathcal{P}_0)$ is the negative of the MRS between the probability of death and wealth computed from the indirect utility evaluated at base risk $\mathcal{P}_0$:

$$v_s = - \left. \frac{V_{\mathcal{P}}(W, H, \mathcal{P})}{V_W(W, H, \mathcal{P})} \right|_{\mathcal{P}=\mathcal{P}_0} .$$

and is given by

$$v_s(W, H, \lambda_m) = \frac{1}{A(\lambda_m)} N(W, H)$$

where $A(\lambda_m)$ is the MPC and N the net total wealth.

Equivalently, the VSL is also the marginal willingness to pay :

$$v_s(W, H, \mathcal{P}_0) = \left. \frac{\partial v(W, H, \mathcal{P}_0, \Delta)}{\partial \Delta} \right|_{\Delta=0} = \lim_{\Delta \to 0} \frac{v(W, H, \mathcal{P}_0, \Delta)}{\Delta}.$$

Theoretical VSL vs Empirical VSL

Definition

The empirical value of a statistical life, $v_s^e = v_s^e\left(W, H, \mathcal{P}_0, \Delta\right)$ is given by :

$$v_s^e(W, H, \mathcal{P}_0, \Delta) = \frac{v\left(W, H, \mathcal{P}_0, \Delta\right)}{\Delta}$$

for small increment $\Delta = 1/n$ where n is the size of the population considered.

- As $\Delta \to 0$, $v_s^e(W, H, \mathcal{P}_0, \Delta) \simeq v_s(W, H, \mathcal{P}_0)$;
- The bias $v_s^e - v_s$ depends on the curvature of the WTP and Δ.

Gunpoint value of life

Proposition

The gunpoint value $v_g = v_g(W, H, \mathcal{P}_0)$ is the WTP to avoid certain, instantaneous death and it solves :

$$V(W - v_g, H, \mathcal{P}_0) = V^m$$

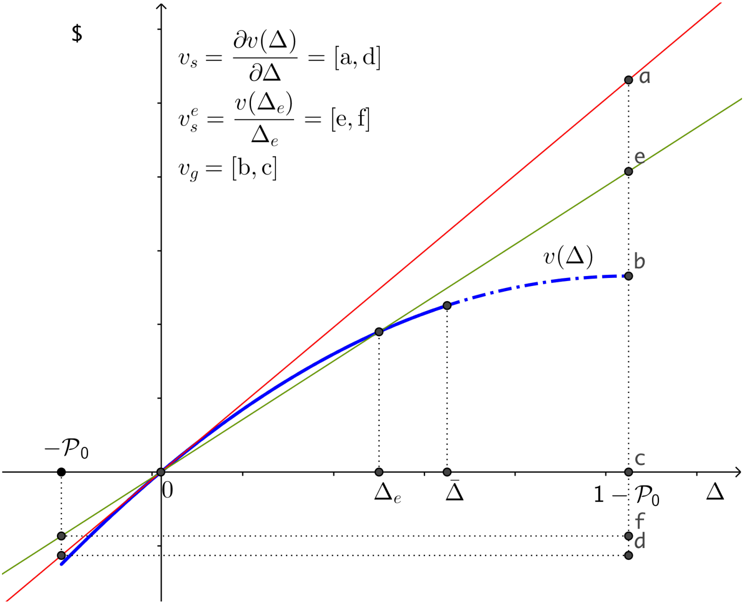
where V^m is the utility at death, and is given by

$$v_g(W, H) = N(W, H) \equiv W + \frac{y - a}{r} + BH.$$

- ✓ Unless y/r is large, $v_g(W, H) - v_h(W, H, \lambda_m) \geq 0$;
- ✓ $v_g(W, H) = A(\lambda_m) v_s(W, H, \lambda_m) < v_s(W, H, \lambda_m)$;
- ✓ $g(c_t - a) = g(v_{s,t}) = g(v_{g,t})$.

To summarize

return



4. Structural estimation

- Econometric model

$$\mathbf{Y}_j = \mathbf{B}(\theta)\mathbf{X_j} + \mathbf{u_j}$$

where

$$\mathbf{Y}_j = [c_j, \pi_j, x_j, I_j, Y_j]'$$
$$\mathbf{X}_j = [1, W_j, H_j]$$

- Data : PSID 2013
  - ✓ Health : "Poor" to "Excellent" using self-reported status (household head).
  - ✓ Financial wealth = risky (stocks in publicly held corporations, mutual funds, investment trusts, private annuities, IRA's or pension plans) plus riskless assets (checking accounts plus bonds plus remaining IRA's and pension).

Estimation of structural parameters

Parameter	Value	Parameter	Value
	a. Law of motion health		
α	0.6843	δ	0.0125
	(0.3720)		(0.0060)
ϕ	0.0136^c		
	b. Sickness and death intensities		
λ_s	0.0347	λ_m	0.0283
	(0.0108)		(0.0089)
	d. Preferences		
γ	2.8953	ε	1.2416
	(1.4497)		(0.3724)
a	0.0140^c	ρ	0.0500^c

Value of Statistical Life *vs* HK Value

Wealth quintile level	Health level				
	Poor	Fair	Good	Very Good	Excellent
	a. Value of Statistical Life v_s				
1	2 167 573	4 379 551	6 591 529	8 803 507	11 015 485
2	2 168 877	4 380 874	6 593 136	8 805 188	11 017 133
3	2 188 829	4 400 253	6 614 190	8 827 429	11 040 023
4	2 360 907	4 582 287	6 800 733	9 021 052	11 238 999
5	4 710 118	7 889 684	9 595 444	12 136 981	15 012 108
All					
- mean	8 351 519				
- median	8 803 507				
	b. Human Capital Value of Life v_h				
	251 968	323 127	394 287	465 446	536 606
All					
- mean	437 756				
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Gunpoint Value of Life *vs* HK Value

Wealth quintile level	Health level				
	Poor	Fair	Good	Very Good	Excellent
	a. Gunpoint Value of Life v_g				
1	116 121	234 620	353 120	471 619	590 119
2	116 191	234 691	353 206	471 709	590 207
3	117 259	235 729	354 334	472 901	591 433
4	126 478	245 481	364 327	483 274	602 093
5	252 329	422 664	514 045	650 199	804 225
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- mean			447 405		
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- HK and GPV appear the better alternatives for wrongful death litigation or curative *vs* terminal care decisions.

Extensions

✓ Endogenous mortality and morbidity

$$\lambda_m(H_{t-}) = \lim_{\tau \to 0} \frac{1}{\tau} P_t\left[t < T_m \leq t + \tau\right] = \lambda_{m0} + \lambda_{m1} H_{t-}^{-\xi_m}$$
$$\lambda_s(H_{t-}) = \eta + \frac{\lambda_{s0} - \eta}{1 + \lambda_{s1} H_{t-}^{-\xi_s}}$$

✓ Ageing : Time-varying parameters $\lambda_{m,t}$, $\lambda_{s,t}$, ϕ_t, δ_t or β_t.

✓ SHARE data

✓ Immortal Life Value : WTA a compensation to renounce to perpetual life

Results remain applicable and are robust.

6. Conclusion

Questions	Findings HK	VSL	GPV
Theoretical links ?			
- Common framework	Dynamic human capital model		
- Willingness to pay	Incr. **concave, bounded**		
- Life valuations	ENPV(Div.)	MWTP	Limiting WTP* ENPV(excess cons.)
Role of primitives ?			
- Technological	✓	✓	✓
- Depreciation risk	✓	✓	✓
- Mortality risk	✓	✓	x
- Preferences	x	✓	x
Robust. of reduced-form findings ?	Yes, VSL $\gg$ HK $\approx$ GPV		
- Struct. est. life values	420 K$	8.35 M$	447 K$
Reasons for differences ?			
- Different model, data ?	No		
- Model specific ?	No		
- Assumptions ?	Yes, **curvature** of WTP		

Overview of Gunpoint Value

- Hicksian Equivalent Variation (EV) : (Maximal) willingness to pay (WTP) to avoid unfavorable event (death).
- Highwaymen question :

  > *What is the amount you would be willing to pay in order to survive in a credible "your money or your life" highwayman threat or, equivalently, how much would you value your own life ?*

- **Gunpoint Value of Life** (GPV), i.e. the equivalent variation that leaves the agent indifferent between remaining alive and *certain* death.

Return

HK, VSL and GPV

A few comments, from the trenches…

Puzzles

- (Excessively?) high levels of revealed VSL estimates (or weak ambition of, for exemple, environmental health policies)
- Lack of complete understanding of the magnitude of the HK/VSL discrepancy
- Questions about the appropriateness of VSL to assess complex morbidity/ mortality impacts?
- « Uncertain » coherence of VSL/QALY valuations…
- Relevance of use of VSL values by Courts (litigation)?

SUMMARY OF MORTALITY VALUATION ESTIMATES (MILLIONS OF 2006$)

STUDY	TYPE OF ESTIMATE	VALUATION (MILLIONS 2006$)
Kneisner and Leeth (1991) (US)	Labor Market	$ 0.9
Smith and Gilbert (1984)	Labor Market	$ 1.1
Dillingham (1985)	Labor Market	$ 1.4
Butler (1983)	Labor Market	$ 1.7
Miller and Guria (1991)	Contingent Valuation	$ 1.9
Moore and Viscusi (1988a)	Labor Market	$ 3.9
Viscusi, Magat, and Huber (1991b)	Contingent Valuation	$ 4.2
Gegax et al. (1985)	Contingent Valuation	$ 5.1
Marin and Psacharopoulos (1982)	Labor Market	$ 4.3
Kneisner and Leeth (1991) (Australia)	Labor Market	$ 5.1
Gerking, de Haan, and Schulze (1988)	Contingent Valuation	$ 5.2
Cousineau, Lacroix, and Girard (1988)	Labor Market	$ 5.6
Jones-Lee (1989)	Contingent Valuation	$ 5.9
Dillingham (1985)	Labor Market	$ 6.0
Viscusi (1978, 1979)	Labor Market	$ 6.3
R.S. Smith (1976)	Labor Market	$ 7.1
V.K. Smith (1976)	Labor Market	$ 7.2
Olson (1981)	Labor Market	$ 8.0
Viscusi (1981)	Labor Market	$ 10.0
R.S. Smith (1974)	Labor Market	$ 11.1
Moore and Viscusi (1988a)	Labor Market	$ 11.3
Kneisner and Leeth (1991) (Japan)	Labor Market	$ 11.7
Herzog and Schlottman (1987)	Labor Market	$ 14.0
Leigh and Folson (1984)	Labor Market	$ 15.0
Leigh (1987)	Labor Market	$ 16.0
Garen (1988)	Labor Market	$ 20.8
Source: Viscusi, 1992 and EPA analysis.		

Basics: WTPs and VSL

- EU= (1-p) u(N) + p V^m with (exogeneous) N=W+ (net) HK , and (if u(0)=0 and u concave) u'(N)< u(N)/N)

- if V^m =0 then WTP(Δ): (1- p_0 -Δ)u(N)= (1-p) u(N-WTP)

- Consequences:

  - Small modification of risk (marginal compensation cf BCA)

    VSL=« WTP(dp) / dp »=u/((1- p_0)u')

    hence VSL>N/(1- p_0) for risk-adverse agents,
    and VSL→∞ when p_0 →1(dead-anyway effect)

  - Extreme modification: WTP((1- p_0))= N….=GPV

The paper provides…

- an encompassing framework to define HK,VSL and GPV in a generic human capital problem, with probabilities of death by age…
- a specific version of this general model of human capital and assets accumulation; derivation of optimal rules; estimation of structural parameters
- Estimates of VSL, HK and GPV,respectively:
  - 8.3M$ for VSL, 0.4M$ for HK and GPV
  - VSL 18.6 times higher…in a completely consistent framework.

(But) concavity matters for WTPs!…

Are these figures « human life valuations »

- Shelling:The VSL should not be interpreted as the value of a given human being; I must choose a nondescriptive title to avoid initial misunderstanding; it's not the worth of a human life that I shall discuss, but of life saving, of preventing death…cf note 6
- Tirole: *Beaucoup reprochent aux économistes de ne pas tenir assez compte des problèmes d'éthique, réclament une frontière claire entre domaines marchand et non marchand. Certains de ces débats reflètent une méconnaissance de nombreux travaux d'économistes, théoriques et expérimentaux … Certes l'introduction de considérations financières heurte nos vues sur le caractère sacré de la vie humaine. La vie « n'a pas de valeur ». Les choix budgétaires en matière de santé (au sein d'un hôpital ou entre différentes recherches) peuvent pourtant faire baisser ou monter la mortalité…*

Meaning of these figures

- VSL (Hammitt): L'objectif de la quantification est d'aider à déterminer si la variation nette des risques pour la santé associés à une intervention justifie le coût d'opportunité des ressources utilisées pour l'atteindre.
- HK: market value of skills/health assets

  →market rate of return of such investments
- What is the question for GPV? Relevance for social choices?

Question 2

- « For purposes such as wrongful death litigation, curative vs terminal care decisions, the HK and GPV appear the better alternatives ». Is this completely proven by the paper?
- Litigation: need to distinguish distributive (effective compensation) and incentives impacts of liability rules?
- Terminal care rules: health insurance as highwaymen? Or ex ante rules defined under veil of ignorance?

Subjective Uncertainty on longevity

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Journée de la Chaire Santé
March 30, 2018

Pourquoi s'intéresser à l'incertitude des individus quant à leur longévité ?

- Estimer les anticipations des individus en matière de longévité permet :
  - de mieux comprendre leurs comportements : âge de départ en retraite, demande d'assurance dépendance, comportements de prévention, comportements à risque,...
  - d'aller plus loin que les seules tables de mortalité

- Littérature abondante sur les anticipations des individus en matière de longévité, avec une mesure de l'EV anticipée :
  - à partir d'une question directe (Hamermesh and Hamermesh, 1983 ; Hamermesh, 1985 ; Mirowsky, 1999 ; Mirowsky and Ross, 2000 ; Brouwer et al., 2005)
  - ou à partir d'un recueil de probabilités de survie (Hurd and McGarry, 1995 ; Liu, Tsou et Hammit, 2007 ; Perozek, 2008 ; Hurd, 2009 ; Peracchi and Perotti, 2011 ; Delavande and Rohwedder, 2011 ; ...)

Pourquoi s'intéresser à l'incertitude des individus quant à leur longévité ?

- Principaux résultats :
  - Les individus utilisent l'information rationellement : impact < 0 des maladies ; impact de la longévité des parents.
  - Sur données longitudinales, corrélation élevée entre les EV anticipées et les décès observés

- En revanche, il n'existe aucune étude sur l'incertitude individuelle quant à cette longévité anticipée.

Pourquoi s'intéresser à l'incertitude des individus quant à leur longévité ?

- Pourtant, celle ci peut également expliquer les comportements de prévention, les décisions de départ en retraite, la demande d'assurance dépendance :
  - ex : si l'incertitude est élevée, les individus peuvent être réticents à reculer l'âge de la retraite, car rien ne leur garantit la durée passée en retraite.
  - ex : l'arrêt du tabac permet d'augmenter l'espérance de vie de quelques années - mais ce gain est relativisé si l'incertitude sur son espérance de vie est élevée.
    $\Rightarrow$ L'efficacité des campagnes de prévention (tabac, obésité) peut donc être limitée si l'incertitude des individus est élevée.

Objet de l'étude

- Etudier l'incertitude des individus quant à leur longévité.
- Receuil des probabilités de survie : enquête auprès de 3331 individus en 2009
- 1- Construction d'une mesure de SLE (subjective life expectancy) et de SUL (subjective uncertainty on longevity)
- 2- Analyse de cette incertitude
  - L'incertitude est-elle élevée ?
  - Son ampleur varie t-elle en fonction des caractéristiques socio-démographiques des individus et de leur information privée (maladies, longévité des parents,...)
  - Est-elle corrélée avec les comportements à risque/les comportements de prévention des individus ?

Les données

Description des données (1)

- 3331 individus interrogés en novembre et décembre 2009
- Entretiens en face à face (45 minutes) - méthode CAPI
- Questionnaire en 5 volets :
  - Caractéristiques socio-démographiques
  - Nombreuses variables d'état de santé : maladies "objectives", limitations fonctionnelles, SAH (0-100)
    et relatives aux modes de vie : tabac, alcool, IMC
  - Probabilités de survie pour la décennie en cours et futures
  - Mais aussi : arbitrage des individus entre santé et revenus ("revenu équivalent santé" (Fleurbeay et al., 2013 ; Schokkaert et al., 2014 ; Samson et al., 2017)) + Anticipations jointes en matière de santé et de revenu (Luchini et al., 2018)

Recueil des probabilités de survie

Chaque individu est interrogé sur sa probabilité de survie à différents âges :

Q5.1 A votre avis, quelles chances avez-vous de vivre au-delà de 50 ans ?

0% 5% 10% 15% 20% 25% 30% 40% 50% 60% 70% 80% 90% 100%

Au-delà de 60 ans ?

0% 5% 10% 15% 20% 25% 30% 40% 50% 60% 70% 80% 90% 100%

Au-delà de 70 ans ?

0% 5% 10% 15% 20% 25% 30% 40% 50% 60% 70% 80% 90% 100%

Au-delà de 80 ans ?

0% 5% 10% 15% 20% 25% 30% 40% 50% 60% 70% 80% 90% 100%

Au-delà de 90 ans ?

0% 5% 10% 15% 20% 25% 30% 40% 50% 60% 70% 80% 90% 100%

$\rightarrow$ 1 seule réponse uniquement

$\rightarrow$ "NSP", "refus" sont autorisées

Recueil des probabilités de survie

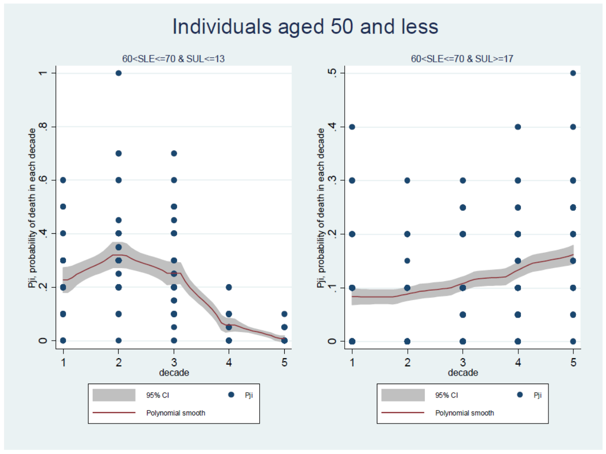
- 1- Tous les individus ne répondent pas au même nombre de questions :
  - Un individu de moins de 51 ans donne 5 probas de survie
  - Un individu entre 51 et 60 ans donne 4 probas de survie
  - ...
  - Un individu entre 81 et 90 ans donne 1 probas de survie
- 2- Les réponses aux questions sont contraintes : on ne peut pas déclarer une probabilité strictement supérieure à celle donnée à la question précédente.
  $\Rightarrow$ Les probas de survie sont, par construction, faiblement décroissantes avec l'âge
- 3- Potentiel biais de sélection : 86% de l'échantillon a répondu à toutes les probas de survie demandées.

Mesure de SLE et de SUL

- Soit $\widehat{p_{j,i}}$ la proba subjective, donnée par l'individu i, de mourir dans la décennie j.
  et x_i est la durée de la vie de l'individu i.
- $E_i(x_i) = \sum_j \widehat{p_{j,i}} x^j$
  où x^j est l'âge moyen au décès observé chez les individus de la décade j (Hypothèse 3)
- $V_i(x_i) = \sum_j \widehat{p_{j,i}} (x^j - E_i(x_i))^2$
- On notera :

$$SLE = E_i(x_i) \text{ et } SUL = \sqrt{V_i(x_i)}$$

Relation entre SUL et les probabilités de décès



Qu'y a t-il derrière cette mesure d'incertitude ?

- Dans notre enquête, il peut y avoir trois types d'incertitude :
  - Les individus connaissent leurs probabilités de survie à chaque âge et leur distribution de probabilités traduit le fait qu'ils sont incertains sur leur longévité ⇒ "risque probabiliste"
  - Les individus ne connaissent pas (ou sont incertains) leurs probabilités de survie à chaque âge ⇒ "ambiguité"
  - Les probabilités données par les individus souffrent de problèmes d'élicitation qui introduisent du bruit (ex : biais vers 0.5) ⇒ "bruit"
- On ne peut distinguer "ambiguité" et "bruit" dans nos données
- Notre mesure de l'incertitude ne reflète t-elle que de l'ambiguité ?
- Ou reflète t-elle aussi le fait que les individus observent la variabilité dans les âges au décès de leurs pairs, ou utilisent de l'information privée pour former leurs probabilités de survie ?

Informations disponibles sur l'état de santé

Indicateurs de santé "objectifs" : liste des maladies au cours des 12 derniers mois

14 groupes de maladies ; 45 maladies listées + questions ouvertes

⇒ 453 maladies

Q2.1 Nous allons vous proposer une liste de maladies et de problèmes de santé. Pour chaque maladie ou problème de santé, pouvez-vous préciser :

- **Si vous avez souffert de cette maladie ou problème de santé au cours des 12 derniers mois?**

Si le répondant a souffert de la maladie cochez la première case

- **Combien de temps cela vous a-t-il affecté (en semaines) ?**

Si le répondant répond en mois, multiplier par 4 pour convertir en semaines

- **Si vous avez reçu un traitement pour cette maladie ou problème de santé au cours des 12 derniers mois ?**

Si le répondant a été traité au cours des 12 derniers mois, cochez la seconde case.

Q2.1.1. Maladies cardiovasculaires

Hypertension artérielle......	□	...... semaines	□ traitement
Angine de poitrine	□	...... semaines	□ traitement
Infarctus du myocarde de moins de 5 ans .	□	...... semaines	□ traitement
Infarctus du myocarde de plus de 5 ans.....	□	...... semaines	□ traitement
Troubles du rythme cardiaque	□	...... semaines	□ traitement
Accident vasculaire cérébral avec séquelle ...	□	...... semaines	□ traitement
Accident vasculaire cérébral sans séquelle ...	□	...... semaines	□ traitement
Artérite des membres inférieurs (maladie des artères)	□	...... semaines	□ traitement
Varices, ulcère de jambe................................	□	...... semaines	□ traitement
Hémorroïdes..	□	...... semaines	□ traitement
Autres, précisez :	□	...... semaines	□ traitement

Q2.1.2. Cancer(s). Précisez localisation et année du diagnostic

a 1. .... c |_|_|_|_|

b 2. .... d |_|_|_|_|

Q2.1.3. Maladies respiratoires et ORL

Bronchite chronique....................................	□	...... semaines	□ traitement

Informations disponibles sur l'état de santé

- Nécessiter de synthétiser l'information sur les maladies pour examiner le lien entre les maladies, la longévité anticipée et l'incertitude.
- Les maladies sont classées en 4 groupes en fonction de leur degré de risque vital :
  - Maladies de type "N" : pas de risque vital (ex : otite, sinusite, migraine)
  - Maladies de type "A" : risque vital aigü
    Risque de décès initialement accru (au cours des premières années de la maladie) ; pour les survivants, espérance de vie comparable à celle de la population générale (ex : méningite, dépression)

Informations disponibles sur l'état de santé

- Maladies de type "C" : risque vital chronique
  Risque de décès comparable à la population indemne de la maladie au cours des premières années ; espérance de vie réduite sur le long terme (ex : diabète, cholesterol)
- Maladies de type "AC" : risque vital aigü et chronique
  Combinaison des deux possibilités ; le risque de décès est durablement supérieur à celui de la population générale (ex : cancer, infarctus, crise cardiaque)

Statistiques descriptives

Variables utilisées dans les régressions

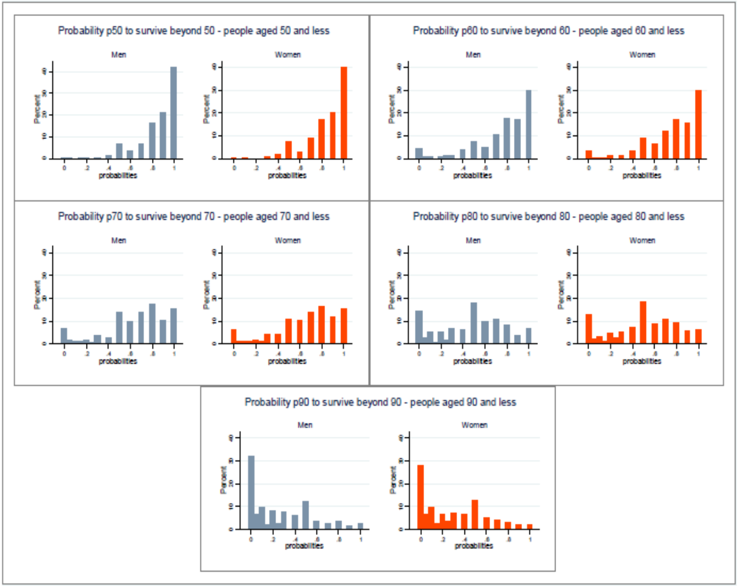
		Women	Men	p-value
Socio-economic characteristics				
Age	Age	47.75 (18.56)	46.61 (17.62)	0.116
Gender	Gender	0.52	0.48	0.000
Education	No diploma	0.12	0.08	0.002
	Primary School certificate	0.12	0.09	0.003
	Junior High school diploma	0.34	0.40	0.003
	High school diploma	0.16	0.17	0.769
	University $\leq$ 2 years	0.13	0.11	0.048
	University $\geq$ 3 years	0.13	0.16	0.033
	Other diploma	0.001	0.002	0.426
Income	Income ≤ 875 €	0.29	0.21	0.000
	Income $\in [875 - 1290]$ €	0.26	0.23	0.167
	Income $\in [1290 - 1800]$ €	0.24	0.27	0.056
	Income > 1800 €	0.21	0.28	0.000
Health Insurance	National Health Ins. only	0.05	0.07	0.018
	Complementary Ins.	0.88	0.87	0.323
	CMUC (Comp. Ins. for low-income ind.)	0.06	0.05	0.045
Family Situation	Marital life	0.55	0.62	0.000
	At least one child	0.45	0.35	0.000
Health				
Vital Risks	0 illness of type N	0.14	0.22	0.000
	1-2 illnesses of type N	0.33	0.42	0.000
	$\geq$ 3 illnesses of type N	0.53	0.36	0.000
	0 illness of type AC	0.80	0.83	0.033
	1 illness of type AC	0.16	0.13	0.029
	$\geq$ 2 illnesses of type AC	0.04	0.03	0.794
	0 illness of type A	0.87	0.93	0.000
	$\geq$ 1 illnesses of type A	0.13	0.07	0.000
	0 illness of type C	0.68	0.68	0.934
	1 illness of type C	0.21	0.21	0.728
	$\geq$ 2 illnesses of type C	0.10	0.11	0.520
Functional Limitations	Difficulties to walk	0.17	0.12	0.000
	Bed-ridden	0.12	0.09	0.003
	Difficulties in everyday activities	0.21	0.14	0.000
	Pain	0.39	0.32	0.0008
Lifestyles	Smoker (individual currently smokes)	[illegible]	[illegible]	[illegible]

Variables utilisées dans les régressions

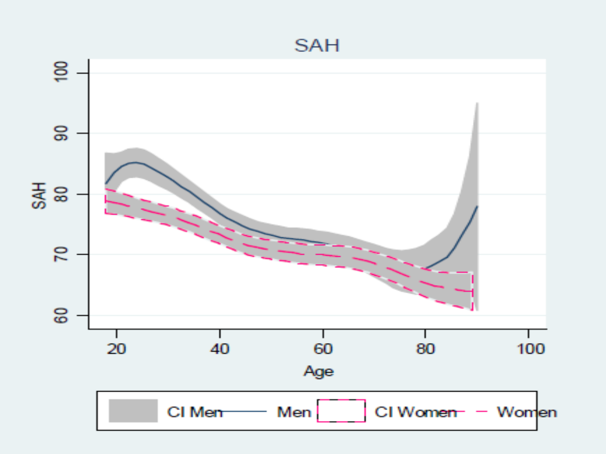
Lifestyles	Smoker (individual currently smokes)	0.32	0.40	0.000
	Underweight (BMI≤18.5)	0.05	0.01	0.000
	Normal weight(18.5<BMI≤25)	0.51	0.49	0.239
	Overweight (25<BMI≤30)	0.22	0.34	0.000
	Obese (30<BMI≤35)	0.11	0.09	0.251
	Severely obese (BMI>35)	0.07	0.06	0.205
	No alcohol	0.34	0.19	0.000
	Alcohol - no risk	0.63	0.75	0.000
	Alcohol - risky behaviour (1)	0.03	0.07	0.000
Parent death and age of death	Father alive (%)	0.47	0.48	0.873
	Father alive (age)	63.4 (11.99)	63.7 (11.88)	0.638
	Father deceased (age at death)	68.7 (15.43)	68.6 (14.67)	0.913
	Mother alive (%)	0.64	0.66	0.335
	Mother alive (age)	64.6 (13.29)	64.7 (12.99)	0.848
	Mother deceased (age at death)	71.6 (17.64)	74.6 (15.67)	0.004
Health and Longevity	*SAH*	72.12 (21.15)	75.85 (18.63)	0.000
	SLE	78.79 (9.72)	77.32 (9.66)	0.0002
	SUL	10.66 (5.48)	10.44 (5.04)	0.316
Number of Observations		1,504	1,292	

Probabilités de survie subjectives

Information initiale recueillie dans l'enquête :

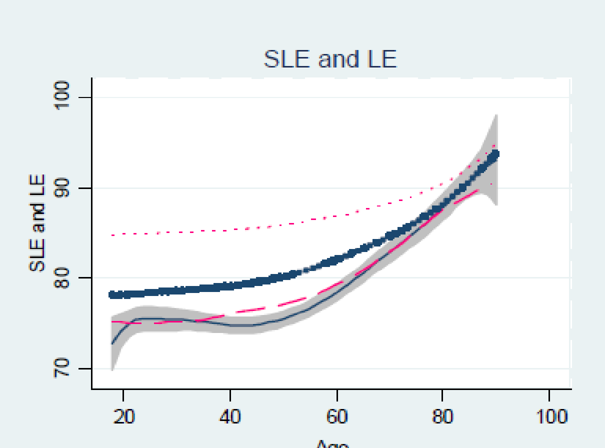


Evolution de SAH avec l'âge



Evolution de la longévité anticipée avec l'âge

- SLE augmente avec l'âge
- on ne retrouve pas le gender gap observé dans les tables de mortalité
- hommes et femmes sont pessimistes (surtout les femmes) - la sous-estimation de leur EV diminue avec l'âge



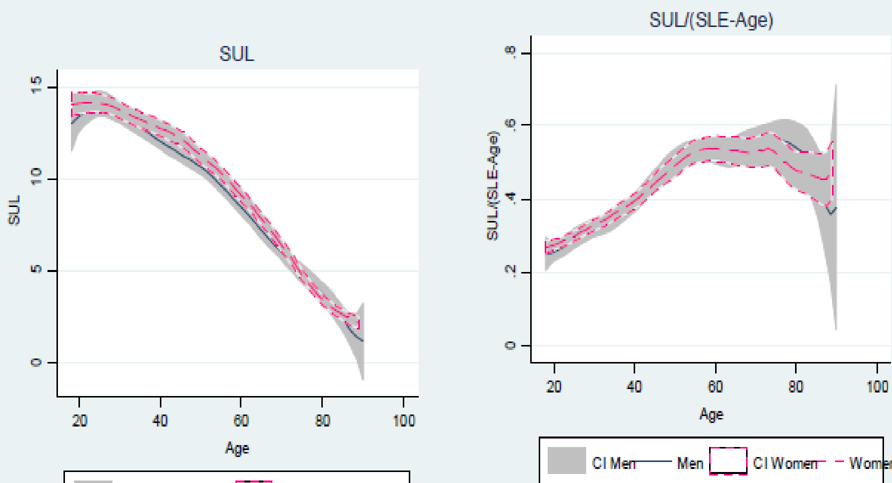
Variance inter-individuelle de SLE

- Variabilité inter-individuelle de SLE est élevée
- Ampleur comparable avec la variabilité des âges au décès observée dans les tables de mortalité

	Age	40	50	60	70	80
SD of age at death	Men	12.1	10.9	9.5	9	10.8
(Life Table 2009)	Women	11.1	10.2	9.3	8.7	9.4
Average SUL	Men	11.4	11.5	9.0	5.6	4.9
(Sample)	Women	12.9	11.5	9.4	6.1	3.8
SD of SLE	Men	10.8	9.1	6.2	6.6	2.4
(Sample)	Women	11.5	8.6	7.4	5.1	4.0

Evolution de l'incertitude avec l'âge

- SUL décroit avec l'âge
- mais augmente avec l'âge quand SUL est normalisé par le restant de vie (subjectif)



L'incertitude est-elle élevée ?

- chez les individus de 40 à 60 ans : SUL est d'ampleur comparable avec la variance des âges au décès observée dans les tables de mortalité
- mais chez les individus de 70, 80 ans : SUL est plus faible que la variance des âges au décès observée dans les tables de mortalité
  $\Rightarrow$ les individus ont acquis de l'information privée après 60 ans
  $\Rightarrow$ SUL procure de l'information supplémentaire et complémentaire par rapport aux seules tables de mortalité

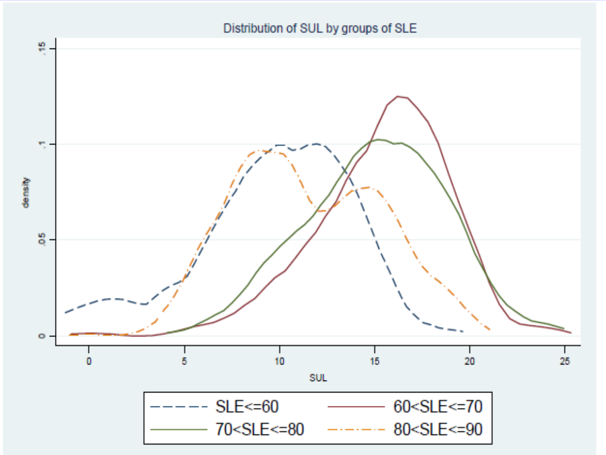
	Age	40	50	60	70	80
SD of age at death	Men	12.1	10.9	9.5	9	10.8
(Life Table 2009)	Women	11.1	10.2	9.3	8.7	9.4
Average SUL	Men	11.4	11.5	9.0	5.6	4.9
(Sample)	Women	12.9	11.5	9.4	6.1	3.8
SD of SLE	Men	10.8	9.1	6.2	6.6	2.4
(Sample)	Women	11.5	8.6	7.4	5.1	4.0

L'incertitude est-elle élevée ?

- Qu'elle soit d'ampleur comparable aux tables de mortalité, ou un peu plus faible, l'incertitude est cependant élevée.
- Calcul d'un IC à 95% pour la longévité :
  $\rightarrow CI_i = [SLE_i \pm 2 * SUL_i]$
- Individus de 50 ans et moins : les bornes moyennes sont $[50,1; 101,5]$
  avec Q3 de la borne inférieure = 60 ans
  avec Q1 de la borne supérieure = 96.7 ans
  $\Rightarrow$ l'IC est très large et apporte donc très peu d'information sur les longueurs de vie anticipées par les individus
- Individus de plus de 80 ans : les bornes moyennes sont $[86.1; 94.8]$
  $\Rightarrow$ l'IC se resserre

Relation entre SLE et SUL

- les individus optimistes et pessimistes ont un SUL plus faible
- Grande variabilité de l'incertitude



L'espérance de vie anticipée et l'incertitude vis à vis de cette longévité varient-elles en fonction des caractéristiques sociodémographiques des individus, de leur état de santé, de leur modes de vie et de la longévité observée de leurs parents ?

Spécification économétrique

- On examine la **corrélation** entre SLE ou SUL et quelques déterminants
- Modèle SURE à 3 équations, estimé séparément pour les hommes et les femmes :

$$\begin{aligned}(\mathrm{I})\ SAH_i &= VR_i'\alpha_1 + X_{1,i}'\beta_1 + Z_i'\delta + u_{1,i} \\ (\mathrm{II})\ SLE_i &= \gamma_2 SAH_i + VR_i'\alpha_2 + X_{2,i}'\beta_2 + u_{2,i} \\ (\mathrm{III})\ SUL_i &= \gamma_3 SAH_i + VR_i'\alpha_3 + X_{2,i}'\beta_3 + u_{3,i}\end{aligned}$$

avec $(u_{1,i}, u_{2,i}, u_{3,i}) \hookrightarrow N(0, \Sigma)$

- Notre spécification permet de prendre en compte une possible corrélation entre les perturbations des 3 équations

Spécification économétrique

- Potentiel biais de sélection ?
  $\rightarrow$ procédure d'Heckman en 2 étapes avec introduction du ratio de Mills : on ne rejette pas l'hypothèse d'absence de biais de sélection

- Potentielle non exogénéité de la variable SAH dans les équations (II) et (III) ?
  $\rightarrow$ test d'Hausman suite à une estimation 2SLS conduit à ne pas rejeter l'hypothèse d'exogénéité de SAH

Résultats des estimations - SAH

	Women			Men		
	(1) SAH	(2) SLE	(3) SUL	(1) SAH	(2) SLE	(3) SUL
AGE						
Age	-0.255	-0.281***	0.015	-0.552**	-0.270**	0.031
	(0.222)	(0.104)	(0.053)	(0.216)	(0.115)	(0.057)
Age^2	0.002	0.005***	-0.002***	0.004**	0.005***	-0.002***
	(0.002)	(0.001)	(0.000)	(0.002)	(0.001)	(0.000)
HEALTH						
SAH	-	0.084***	0.008	-	0.114***	-0.005
		(0.012)	(0.006)		(0.014)	(0.007)
Vital Risks:						
0 illness of type N	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
1-2 illnesses of type N	-5.564***	-0.145	0.827**	-2.656**	-0.475	0.133
	(1.426)	(0.671)	(0.345)	(1.118)	(0.593)	(0.292)
$\geq$ 3 illnesses of type N	-9.869***	-0.766	0.744**	-6.059***	-0.976	0.175
	(1.432)	(0.669)	(0.344)	(1.249)	(0.649)	(0.320)
0 illness of type AC	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
1 illness of type AC	-6.890***	-1.344**	-0.103	-3.570***	-0.989	0.318
	(1.250)	(0.592)	(0.304)	(1.286)	(0.684)	(0.337)
$\geq$ 2 illnesses of type AC	-7.488***	1.364	-0.261	-5.708**	-1.466	0.425
	(2.588)	(1.213)	(0.623)	(2.391)	(1.271)	(0.627)
0 illness of type A	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
$\geq$ 1 illnesses of type A	-8.537***	-1.243*	-0.222	-10.568***	-2.115**	-0.028
	(1.424)	(0.666)	(0.342)	(1.680)	(0.904)	(0.446)
0 illness of type C	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
1 illness of type C	-1.820	-0.905	0.309	-3.647***	-0.096	0.535*
	(1.184)	(0.556)	(0.285)	(1.131)	(0.603)	(0.297)
$\geq$ 2 illnesses of type C	-5.022***	-2.681***	-0.609	-8.792***	-1.907**	-0.435
	(1.707)	(0.801)	(0.411)	(1.563)	(0.841)	(0.414)
Functional Limitations:						
Difficulties to walk: Yes	-4.516***	-		-5.972***		
	(1.371)			(1.435)		
Bed-ridden: Yes	-2.292	-		-1.300		
	(1.542)			(1.620)		
Difficulties in everyday activities: Yes	-5.506***	-		-5.589***		
	(1.527)			(1.585)		
Pain: Yes	-3.377***	-		-2.329**		
	(1.204)			(1.104)		

Résultats des estimations - SAH

	Women			Men		
	(1) SAH	(2) SLE	(3) SUL	(1) SAH	(2) SLE	(3) SUL
PARENT DEATH AND AGE OF DEATH						
Father alive	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Father alive - age unknown	6.558	-1.455	6.265***	7.668	0.153	5.737***
	(6.647)	(3.122)	(1.603)	(6.611)	(3.512)	(1.732)
Father alive - age	0.043	-0.008	0.058***	0.093	0.079*	0.047**
	(0.085)	(0.040)	(0.021)	(0.087)	(0.046)	(0.023)
Father deceased	1.043	-1.382	4.855***	6.970	3.253	2.966*
	(6.493)	(3.046)	(1.564)	(6.560)	(3.488)	(1.720)
Father deceased - age unknown	4.067	1.086	0.066	-0.077	2.243	0.614
	(3.843)	(1.805)	(0.927)	(3.680)	(1.951)	(0.962)
Father deceased - age	0.075	0.003	-0.002	0.006	0.021	0.004
	(0.047)	(0.022)	(0.011)	(0.046)	(0.025)	(0.012)
Mother alive	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mother alive - age unknown	-9.581	1.758	-2.956*	-5.997	8.359**	-4.778**
	(7.242)	(3.397)	(1.744)	(7.301)	(3.884)	(1.915)
Mother alive - age	-0.128	0.001	-0.024	0.006	0.020	-0.022
	(0.084)	(0.040)	(0.020)	(0.087)	(0.046)	(0.023)
Mother deceased	-8.218	-4.255	-1.956	-2.021	0.117	-1.948
	(6.550)	(3.075)	(1.579)	(7.318)	(3.891)	(1.918)
Mother deceased - age unknown	-3.320	0.493	-0.209	2.275	-1.774	-0.629
	(4.433)	(2.080)	(1.068)	(4.587)	(2.443)	(1.205)
Mother deceased - age	-0.032	0.027	-0.002	-0.008	0.004	-0.003
	(0.050)	(0.023)	(0.012)	(0.053)	(0.028)	(0.014)
LIFESTYLES						
Smoker: Yes	-1.999*	-1.956***	-0.122	-3.332***	-2.289***	-0.432*
	(1.057)	(0.495)	(0.254)	(0.919)	(0.491)	(0.242)
Underweight	-1.186	-1.391	-0.452	13.561***	4.478**	-1.935*
	(2.098)	(0.985)	(0.506)	(4.024)	(2.147)	(1.059)
Normal weight	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Overweight	-2.839**	0.391	0.164	-1.492	-0.384	-0.006
	(1.117)	(0.525)	(0.270)	(0.977)	(0.521)	(0.257)
Obese	-3.372**	1.698**	0.322	-2.804*	0.022	-1.213***
	(1.510)	(0.708)	(0.363)	(1.528)	(0.814)	(0.401)
Severely obese	-10.606***	-0.177	0.044	-8.701***	-0.806	-1.235**
	(1.832)	(0.865)	(0.444)	(1.867)	(1.001)	(0.493)
No alcohol	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Alcohol - no risk	3.099***	1.123**	-0.181	1.255	1.319**	0.052
	(0.977)	(0.459)	(0.236)	(1.101)	(0.586)	(0.289)
Alcohol - risky behaviour	-1.105	0.475	0.105	-0.390	-2.280**	0.133
	(2.836)	(1.330)	(0.683)	(1.910)	(1.017)	(0.501)

Résultats des estimations - SAH

	Women (1) SAH	Women (2) SLE	Women (3) SUL	Men (1) SAH	Men (2) SLE	Men (3) SUL
SOCIO-DEMOGRAPHIC						
Education:						
No diploma	-3.909**	-0.541	0.066	-3.160*	-0.811	-0.513
	(1.818)	(0.854)	(0.439)	(1.869)	(0.993)	(0.490)
Primary School certificate	-6.060***	-0.342	0.442	-1.953	-1.851*	-0.256
	(1.874)	(0.880)	(0.452)	(1.915)	(1.019)	(0.503)
Junior High school diploma	-4.193***	-1.189*	0.962***	-0.968	-2.622***	-0.595*
	(1.365)	(0.643)	(0.330)	(1.246)	(0.663)	(0.327)
High school diploma	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
University ($\leq$ 2 years)	-0.790	0.920	1.064***	1.105	-1.540*	-0.668
	(1.640)	(0.770)	(0.395)	(1.645)	(0.874)	(0.431)
University ($\geq$ 3 years)	-2.904*	0.945	0.427	0.900	-0.467	0.156
	(1.681)	(0.789)	(0.405)	(1.509)	(0.801)	(0.395)
Other diploma	-29.444**	-3.216	0.701	-12.797	3.629	1.592
	(13.750)	(6.465)	(3.320)	(8.334)	(4.440)	(2.189)
Income:						
Income $\leq$ 875 €	-4.000***	-1.177*	-0.189	-2.425*	-0.714	-1.375***
	(1.383)	(0.651)	(0.334)	(1.315)	(0.700)	(0.345)
Income $\in$ [875 − 1290] €	-3.268**	-0.416	0.036	-0.661	0.070	-0.590*
	(1.277)	(0.601)	(0.309)	(1.188)	(0.630)	(0.311)
Income $\in$ [1290 − 1800] €	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Income > 1800 €	-1.025	-0.054	-0.283	0.441	-1.216*	-0.444
	(1.345)	(0.631)	(0.324)	(1.168)	(0.622)	(0.307)
Health Insurance:						
National Health Ins. only	-1.214	-0.868	1.020*	-2.364	0.815	0.111
	(2.173)	(1.020)	(0.524)	(1.649)	(0.879)	(0.433)
CMUC	2.082	-0.379	0.315	-5.238**	-4.460***	0.237
	(1.987)	(0.930)	(0.478)	(2.189)	(1.168)	(0.576)
Complementary Insurance	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Family Situation:						
Single	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Marital life	0.925	0.607	0.493**	1.328	-0.042	0.061
	(1.029)	(0.482)	(0.248)	(1.026)	(0.546)	(0.269)
No Child	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
At least one child	0.402	-0.098	-0.216	1.197	-0.868	-0.110
	(1.054)	(0.495)	(0.254)	(1.073)	(0.571)	(0.281)
Constant	103.265***	74.918***	11.041***	96.451***	66.306***	13.883***
	(4.199)	(2.321)	(1.192)	(4.086)	(2.560)	(1.262)
$\rho_{1,2}$		-0.002			0.011	
$\rho_{1,3}$		-0.012			-0.014	
$\rho_{2,3}$		-0.293***			-0.235***	
R2	0.353	0.316	0.446	0.359	0.340	0.408
St. Dev of Dependent Variable	21.04	9.61	5.48	18.45	9.69	5.05
RMSE	16.91	7.95	4.08	14.77	7.87	3.88
N		1504			1292	

Résultats des estimations - SLE

	Women			Men		
	(1) SAH	(2) SLE	(3) SUL	(1) SAH	(2) SLE	(3) SUL
AGE						
Age	-0.255	-0.281***	0.015	-0.552**	-0.270**	0.031
	(0.222)	(0.104)	(0.053)	(0.216)	(0.115)	(0.057)
Age^2	0.002	0.005***	-0.002***	0.004**	0.005***	-0.002***
	(0.002)	(0.001)	(0.000)	(0.002)	(0.001)	(0.000)
HEALTH						
SAH	-	0.084***	0.008	-	0.114***	-0.005
		(0.012)	(0.006)		(0.014)	(0.007)
Vital Risks:						
0 illness of type N	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
1-2 illnesses of type N	-5.564***	-0.145	0.827**	-2.656**	-0.475	0.133
	(1.426)	(0.671)	(0.345)	(1.118)	(0.593)	(0.292)
$\geq$ 3 illnesses of type N	-9.869***	-0.766	0.744**	-6.059***	-0.976	0.175
	(1.432)	(0.669)	(0.344)	(1.249)	(0.649)	(0.320)
0 illness of type AC	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
1 illness of type AC	-6.890***	-1.344**	-0.103	-3.570***	-0.989	0.318
	(1.250)	(0.592)	(0.304)	(1.286)	(0.684)	(0.337)
$\geq$ 2 illnesses of type AC	-7.488***	1.364	-0.261	-5.708**	-1.466	0.425
	(2.588)	(1.213)	(0.623)	(2.391)	(1.271)	(0.627)
0 illness of type A	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
$\geq$ 1 illnesses of type A	-8.537***	-1.243*	-0.222	-10.568***	-2.115**	-0.028
	(1.424)	(0.666)	(0.342)	(1.680)	(0.904)	(0.446)
0 illness of type C	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
1 illness of type C	-1.820	-0.905	0.309	-3.647***	-0.096	0.535*
	(1.184)	(0.556)	(0.285)	(1.131)	(0.603)	(0.297)
$\geq$ 2 illnesses of type C	-5.022***	-2.681***	-0.609	-8.792***	-1.907**	-0.435
	(1.707)	(0.801)	(0.411)	(1.563)	(0.841)	(0.414)
Functional Limitations:						
Difficulties to walk: Yes	-4.516***	-		-5.972***		
	(1.371)			(1.435)		
Bed-ridden: Yes	-2.292	-		-1.300		
	(1.542)			(1.620)		
Difficulties in everyday activities: Yes	-5.506***	-		-5.589***		
	(1.527)			(1.585)		
Pain: Yes	-3.377***	-		-2.329**		
	(1.204)			(1.104)		

Résultats des estimations - SLE

	Women			Men		
	(1) SAH	(2) SLE	(3) SUL	(1) SAH	(2) SLE	(3) SUL
PARENT DEATH AND AGE OF DEATH						
Father alive	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Father alive - age unknown	6.558	-1.455	6.265***	7.668	0.153	5.737***
	(6.647)	(3.122)	(1.603)	(6.611)	(3.512)	(1.732)
Father alive - age	0.043	-0.008	0.058***	0.093	0.079*	0.047**
	(0.085)	(0.040)	(0.021)	(0.087)	(0.046)	(0.023)
Father deceased	1.043	-1.382	4.855***	6.970	3.253	2.966*
	(6.493)	(3.046)	(1.564)	(6.560)	(3.488)	(1.720)
Father deceased - age unknown	4.067	1.086	0.066	-0.077	2.243	0.614
	(3.843)	(1.805)	(0.927)	(3.680)	(1.951)	(0.962)
Father deceased - age	0.075	0.003	-0.002	0.006	0.021	0.004
	(0.047)	(0.022)	(0.011)	(0.046)	(0.025)	(0.012)
Mother alive	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mother alive - age unknown	-9.581	1.758	-2.956*	-5.997	8.359**	-4.778**
	(7.242)	(3.397)	(1.744)	(7.301)	(3.884)	(1.915)
Mother alive - age	-0.128	0.001	-0.024	0.006	0.020	-0.022
	(0.084)	(0.040)	(0.020)	(0.087)	(0.046)	(0.023)
Mother deceased	-8.218	-4.255	-1.956	-2.021	0.117	-1.948
	(6.550)	(3.075)	(1.579)	(7.318)	(3.891)	(1.918)
Mother deceased - age unknown	-3.320	0.493	-0.209	2.275	-1.774	-0.629
	(4.433)	(2.080)	(1.068)	(4.587)	(2.443)	(1.205)
Mother deceased - age	-0.032	0.027	-0.002	-0.008	0.004	-0.003
	(0.050)	(0.023)	(0.012)	(0.053)	(0.028)	(0.014)
LIFESTYLES						
Smoker: Yes	-1.999*	-1.956***	-0.122	-3.332***	-2.289***	-0.432*
	(1.057)	(0.495)	(0.254)	(0.919)	(0.491)	(0.242)
Underweight	-1.186	-1.391	-0.452	-13.561***	4.478**	-1.935*
	(2.098)	(0.985)	(0.506)	(4.024)	(2.147)	(1.059)
Normal weight	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Overweight	-2.839**	0.391	0.164	-1.492	-0.384	-0.006
	(1.117)	(0.525)	(0.270)	(0.977)	(0.521)	(0.257)
Obese	-3.372**	1.698**	0.322	-2.804*	0.022	-1.213***
	(1.510)	(0.708)	(0.363)	(1.528)	(0.814)	(0.401)
Severely obese	-10.606***	-0.177	0.044	-8.701***	-0.806	-1.235**
	(1.832)	(0.865)	(0.444)	(1.867)	(1.001)	(0.493)
No alcohol	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Alcohol - no risk	3.099***	1.123**	-0.181	1.255	1.319**	0.052
	(0.977)	(0.459)	(0.236)	(1.101)	(0.586)	(0.289)
Alcohol - risky behaviour	-1.105	0.475	0.105	-0.390	-2.280**	0.133
	(2.836)	(1.330)	(0.683)	(1.910)	(1.017)	(0.501)

Résultats des estimations - SLE

	Women			Men		
	(1) SAH	(2) SLE	(3) SUL	(1) SAH	(2) SLE	(3) SUL
SOCIO-DEMOGRAPHIC						
Education:						
No diploma	-3.909**	-0.541	0.066	-3.160*	-0.811	-0.513
	(1.818)	(0.854)	(0.439)	(1.869)	(0.993)	(0.490)
Primary School certificate	-6.060***	-0.342	0.442	-1.953	-1.851*	-0.256
	(1.874)	(0.880)	(0.452)	(1.915)	(1.019)	(0.503)
Junior High school diploma	-4.193***	-1.189*	0.962***	-0.968	-2.622***	-0.595*
	(1.365)	(0.643)	(0.330)	(1.246)	(0.663)	(0.327)
High school diploma	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
University ($\leq$ 2 years)	-0.790	0.920	1.064***	1.105	-1.540*	-0.668
	(1.640)	(0.770)	(0.395)	(1.645)	(0.874)	(0.431)
University ($\geq$ 3 years)	-2.904*	0.945	0.427	0.900	-0.467	0.156
	(1.681)	(0.789)	(0.405)	(1.509)	(0.801)	(0.395)
Other diploma	-29.444**	-3.216	0.701	-12.797	3.629	1.592
	(13.750)	(6.465)	(3.320)	(8.334)	(4.440)	(2.189)
Income:						
Income $\leq$ 875 €	-4.000***	-1.177*	-0.189	-2.425*	-0.714	-1.375***
	(1.383)	(0.651)	(0.334)	(1.315)	(0.700)	(0.345)
Income $\in [875 - 1290]$ €	-3.268**	-0.416	0.036	-0.661	0.070	-0.590*
	(1.277)	(0.601)	(0.309)	(1.188)	(0.630)	(0.311)
Income $\in [1290 - 1800]$ €	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Income $>$ 1800 €	-1.025	-0.054	-0.283	0.441	-1.216*	-0.444
	(1.345)	(0.631)	(0.324)	(1.168)	(0.622)	(0.307)
Health Insurance:						
National Health Ins. only	-1.214	-0.868	1.020*	-2.364	0.815	0.111
	(2.173)	(1.020)	(0.524)	(1.649)	(0.879)	(0.433)
CMUC	2.082	-0.379	0.315	-5.238**	-4.460***	0.237
	(1.987)	(0.930)	(0.478)	(2.189)	(1.168)	(0.576)
Complementary Insurance	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Family Situation:						
Single	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Marital life	0.925	0.607	0.493**	1.328	-0.042	0.061
	(1.029)	(0.482)	(0.248)	(1.026)	(0.546)	(0.269)
No Child	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
At least one child	0.402	-0.098	-0.216	1.197	-0.868	-0.110
	(1.054)	(0.495)	(0.254)	(1.073)	(0.571)	(0.281)
Constant	103.265***	74.918***	11.041***	96.451***	66.306***	13.883***
	(4.199)	(2.321)	(1.192)	(4.086)	(2.560)	(1.262)
$\rho_{1,2}$		-0.002			0.011	
$\rho_{1,3}$		-0.012			-0.014	
$\rho_{2,3}$		-0.293***			-0.235***	
R2	0.353	0.316	0.446	0.359	0.340	0.408
St. Dev of Dependent Variable	21.04	9.61	5.48	18.45	9.69	5.05
RMSE	16.91	7.95	4.08	14.77	7.87	3.88
N		1504			1292	

Résultats des estimations - SUL

	Women			Men		
	(1) SAH	(2) SLE	(3) SUL	(1) SAH	(2) SLE	(3) SUL
AGE						
Age	-0.255	-0.281***	0.015	-0.552**	-0.270**	0.031
	(0.222)	(0.104)	(0.053)	(0.216)	(0.115)	(0.057)
Age^2	0.002	0.005***	-0.002***	0.004**	0.005***	-0.002***
	(0.002)	(0.001)	(0.000)	(0.002)	(0.001)	(0.000)
HEALTH						
SAH	-	0.084***	0.008	-	0.114***	-0.005
		(0.012)	(0.006)		(0.014)	(0.007)
Vital Risks:						
0 illness of type N	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
1-2 illnesses of type N	-5.564***	-0.145	0.827**	-2.656**	-0.475	0.133
	(1.426)	(0.671)	(0.345)	(1.118)	(0.593)	(0.292)
$\geq$ 3 illnesses of type N	-9.869***	-0.766	0.744**	-6.059***	-0.976	0.175
	(1.432)	(0.669)	(0.344)	(1.249)	(0.649)	(0.320)
0 illness of type AC	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
1 illness of type AC	-6.890***	-1.344**	-0.103	-3.570***	-0.989	0.318
	(1.250)	(0.592)	(0.304)	(1.286)	(0.684)	(0.337)
$\geq$ 2 illnesses of type AC	-7.488***	1.364	-0.261	-5.708**	-1.466	0.425
	(2.588)	(1.213)	(0.623)	(2.391)	(1.271)	(0.627)
0 illness of type A	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
$\geq$ 1 illnesses of type A	-8.537***	-1.243*	-0.222	-10.568***	-2.115**	-0.028
	(1.424)	(0.666)	(0.342)	(1.680)	(0.904)	(0.446)
0 illness of type C	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
1 illness of type C	-1.820	-0.905	0.309	-3.647***	-0.096	0.535*
	(1.184)	(0.556)	(0.285)	(1.131)	(0.603)	(0.297)
$\geq$ 2 illnesses of type C	-5.022***	-2.681***	-0.609	-8.792***	-1.907**	-0.435
	(1.707)	(0.801)	(0.411)	(1.563)	(0.841)	(0.414)
Functional Limitations:						
Difficulties to walk: Yes	-4.516***	-		-5.972***		
	(1.371)			(1.435)		
Bed-ridden: Yes	-2.292	-		-1.300		
	(1.542)			(1.620)		
Difficulties in everyday activities: Yes	-5.506***	-		-5.589***		
	(1.527)			(1.585)		
Pain: Yes	-3.377***	-		-2.329**		
	(1.204)			(1.104)		

Résultats des estimations - SUL

	Women			Men		
	(1) SAH	(2) SLE	(3) SUL	(1) SAH	(2) SLE	(3) SUL
PARENT DEATH AND AGE OF DEATH						
Father alive	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Father alive - age unknown	6.558	-1.455	6.265***	7.668	0.153	5.737***
	(6.647)	(3.122)	(1.603)	(6.611)	(3.512)	(1.732)
Father alive - age	0.043	-0.008	0.058***	0.093	0.079*	0.047**
	(0.085)	(0.040)	(0.021)	(0.087)	(0.046)	(0.023)
Father deceased	1.043	-1.382	4.855***	6.970	3.253	2.966*
	(6.493)	(3.046)	(1.564)	(6.560)	(3.488)	(1.720)
Father deceased - age unknown	4.067	1.086	0.066	-0.077	2.243	0.614
	(3.843)	(1.805)	(0.927)	(3.680)	(1.951)	(0.962)
Father deceased - age	0.075	0.003	-0.002	0.006	0.021	0.004
	(0.047)	(0.022)	(0.011)	(0.046)	(0.025)	(0.012)
Mother alive	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mother alive - age unknown	-9.581	1.758	-2.956*	-5.997	8.359**	-4.778**
	(7.242)	(3.397)	(1.744)	(7.301)	(3.884)	(1.915)
Mother alive - age	-0.128	0.001	-0.024	0.006	0.020	-0.022
	(0.084)	(0.040)	(0.020)	(0.087)	(0.046)	(0.023)
Mother deceased	-8.218	-4.255	-1.956	-2.021	0.117	-1.948
	(6.550)	(3.075)	(1.579)	(7.318)	(3.891)	(1.918)
Mother deceased - age unknown	-3.320	0.493	-0.209	2.275	-1.774	-0.629
	(4.433)	(2.080)	(1.068)	(4.587)	(2.443)	(1.205)
Mother deceased - age	-0.032	0.027	-0.002	-0.008	0.004	-0.003
	(0.050)	(0.023)	(0.012)	(0.053)	(0.028)	(0.014)
LIFESTYLES						
Smoker: Yes	-1.999*	-1.956***	-0.122	-3.332***	-2.289***	-0.432*
	(1.057)	(0.495)	(0.254)	(0.919)	(0.491)	(0.242)
Underweight	-1.186	-1.391	-0.452	-13.561***	4.478**	-1.935*
	(2.098)	(0.985)	(0.506)	(4.024)	(2.147)	(1.059)
Normal weight	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Overweight	-2.839**	0.391	0.164	-1.492	-0.384	-0.006
	(1.117)	(0.525)	(0.270)	(0.977)	(0.521)	(0.257)
Obese	-3.372**	1.698**	0.322	-2.804*	0.022	-1.213***
	(1.510)	(0.708)	(0.363)	(1.528)	(0.814)	(0.401)
Severely obese	-10.606***	-0.177	0.044	-8.701***	-0.806	-1.235**
	(1.832)	(0.865)	(0.444)	(1.867)	(1.001)	(0.493)
No alcohol	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Alcohol - no risk	3.099***	1.123**	-0.181	1.255	1.319**	0.052
	(0.977)	(0.459)	(0.236)	(1.101)	(0.586)	(0.289)
Alcohol - risky behaviour	-1.105	0.475	0.105	-0.390	-2.280**	0.133
	(2.836)	(1.330)	(0.683)	(1.910)	(1.017)	(0.501)

Résultats des estimations - SUL

	Women			Men		
	(1) SAH	(2) SLE	(3) SUL	(1) SAH	(2) SLE	(3) SUL
SOCIO-DEMOGRAPHIC						
Education:						
No diploma	-3.909**	-0.541	0.066	-3.160*	-0.811	-0.513
	(1.818)	(0.854)	(0.439)	(1.869)	(0.993)	(0.490)
Primary School certificate	-6.060***	-0.342	0.442	-1.953	-1.851*	-0.256
	(1.874)	(0.880)	(0.452)	(1.915)	(1.019)	(0.503)
Junior High school diploma	-4.193***	-1.189*	0.962***	-0.968	-2.622***	-0.595*
	(1.365)	(0.643)	(0.330)	(1.246)	(0.663)	(0.327)
High school diploma	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
University ($\leq$ 2 years)	-0.790	0.920	1.064***	1.105	-1.540*	-0.668
	(1.640)	(0.770)	(0.395)	(1.645)	(0.874)	(0.431)
University ($\geq$ 3 years)	-2.904*	0.945	0.427	0.900	-0.467	0.156
	(1.681)	(0.789)	(0.405)	(1.509)	(0.801)	(0.395)
Other diploma	-29.444**	-3.216	0.701	-12.797	3.629	1.592
	(13.750)	(6.465)	(3.320)	(8.334)	(4.440)	(2.189)
Income:						
Income $\leq$ 875 €	-4.000***	-1.177*	-0.189	-2.425*	-0.714	-1.375***
	(1.383)	(0.651)	(0.334)	(1.315)	(0.700)	(0.345)
Income $\in$ [875 − 1290] €	-3.268**	-0.416	0.036	-0.661	0.070	-0.590*
	(1.277)	(0.601)	(0.309)	(1.188)	(0.630)	(0.311)
Income $\in$ [1290 − 1800] €	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Income > 1800 €	-1.025	-0.054	-0.283	0.441	-1.216*	-0.444
	(1.345)	(0.631)	(0.324)	(1.168)	(0.622)	(0.307)
Health Insurance:						
National Health Ins. only	-1.214	-0.868	1.020*	-2.364	0.815	0.111
	(2.173)	(1.020)	(0.524)	(1.649)	(0.879)	(0.433)
CMUC	2.082	-0.379	0.315	-5.238**	-4.460***	0.237
	(1.987)	(0.930)	(0.478)	(2.189)	(1.168)	(0.576)
Complementary Insurance	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Family Situation:						
Single	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Marital life	0.925	0.607	0.493**	1.328	-0.042	0.061
	(1.029)	(0.482)	(0.248)	(1.026)	(0.546)	(0.269)
No Child	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
At least one child	0.402	-0.098	-0.216	1.197	-0.868	-0.110
	(1.054)	(0.495)	(0.254)	(1.073)	(0.571)	(0.281)
Constant	103.265***	74.918***	11.041***	96.451***	66.306***	13.883***
	(4.199)	(2.321)	(1.192)	(4.086)	(2.560)	(1.262)
$\rho_{1,2}$		-0.002			0.011	
$\rho_{1,3}$		-0.012			-0.014	
$\rho_{2,3}$		-0.293***			-0.235***	
R2	0.353	0.316	0.446	0.359	0.340	0.408
St. Dev of Dependent Variable	21.04	9.61	5.48	18.45	9.69	5.05
RMSE	16.91	7.95	4.08	14.77	7.87	3.88
N		1504			1292	

L'espérance de vie et l'incertitude vis à vis de cette longévité sont-elles corrélées aux comportements à risque des individus ?

SUL et comportements à risque

- Les messages de santé publique se focalisent uniquement sur l'espérance de vie.
- SUL apporte t-il une information complémentaire à SLE pour expliquer les comportements à risque, les comportements de prévention ou la demande d'assurance des individus ?

	Smoker	Obese+Sev. Obese	Severely Obese	Drinker	Compl. Insurance
Women					
SLE	-0.007***	0.002	-0.001	-0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
SUL	-0.005*	0.002	-0.001	0.000	-0.004*
	(0.003)	(0.002)	(0.002)	(0.001)	(0.002)
Control variables	Yes	Yes	Yes	Yes	Yes
N for $y = 1$	440	187	84	43	882
Men					
SLE	-0.009***	-0.001	-0.002**	-0.004***	-0.000
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
SUL	-0.008**	-0.010***	-0.004**	-0.002	0.001
	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)
Control variables	Yes	Yes	Yes	Yes	Yes
N for $y = 1$	452	156	117	105	753

Notes: Control variables include all variables presented in table 3, except lifestyles variables.

Pourquoi SUL est-elle négativement corrélée aux comportements à risque ?

Les messages doivent prendre en compte l'influence de SUL.

- A SLE donnée, une $\nearrow$ exogène de SUL entraine une modification du poids relatif accordé à chaque période de la vie : ils sont plus étalés.
- Les périodes de milieu de vie ont moins de poids ; les périodes de début et fin de vie ont plus de poids.
  $\Rightarrow$ La survie à des âges élevés est plus attractive $\Rightarrow$ modification des comportements pour $\nearrow$ proba de vivre plus vieux

Conclusion

- **Large dispersion inter-individuelle des niveaux de SLE**
- **L'incertitude des individus est élevée** : plus de 10 ans pour les hommes et les femmes
  - Pour les individus de moins de 60 ans, son ampleur est comparable à celle calculée dans les tables de mortalité.
  - Pour les individus de 70 ou 80 ans, elle est en revanche plus faible : ces individus ont de l'information privée qu'ils utilisent lorsqu'ils répondent.
- L'analyse économétrique confirme que **les individus utilisent cette information privée** : les variables relatives à l'âge au décès des parents sont (presque) les seules variables corrélées à l'incertitude.
- Une seconde analyse montre que **l'incertitude est négativement corrélée, à niveau de SLE donné, aux comportements à risque**.

Quelles implications en termes de politiques publiques ?

- Les comportements à risque sont corrélés à la fois à l'espérance de vie anticipée mais aussi à l'incertitude.
- Donc les messages de santé publique (tabac, alcool) ou les politiques liées à l'âge de départ en retraite, qui ont pour seul argument l'espérance de vie, peuvent être contre productifs.
- ex : $\nearrow$ l'age de la retraite :
  - peut être acceptable si les individus ont tous une EV proche de la moyenne nationale et un SUL faible.
  - Mais non acceptable pour la proportion d'individus ayant une SLE est faible et/ou un SUL élevé : cela réduit la probabilité de profiter de leur retraite
- ex : politiques de réduction du tabagisme :
  - le gain d'EV lié à l'arrêt du tabac est relativisé si l'incertitude de l'individu sur son EV est élevée.
    $\Rightarrow$ L'efficacité des campagnes de prévention (tabac, obésité) peut donc être limitée si l'incertitude des individus est élevée.

Impact of later retirement on mortality

Evidence from French pension reform

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Journée de la Chaire Santé – 30 mars 2018
Université Paris-Dauphine

Motivation

Context

- Demographic ageing
- Financial sustainability of pension systems

Possible channels

- Later retirement increases health
- Later retirement decreases health

Motivation

Two main issues

- Academic issue: link between past career and health
  - Reverse causality issue
- Public policies issues: impact of pension system reforms
  - Acceptability of such reforms, social inequality
  - Spill effect

Literature

- Large range of health outcomes:
  - **self-reported health** – Shai, 2018; Eibich, 2015; Coe and Zamarro, 2011; Coe and Lindeboom, 2008; Neumann, 2008
  - **mental health** – Mazonna and Peracchi, 2017; Bingley and Martinello, 2013; Bonsang et al., 2012; De Grip et al., 2012; Coe and Zamarro, 2011; Rohwedder and Willis, 2010
  - **physical health** – Neumann, 2008; Dave et al., 2008; Behncke, 2012
  - **health care expenditures** – Shai, 2018; Hagen, 2017; Caroli et al., 2016; Eibich, 2015
  - **health related-behaviors** – Godard, 2016; Eibich, 2015; Insler, 2014
- Choice to focus on mortality
  - Consequences of the whole past health
  - Comparability

Literature

Correlation between early retirement and mortality

- Quaade et al. (2002): positive association
- Kuhn et al. (2010): early retirement increases the chance of premature death

Correlation between later retirement and mortality

- Bamia et al. (2007): an increase in retirement age is associated with a decrease in mortality
- Tsai et al. (2005): no differences between those who retire at 60 and 65

$\Rightarrow$ Selection bias

Motivation

- **Causal impact of retirement on mortality**
  - Hernaes et al. (2013): early retirement does not change mortality in Norway
  - Bloemen et al. (2017): early retirement decreases the probability of dying in Netherlands
  - Hagen (2017): later retirement does not change mortality in Sweden
  - Fitzpatrick and Moore (2018): a two percent increase in male mortality after age 62 (RDD on SS threshold) in the US

This paper

Objective

1. Estimate the causal **effect of later retirement on mortality**
   - 1st stage: causal effect of 1993 pension reform on later retirement age
   - 2nd stage: effect of later retirement on mortality

Main results

1. The 1993 pension reform has a strong impact on claiming age and can be used as IV
2. No significant impact of later retirement on mortality

Outline of the presentation

1. French pension system
2. Data
3. Empirical strategy
4. Results

Outline

1. French pension system
2. Data
3. Empirical strategy
4. Results

French pension system

Before the reform, retirement with full replacement rate :

1. Be 60 or older and contribute 150 quarters
2. Be 65 or older

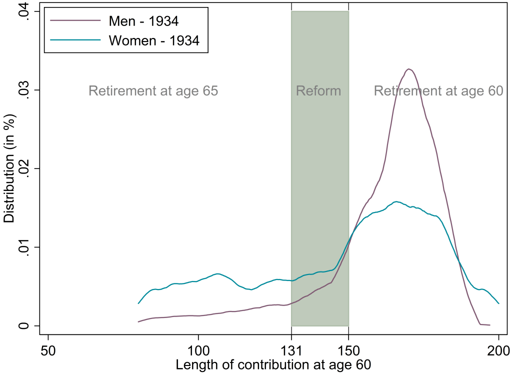
After the 1993 reform, condition 1. change:

Birth year	**Nb of contr. quarters**
1933 and before	150
1934	151
1935	152
1936	153
...	...
1942	159
1943 and after	160

Computation formula of pension benefit

Impact of the 1993 pension reform

Figure 1: Distribution of contribution length at age 60



Back to presentation

Impact of the 1993 pension reform

Figure 2: Distribution of contribution length – cohort 1930

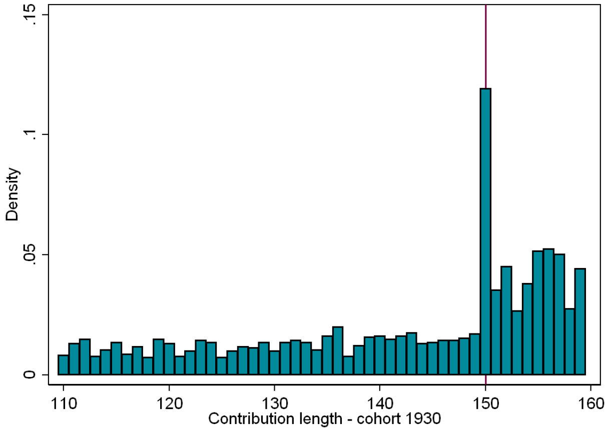


Figure 2: Distribution of contribution length – cohort 1932

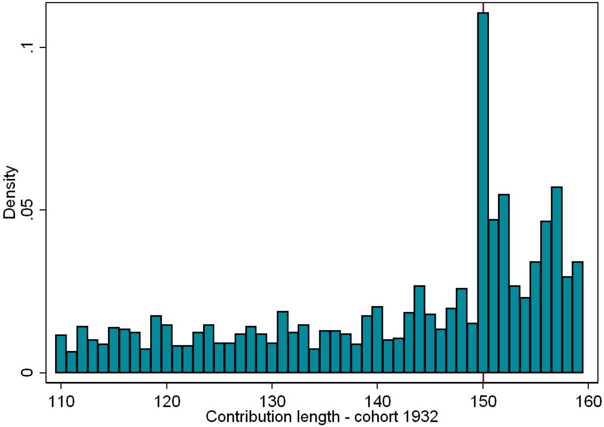
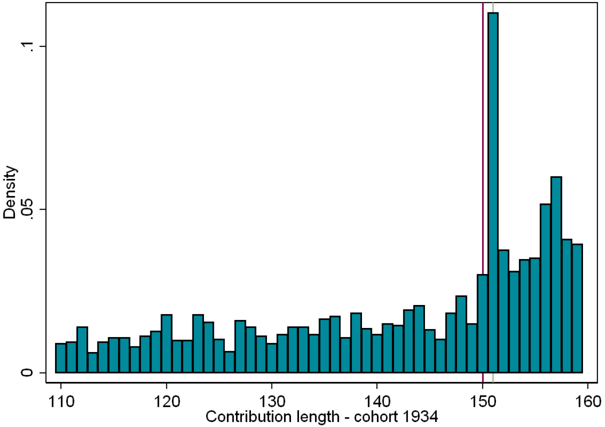
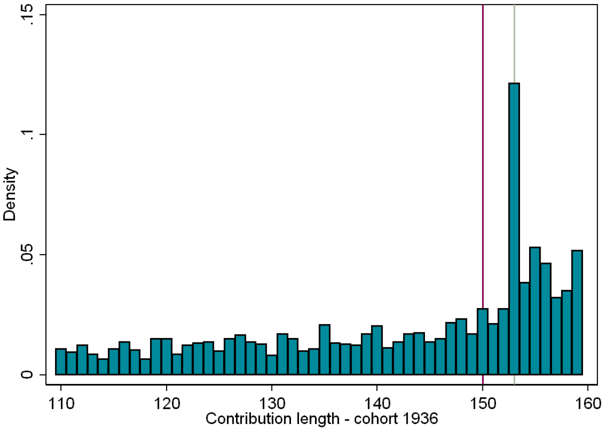


Figure 2: Distribution of contribution length – cohort 1934



Impact of the 1993 pension reform

Figure 2: Distribution of contribution length – cohort 1936



Impact of the 1993 pension reform

Figure 2: Distribution of contribution length – cohort 1938

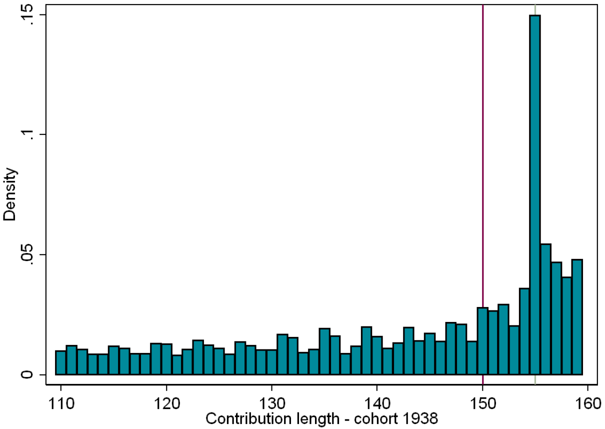
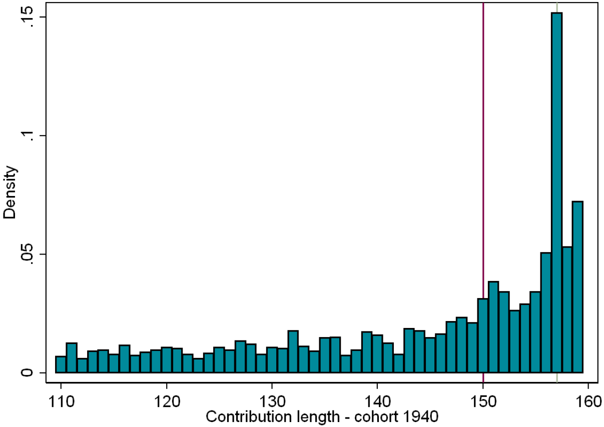


Figure 2: Distribution of contribution length – cohort 1940



Outline

Data

French administrative data on pension benefit

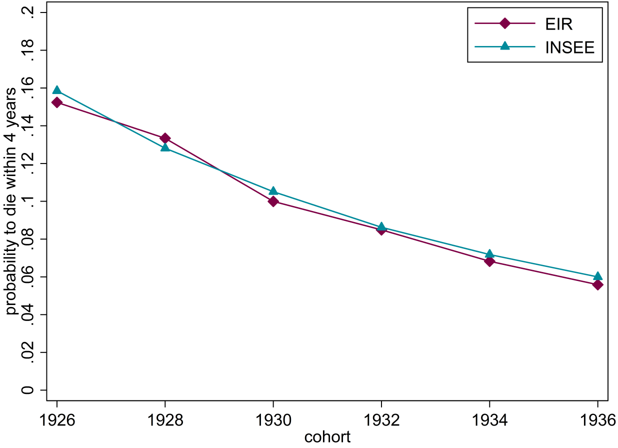
EIR: échantillon interrégime des retraités

- Waves every five years (1997, 2001, 2004, 2008, 2012)
- Include all retirees born in early october, all even years from 1906 to 1978
- Include information relevant for pension benefit computation (reference wage, contribution length, replacement rate, retirement age, claiming age)
- Information about death (dummy for being death in each wave, month and year of death)
- Characteristics of EIR are similar to the national population. Comparison of death: EIR and INSEE

Data

French administrative data on pension benefit

Figure 3: Death probability within 4 years – EIR and INSEE



Data
Sample

sample by cohort	sample by age
Wage earners in the private sector	
Has contributed at age 60 between 80 and 180 quarters	
Benefit from a normal pension (ie. no disability pension)	
born between 1930 and 1938	born in 1934 and 1938
Alive and retired **in 2004**	Alive and retired **at age 70**
Death probability in 2008 and 2012	Death at age 74
$N = 19,962$	$N = 9,588$

Detail on cohort selection

Data
sample

Figure 4: sample by cohort

wave 2004	
1930	74 y.o.
1932	72 y.o.
1934	70 y.o.
1936	68 y.o.
1938	66 y.o.

⟹

wave 2008	
1930	78 y.o.
1932	76 y.o.
1934	74 y.o.
1936	72 y.o.
1938	70 y.o.

Data

sample

Figure 5: sample by age

wave 2004	
1934	70 y.o.
wave 2008	
1938	70 y.o.

→

wave 2008	
1934	74 y.o.
wave 2012	
1938	74 y.o.

Descriptive statistics

Compare to the national population, our sample is composed by relatively:

- Less women
- More farmers and executives
- Individuals in better health

Table 1: Descriptive statistics

	our sample	EIR 2004
Women	40.47%	49.64 %
Farmers	14.21%	10.85 %
Executives	3.47%	2.10%
Death	6.28%	6.57%

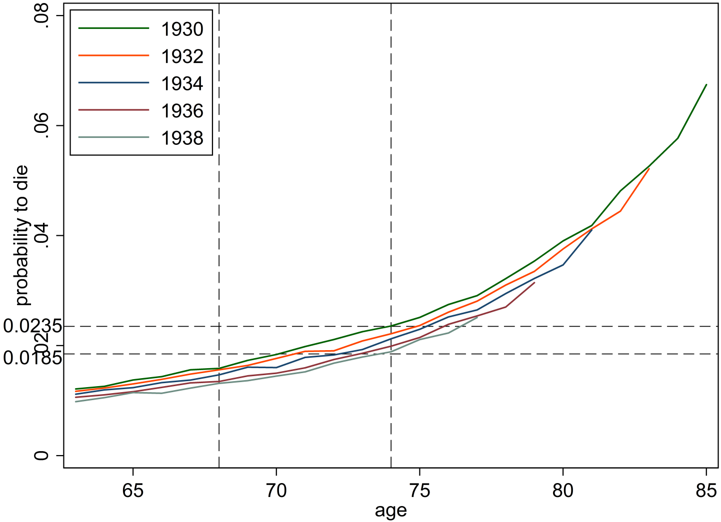
Data

Descriptive statistics

Table 2: Death probability by cohort

Birth year	Total	death proba. between 2004 and 2008		
		Our sample		National statistics
		N	%	% nat.
1930	3851	354	9.19	10.51
1932	3576	308	7.93	8.62
1934	3682	247	6.29	7.18
1936	3839	216	5.33	6.00
1938	6771	307	4.34	5.02
Total	22797	1432	6.28	

Figure 6: Death probability by cohort



Data

Variables of interest

Contribution length at claiming age (Age_{liq}):

- D_{liq}

Contribution length at age 60:

- $D_{60} = D_{liq} - 4(Age_{liq} - 60)$

Variation in contribution length due to the reform:

- $Var_{rcl} = (RCL_{c_i} - D_{60}) - (150 - D_{60})$

Detail

Outline

Empirical strategy

2SLS regression

- Identification strategy: Variation of required contribution length by cohort due to the 1993 reform
- **1st stage of 2SLS**:

$$Ret_i = \alpha_1 + \beta_1 Var_{rcl_i} + \sum_g \gamma_{1,g} \mathbb{1}_{\{yob_i = g\}} + \sum_t \delta_{1,t} \mathbb{1}_{\{D_{60_i} = t\}} + \zeta_1 X_i + \varepsilon_1$$

with:

- Ret_i, claiming age (in quarter) of individual i
- Var_{rcl_i}, quarter of contribution's variation due to the reform
- $\mathbb{1}_{\{yob_i = g\}}$, dummies for cohort
- $\mathbb{1}_{\{D_{60_i} = t\}}$, dummies for the contribution length at age 60
- X_i, control variables (sex, marital status, wage, executive, and farmer)

Empirical strategy

2SLS regression

- **2nd stage of 2SLS**:

$$q4_i = \alpha_2 + \beta_2 \hat{Ret}_i + \zeta_2 Xi + \varepsilon_2$$

with:

  - $q4_i$, Dummy=1 if individual i dies within four years
  - Ret_i, claiming age (in quarter) of individual i
  - X_i, control variables (cohort, sex, D_{60}, marital status, wage, executive and farmer)

- Alternative specification:

$$q8_i = \alpha_3 + \beta_3 \hat{Ret}_i + \zeta_3 Xi + \varepsilon_3$$

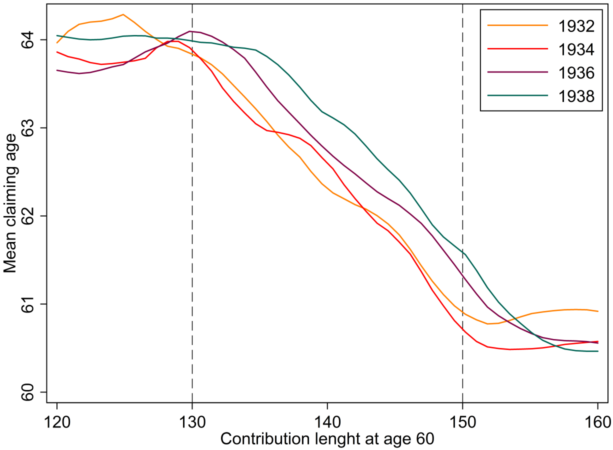
with $q8_i$, Dummy=1 if individual i dies within eight years

Outline

Results

Reform's effect on claiming age

Figure 7: Mean claiming age per contribution length at age 60



Results

Reform's effect on claiming age

Table 3: Effect of the reform on claiming age (first stage)

	All	Men	Women
Sample by cohort			
Reform	0.729***	0.856***	0.516***
	(0.0549)	(0.0637)	(0.0969)
N	19962	11999	7963
Sample by age			
Reform	0.823***	0.973***	0.572***
	(0.0807)	(0.0918)	(0.146)
N	9588	5846	3742

Control for: sex, cohort, executive, farmer, wage, marital status and contribution length at age 60. Robust standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Effect of delaying retirement on mortality

Table 4: Effect of later retirement on mortality within 4 years (second stage of the 2SLS) Alternative specification

	Total	Men	Women
Sample by cohort			
Claiming age	0.0070**	0.0056	0.0076
	(0.0031)	(0.0038)	(0.0057)
N	19962	11999	7963
Sample by age			
Claiming age	0.0042	0.0060	0.0005
	(0.0040)	(0.0050)	(0.0074)
N	9588	5846	3742

Control for: sex, cohort, executive, farmer, wage, marital status and contribution length at age 60. Robust standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Reduced form

Table 5: Effect of the reform on mortality within 4 years

	Total	Men	Women
Sample by cohort			
Reform	0.0051**	0.0048	0.0039
	(0.0022)	(0.0033)	(0.0028)
N	19962	11999	7963
Sample by age			
Reform	0.0034	0.0059	0.0003
	(0.0032)	(0.0049)	(0.0043)
N	9588	5846	3742

Control for: sex, cohort, executive, farmer, wage, marital status and contribution length at age 60. Robust standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Robustness checks

- Non-significant 0.004 effect when controlling for differential mortality effects

Control for sample selection effect Robustness checks

- Results are never significant when cohort 1938 is dropped
- Results are virtually unchanged with contribution length at age 60 between 120 and 160 quarters
- CI=[-0.005;0.02]
- Reduced form See RF

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- Power analysis

Minimum detectable effect (Duflo, 2006):

$$MDE = (t_{1-k} + t_{\frac{\alpha}{2}}) * \sqrt{\frac{1}{p_T(1-p_T)}} * \sqrt{\frac{\sigma^2}{N}} \tag{1}$$

Sample size required for a given MDE:

$$N = \frac{1}{p_T(1-p_T)} * \left(\frac{\sigma * (t_{1-k} + t_{\frac{\alpha}{2}})}{MDE}\right)^2 \tag{2}$$

Other MDE formula Graph of statistical power

Table 6: MDE considering the sample size

	Sample size	Share of treated	Death proba.	$\hat{\beta}$	MDE
Us	9,588	16.88%	6.09%	0.004	0.02
Bloemen	133,379	82.48%	0.8832%	-0.026	0.001887
Hernaes	148,037	80.00%	5.90%	0.002	0.0043
Hagen	133,026	29.05%	4.30%	0.000283	0.0034

Discussion

Table 7: Required sample size considering an expected MDE

	MDE	N
Our main sample	0.004	200,000
Bloemen et al. (2017)	-0.026	703
Hernaes et al. (2013)	0.002	680,108
Hagen et al. (2017)	0.000283	16,435,400

Discussion

Conclusion

- Large impact of the 1993 reform on claiming age
- No significant impact on mortality when controlling for differential mortality effects

Limits: selection effects

- Selection of individuals alive at age 70
- Selection of individuals who benefit from a normal pension
- Disentangle income effect and later retirement effect
- The reform does not affect individuals with very long or short career Detail

Futher work

- Use exhaustive data to improve the power of our results

Appendix

Table A1: Detail of EIR cohort by cohort

	october		EIR				
Cohort	**from**	**to**	**1997**	**2001**	**2004**	**2008**	**2012**
1930	1	6	Yes	Yes	Yes	Yes	Yes
1932	1	6	Yes	Yes	Yes	Yes	Yes
1934	1	6	Yes	Yes	Yes	Yes	Yes
	7	10	No	Yes	No	Yes	Yes
	11	12	No	Yes	No	No	No
1936	1	6	Yes	Yes	Yes	Yes	Yes
	7	10	No	No	No	Yes	Yes
1938	1	6	Yes	Yes	Yes	Yes	Yes
	7	10	No	No	Yes	Yes	Yes
	11	24	No	No	Yes	No	Yes

Back to presentation

pension formula:

$$P = \tau \times PC \times W_{ref}$$

with τ the replacement rate, PC, the proratisation coefficient, and W_{ref} the reference wage

Replacement rate formula (pre-reform):

$$\tau = 0.5 - \delta \times max[0; min(4 \times (65 - a); 150 - d)]$$

with a is the claiming age; d the number of quarters contributed; and δ is the minimization coefficient, equal to 1.25 % per missing quarter. Back to presentation

Table A2: Reform impact

Var_{rcl}	Cohort	D_{60}
0	1930-32	All
	1934	$\in [0;130] \cup [151;+\infty[$
	1936	$\in [0;130] \cup [153;+\infty[$
	1938	$\in [0;130] \cup [155;+\infty[$
1	1934	$\in [131;151[$
	1936	$\in (\{131\};\{152\})$
	1938	$\in (\{131\};\{153\})$
2	1936	$\in (\{132\};\{151\})$
	1938	$\in (\{132\};\{153\})$
3	1936	$\in [133;151[$
	1938	$\in (\{133\};\{152\})$
4	1938	$\in (\{134\};\{151\})$
5	1938	$\in [135;151[$

Back to presentation

Table A3: Effect of later retirement on mortality within 4 years (IV – binary model with endogenous explanatory variable)

	Total	Men	Women
Sample by cohort			
Claiming age	0.0070**	0.0056	0.0076
	(0.0031)	(0.0038)	(0.0057)
N	19962	11999	7963
Sample by age			
Claiming age	0.0040	0.0068	0.0004
	(0.0040)	(0.0050)	(0.0090)
N	9588	5846	3742

Control for: sex, cohort, executive, farmer, wage, marital status and contribution length at age 60. Robust standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Back to presentation

Table A4: 2SLS

Back to pres.

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Dep. variable: death from 2004 to 2008

	Total			Men			Women		
Panel	m.e.	s.e.	N	m.e.	s.e.	N	m.e.	s.e.	N
A	0.0109	(0.0085)	4996	0.0098	(0.0118)	2677	0.0111	(0.0113)	2319
B	0.0108	(0.0071)	13518	0.0067	(0.0083)	7993	0.0191	(0.0154)	5525
C	0.0072**	(0.0036)	7136	0.0076	(0.0050)	3888	0.0046	(0.0051)	3248
D	0.0070**	(0.0031)	19962	0.0056	(0.0038)	11999	0.0076	(0.0057)	7963

Dep. variable: death from 2004 to 2012

	Total			Men			Women		
Panel	m.e.	s.e.	N	m.e.	s.e.	N	m.e.	s.e.	N
A	0.0118	(0.0123)	4996	0.0105	(0.0170)	2677	0.0136	(0.0174)	2319
B	0.0110	(0.0102)	13518	0.0136	(0.0124)	7993	0.0087	(0.0196)	5525
C	0.0049	(0.0052)	7136	0.0030	(0.0069)	3888	0.0066	(0.0080)	3248
D	0.0035	(0.0043)	19962	0.0026	(0.0053)	11999	0.0028	(0.0081)	7963

Dep. variable: death within four years

	Total			Men			Women		
Panel	m.e.	s.e.	N	m.e.	s.e.	N	m.e.	s.e.	N
E	0.0071	(0.0089)	2450	0.0116	(0.0133)	1322	0.0043	(0.0116)	1128
F	0.0122	(0.0081)	6725	0.0149	(0.0100)	3953	0.0124	(0.0153)	2772
G	0.0055	(0.0054)	3308	0.0110	(0.0076)	1831	-0.0018	(0.0074)	1477
H	0.0042	(0.0040)	9588	0.0060	(0.0050)	5846	0.0005	(0.0074)	3742

Control for: sex, cohort, executive, farmer, wage, marital status and contribution length at age 60. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Each line presents the coefficient associated with Var_{rcl} (m.e.) for men and women resp. Panel A (resp. B) includes individuals born in 1930, 32, 34, 36 who have contributed between 120 and 160 quarters (resp. 80 to 180 quarters). Panel C (resp. D) includes individuals born in 1930, 32, 34, 36 and 38 who have contributed between 120 and 160 quarters (resp. 80 to 180 quarters). Panel E (resp. F) includes individuals born in 1932 and 36 who have contributed between 120 and 160 quarters (resp. 80 to 180 quarters). Panel G (resp. H) includes individuals born in 1934 and 38 who have contributed between 120 and 160 quarters (resp. 80 to 180 quarters).

Table A5: RF Back to pres.

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	Dep. variable: death from 2004 to 2008								
	Total			Men			Women		
sample	m.e.	s.e.	N	m.e.	s.e.	N	m.e.	s.e.	N
A	0.0076	(0.0057)	4996	0.0074	(0.0089)	2677	0.0069	(0.0065)	2319
B	0.0074	(0.0047)	13518	0.0059	(0.0072)	7993	0.0085	(0.0057)	5525
C	0.0055**	(0.0027)	7136	0.0065	(0.0042)	3888	0.0030	(0.0033)	3248
D	0.0051**	(0.0022)	19962	0.0048	(0.0033)	11999	0.0039	(0.0028)	7963
	Dep. variable: death from 2004 to 2012								
	Total			Men			Women		
sample	m.e.	s.e.	N	m.e.	s.e.	N	m.e.	s.e.	N
A	0.0082	(0.0084)	4996	0.0080	(0.0130)	2677	0.0085	(0.0104)	2319
B	0.0076	(0.0069)	13518	0.0118	(0.0106)	7993	0.0039	(0.0086)	5525
C	0.0038	(0.0040)	7136	0.0025	(0.0059)	3888	0.0043	(0.0051)	3248
D	0.0026	(0.0032)	19962	0.0023	(0.0046)	11999	0.0014	(0.0042)	7963
	Dep. variable: death within four years								
	Total			Men			Women		
sample	m.e.	s.e.	N	m.e.	s.e.	N	m.e.	s.e.	N
E	0.0060	(0.0075)	2450	0.0104	(0.0119)	1322	0.0032	(0.0086)	1128
F	0.0095	(0.0060)	6725	0.0148	(0.0096)	3953	0.0061	(0.0070)	2772
G	0.0044	(0.0043)	3308	0.0098	(0.0067)	1831	-0.0012	(0.0050)	1477
H	0.0034	(0.0032)	9588	0.0059	(0.0049)	5846	0.0003	(0.0043)	3742

Control for: sex, cohort, executive, farmer, wage, marital status and contribution length at age 60. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Each line presents the coefficient associated with Var_{rcl} (m.e.) for men and women resp (linear probability model). Panel A (resp. B) includes individuals born in 1930, 32, 34, 36 who have contributed between 120 and 160 quarters (resp. 80 to 180 quarters). Panel C (resp. D) includes individuals born in 1930, 32, 34, 36 and 38 who have contributed between 120 and 160 quarters (resp. 80 to 180 quarters). Panel E (resp. F) includes individuals born in 1932 and 36 who have contributed between 120 and 160 quarters (resp. 80 to 180 quarters). Panel G (resp. H) includes individuals born in 1934 and 38 who have contributed between 120 and 160 quarters (resp. 80 to 180 quarters).

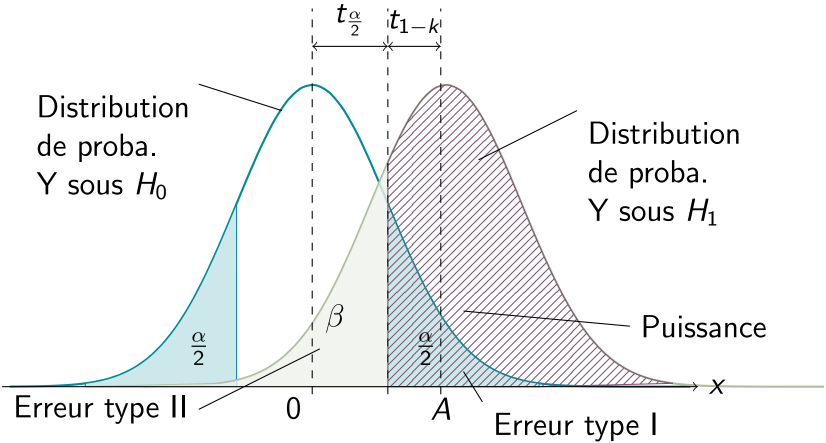
Table A6: Formules MDE et Taille d'échantillon optimale

	Bloom (1995)	Duflo(2006)	McConnell et al. (2015)
MDE	$\sqrt{\frac{p_0(1-p_0)(1-R^2)A^2}{T(1-T)N}}$	$\sqrt{\frac{A^2 p(1-p)}{T(1-T)N}}$	$\sqrt{\left(\frac{p_0(1-p_0)}{1-T}+\frac{p_1(1-p_1)}{T}\right)\frac{A^2}{N}}$
N^*	$\frac{p_0(1-p_0)(1-R^2)A^2}{T(1-T)\delta^2}$	$\frac{A^2 p(1-p)}{T(1-T)\delta^2}$	$\frac{A^2}{\delta^2}\times\left(\frac{p_0(1-p_0)}{1-T}+\frac{p_1(1-p_1)}{T}\right)$

avec N la taille d'échantillon;
N^* la taille d'échantillon requise pour un coefficient δ;
δ le MDE;
T la proportion de traités;
p La probabilité que l'outcome binaire soit égal à 1 $(p = p(Y = 1)$;
$p_0 = p(Y = 1|T = 0)$ et $p_1 = p(Y = 1|T = 1)$;
$(1 - R^2)$ obtenu en régressant T sur les covariables.
$A = t_{1-k} + t_{\alpha/2}$.

Retour à la présentation

Figure A1: Représentation graphique de la puissance statistique



Retour à la présentation

Table A7: Définition des deux types d'erreur

		Vraie valeur	
		$\beta = 0 \Leftrightarrow H_0 vraie$	$\beta \neq 0 \Leftrightarrow H_0 fausse$
Valeur estimée	$\beta = 0 \Leftrightarrow H_0$ acceptée	OK	Erreur type II
	$\beta \neq 0 \Leftrightarrow H_0$ rejetée	Erreur type I	OK

◂ Retour à la présentation

- Discussion -
Impact of later retirement on mortality
Evidence from France
A. Bozio, C. Garrouste & E. Perdrix

Hélène Huber-Yahi[1]

[1]CES, Université Paris 1 et PSE

Journée de la Chaire Santé
Université Paris Dauphine
30 mars 2018

Plan

Présentation

Discussion

Contexte

- Quel impact de l'âge de la retraite sur la mortalité ?
- Littérature: partir à la retraite plus tôt n'a pas d'effet au Danemark (Nielsen 2017), a un effet délétère en Autriche (Kuhn 2010), et bénéfique aux Pays-Bas (Bloemen 2017)
- Ici: première étude sur le cas français
- Difficulté: endogénéité car double causalité santé $\longleftrightarrow$ âge de départ à la retraite
- Solution: expérience naturelle
- 1993: réforme des retraites du le secteur privé (Balladur)
- Allongement progressif des trimestres nécessaires pour bénéficier d'une retraite à taux plein à partir de 60 ans: de 150 à 160 trimestres

Données

- Echantillon Inter-Régime des Retraités (EIR) 2004, 2008 et 2012
- Cohortes contrôles: 1930, 1932 (ont minimum 61 ans en 1993)
- Cohortes traitées: 1934, 1936, 1938 (ont minimum 55 ans en 1993)
- Ont tous au moins 65 ans en 2004
- Limites: carrières très longues ou très courtes non affectées par la réforme

Stratégie

- But: estimer l'impact de l'âge du départ en retraite (A) sur la mortalité à 4 et 8 ans (contraintes de l'échantillon)
- Mortalité: critère objectif
- Moindres carrés en deux étapes: variables instrumentales (VI)
- (1) Instrumenter A par le nombre de trimestres suppplémentaires ($NbTrim$) imposés par la réforme $\Rightarrow \widehat{A}$
- (2) Utiliser $\widehat{A}$ comme facteur explicatif de la probabilité de mortalité (modèle linéaire)
- Résultat: effet souvent non significatif (nombreuses analyses de robustesse, avec divers échantillons)
- Avec ajout de la cohorte 1938, résultat significatif: légère augmentation de la probabilité de décès
- Analyse de la puissance statistique: l'effet minimum détectable avec les données serait faible

Plan

Présentation

Discussion

Données

- Quel usage est-il fait de la dimension panel des données (à part l'information sur la mortalité) ?
- Echantillon non soumis à la réforme Fillon de 2003 ?
- On aimerait en savoir plus sur les données
- La réforme a-t-elle pu être anticipée ?
- Certains en manque de trimestres ont-il pu partir à la retraite juste avant la réforme pour ne pas être encore plus pénalisés ?
- Comment prendre en compte l'arbitrage entre désutilité liée au travail et perte en montant de retraite ? Les individus font-ils un choix rationnel par exemple en fonction de leur espérance de vie ?
- Espérance de vie à 35 ans (1976-84): cadres 41.7 ans, ouvriers 35.7 ans: mortalité sélective, sur un échantillon déjà plutôt âgé

Stratégie

- *NbTrim* explique significativement A dans la régression (1) $\Rightarrow$ bon instrument pour A ?
- VI fournissent un effet calculé uniquement sur les *compliers*, i.e. ceux qui réagissent à l'instrument: LATE *(Local Average Treatment Effect)*
- Ici: détection des compliers ? Car échantillon très hétérogène, typologie ?
- Instrument de qualité ? Certainement (visuellement) mais à vérifier (cf. Angrist & Krueger et le trimestre de naissance[1])
- L'effet de l'âge sur la mortalité est linéaire: pourrait-il ne pas l'être ? (A et A^2)
- Idem pour l'impact de *NbTrim* sur A
- Pourquoi pas les VI par maximum de vraisemblance ?
- Pourquoi un *LPM* et pas un *ivprobit* dans la régression (2) ?

[1] Does Compulsory School Attendance Affect Schooling and Earnings? QJE 2001

Résultats (1)

- Le papier annonce une stratégie en *différence de différences*, mais comment est-ce mis en œuvre en pratique ?
- Pas assez de données pré-réforme pour constater une tendance générale: peut-on rajouter des individus qui n'ont pas fait face à un changement ?
- Pourquoi ne pas utiliser les vagues précédentes de l'EIR ? (début de l'EIR: 1988)
- 1 trimestre c'est peu, et le changement maximal a été de +10 trimestres, i.e. 2.5 ans
- Un changement aussi faible peut-il affecter la mortalité des individus qui ont des métiers non pénibles ?
- L'effet est peut-être plus pénible pour les gens qui partent bientôt en retraite que pour ceux qui partiront longtemps après (actualisation ?)

Résultats (2)

- Sur l'effet minimal détectable: pourquoi est-ce la spécification de Duflo qui est la meilleure ici ?
- Dans quelle mesure cela dépend-il des covariables et de leur nombre ? Et du fait que A est déjà instrumenté ?
- Résultat intéressant par sexe: l'effet de la réforme sur A est de 1 pour 1 pour les hommes, 0.5 pour 1 pour les femmes
- Les femmes ont de toute manière trop peu de trimestres pour subir la réforme ? Décision jointe dans les couples ?
- Plus que l'âge de la retraite en soi, c'est peut-être aussi le revenu (baisse de revenu), la couverture sociale (perte de certains avantages) ... qui joue sur la mortalité: contrôler par la perte de revenu ?
- On aimerait voir les régressions complètes (au moins une) avec les covariables (avec type d'activité ?)

Health & Working Time: A Macroeconomic Perspective on the American Puzzle

Tanguy Le Fur & Alain Trannoy

Aix-Marseille University, CNRS, EHESS, Centrale Marseille, AMSE

"Mutual emulation and desire for a greater gain prompted them [workers] to over-work themselves, and to hurt their health by excessive labour" - Adam Smith, 1776

Warning

- Macroeconomists tell a story and show its plausibility
- Do not ask for a hard identification!
- There are plenty of explanations regarding the growing American health gap w.r.t. to other developed countries
  - Deaths of despair (Case & Deaton; 2015, 2017)
  - Smoking prevalence in the US
  - Inequality and access to health care

Originality

- We do not add an explanation of the American disadvantage in isolation to other phenomena
- We jointly explain that Americans have a poorer health and that they spend more in health care
- They work more (longer hours) and for a long time (at least 30-35 years)

The key link

- It appears there are some links between long hours of work and poor health
  - **Leisure and health**: Sickles & Yazbeck (1998); He, Huang & Hung (2013); Pressman et al. (2009)
  - **Work and health**: Sparks et al. (1997), White & Beswick (2003), Bamai & Tamakoshi (2014), Ruhm (2000, 2003,2007)
  - **Work and health behaviors**: Ruhm (1995, 2005), Ruhm & Black (2002), Berniell (2013), Ahn (2015)
- Bassanini & Caroli (2015) argue instead that the lack of control over one's hours of work is detrimental to health
  - Provided that the % of workers lacking control is not lower in the US than elsewhere, our story remains valid

Contribution

Can different preferences for leisure leading to a higher number of hours worked also explain the American health disadvantage despite the greater share of medical expenditure?

- We introduce health capital in a neoclassical exogenous growth model with endogenous labor supply
- The rate of depreciation of health capital is a positive function of individual labor supply
- We study how the steady state values of the variables of interest change with preferences for leisure

Outline

1 Stylized Facts

2 The Model

3 A (heroic) calibration

- Counterfactual: the US with different preferences for leisure

Stylized Facts

A The overworked American

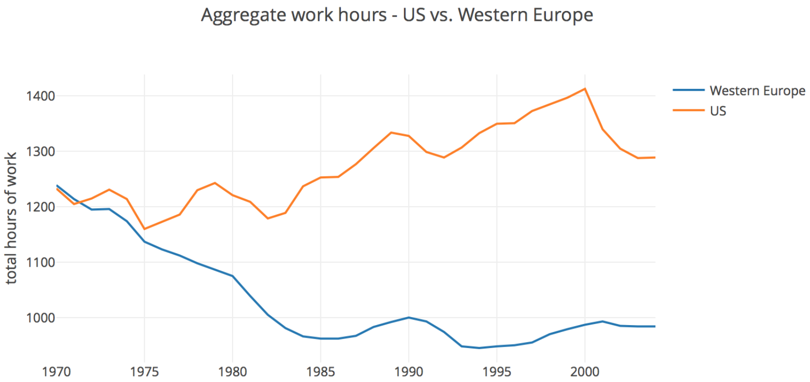
B The American health disadvantage

C The overspending American

The overworked American

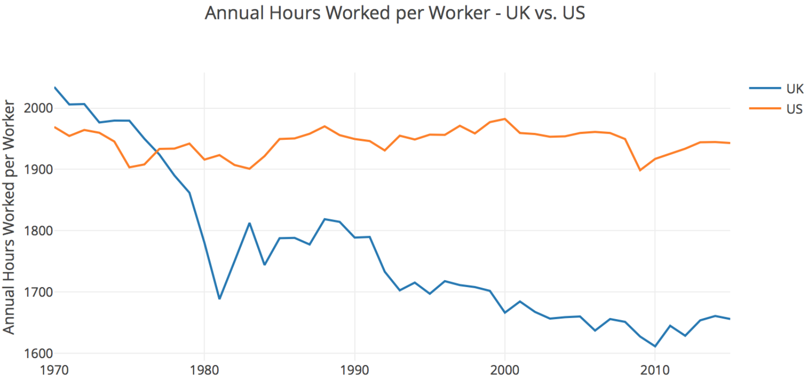
- Americans today work substantially more than European and the difference stems mostly from hours worked at the intensive margin (Bick et al, 2016)
- There is an ongoing debate about the reasons why
  - Prescott (2004): higher labor taxes in Europe dis-incentivize people to work and can account for all the difference in hours worked
  - Blanchard (2004): Europeans have used productivity gains to increase leisure rather than income
- Heterogeneity in preferences for leisure across countries, especially between Western Europe and the US (Bargain et al, 2012a)

The overworked American



Source: Ohanian, Raffo & Rogerson (2008)

The overworked American

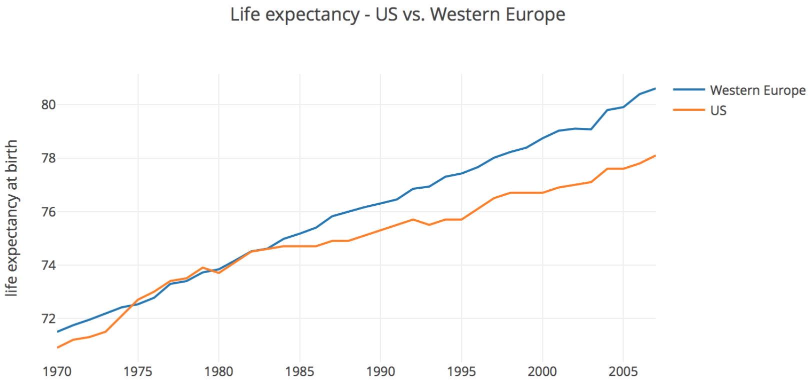


Source: Blundell, Bozio & Laroque (2011), extended by Bozio (2017)

The American health disadvantage

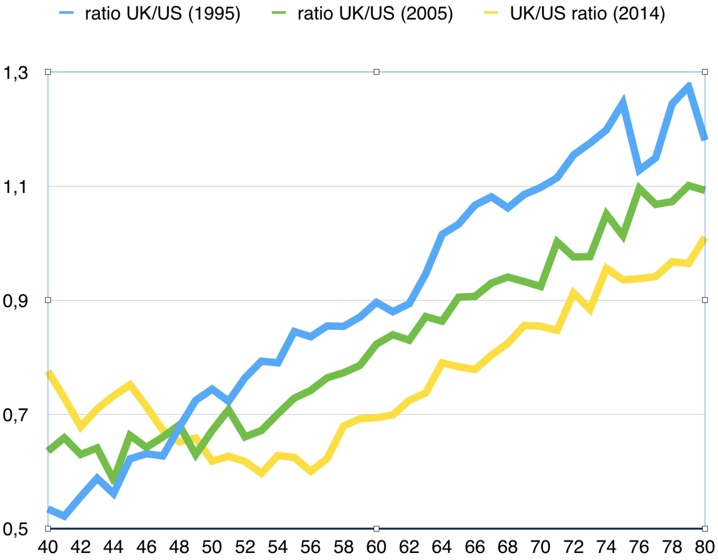
- Americans live shorter lives and are in poorer health throughout the life cycle (National Research Council, 2011; 2013) than their European counterparts
  - Americans report a greater disease burden: 30% higher for lung disease and myocardial infarction, 60% higher for heart disease and stroke, 100% for diabetes (Banks et al, 2006)
  - The disadvantage is pervasive across both age groups and the socio-economic distribution (Martinson et al, 2011a; Avendano et al, 2009, 2010; Crimmins et al, 2010; Glei et al, 2010)

The American health disadvantage



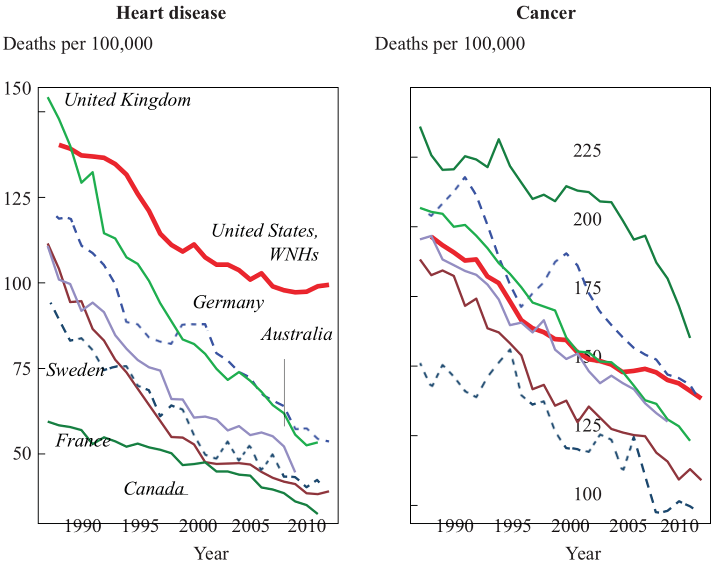
Source: OECD

The American health disadvantage



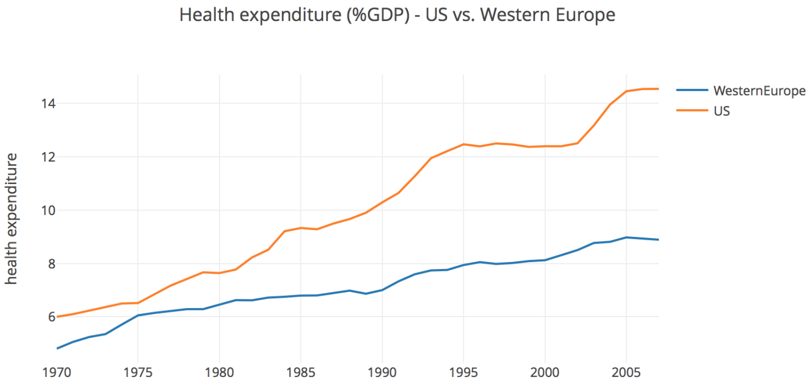
Mortality rates by age (UK/US). Source: HMD

The American health disadvantage



Heart Disease and Cancer Mortality by Country for Age 50-54, 1989-2014. (Source: Case & Deaton)

The overspending in health care



Source: OECD

The Model

Health capital

- We use Grossman's concept of health capital (1972)
  - Health as a capital stock that can be increased via medical investment and that depreciates over time.
  - We assume that its rate of depreciation δ_h is a function of individual labor supply

$$\dot{h}(t) = m(t)^{\sigma} - \underbrace{z \cdot l(t)^{\gamma}}_{\delta_h} \cdot h(t)$$

  - We assume medical investments are subject to decreasing returns ($\sigma < 1$) and that δ_h is a convex function of labor supply ($\gamma > 1$)

Health capital (ctd.)

- The general solution to the differential equation for health capital is:

$$h(t) = h_0 e^{-L(t)} + \int_0^t m(s)^\sigma e^{-L(s)} ds$$

where $L(t) = \frac{z}{1+\gamma} \int_0^t l(s)^{1+\gamma} ds$ and $L(t) = \frac{z}{1+\gamma} \int_s^t l(\tau)^{1+\gamma} d\tau$

- Medical expenditure in period s is discounted by the amount of work between periods s and t
  - Past hours of work lower the effect of health expenditure in later periods

Firms

- Firms produce a unique final good using a Cobb-Douglas technology:
$$y(t) = k(t)^{\alpha} l(t)^{1-\alpha}$$

- This final good can be used for consumption $c(t)$ or medical investment $m(t)$.

- Firms' optimization yields the usual first order conditions:

$$\begin{aligned} r(t) &= \alpha k(t)^{\alpha-1} l(t)^{1-\alpha} - \delta \\ w(t) &= (1-\alpha) k(t)^{\alpha} l(t)^{-\alpha} \end{aligned}$$

Households

- Households derive utility from consumption $c(t)$ and their health status $h(t)$, but dislike working $l(t)$

$$u(c, h, l) = \nu \cdot \log[c(t)] + (1 - \nu) \cdot \log[h(t)] - \phi \cdot l(t)$$

- They get income from the labor they supply $l(t)$ and the assets they hold $a(t)$, use it to consume $c(t)$ and purchase medical care $m(t)$ and save the rest

$$\dot{a(t)} = w(t)l(t) + r(t)a(t) - c(t) - p \cdot m(t)$$

First order conditions

- The households' utility maximization problems gives the familiar Euler equation for consumption:

$$\frac{\dot{c}(t)}{c(t)} = r(t) - \rho$$

- But also two novel features of the model:

$$\frac{\dot{m}(t)}{m(t)} = \frac{1}{1-\sigma}\left[r(t) + \delta_h(t) - \frac{\sigma}{p}m(t)^{\sigma-1}\mathrm{MRS}_{h,c}\right]$$

$$\mathrm{MRS}_{l,c} = w(t) - \frac{p}{\sigma}m(t)^{1-\sigma}l(t)^{\gamma-1}h(t)$$

Long run analysis

Health Expenditure

- How do health expenditure vary with preferences for leisure?

$$\frac{\partial(p\cdot m/y)^\star}{\partial l(\phi)^\star} = \left[\frac{(1-\alpha)\delta+\rho}{\rho+\delta}\left(\frac{\alpha}{\delta+\rho}\right)^{\frac{\alpha}{1-\alpha}}\right]\frac{\gamma\sigma(1-\nu)\nu\rho z l(\phi)^{\star\,\gamma-1}}{([\sigma(1-\nu)+\nu]z l(\phi)^{\star\,\gamma}+\nu\rho)^2} > 0$$

Proposition 1

Medical expenditure as a share of GDP decreases with preferences for leisure ϕ.

Health Capital Stock

- How does the health capital stock vary with preferences for leisure?

$$h^{\star} = \frac{1}{z}\left[\left(\frac{1}{p}\right)\frac{(1-\alpha)\delta+\rho}{\rho+\delta}\left(\frac{\alpha}{\delta+\rho}\right)^{\frac{\alpha}{1-\alpha}}\right]^{\sigma}\left[\frac{\sigma(1-\nu)}{z[\sigma(1-\nu)+\nu]l^{\star\gamma}+\nu\rho}\right]^{\sigma} l(\phi)^{\star(1+\gamma)\sigma-\gamma}$$

  - The sign of the derivative is ambiguous and ultimately depends on the returns to health investments σ

Proposition 2

There exists a unique value $0 < \sigma^{\star} < 1$ below which the steady state health capital stock increases with preferences for leisure ϕ.

Calibration exercise

Health capital parameters

- $\delta_h = z \cdot I^{\gamma}$: Scholz & Seshadri (2010) take a value of 5%; Lawver (2012) between 0 and 5%
  - We choose $\delta_h = 2.5\%$ as a benchmark and let it vary
  - We set $\gamma = 2$ to have a unique root and calibrate z accordingly
- We set σ between 0.7 and 0.9 to indicate decreasing returns
  - $\sigma = 0.8$ as a benchmark

Health capital and mortality

- We also need to draw a relation between the steady state health capital stock $h^\star$ and mortality rates
  - To do so, we use a logistic function

$$T = \frac{T_0}{T_0 + (1 - T_0)\, e^{-\psi \cdot h^\star}}$$

  - $T \in [0; 1]$ can be interpreted as a survival probability
  - T_0 is the survival probability without any health capital
- We then calibrate the parameter ψ to match the survival probability between age 55-64 in the US

Calibration

- We want to investigate the effect of a reduction in hours worked on both the share of health expenditure and the health capital stock
- To do so we calibrate the model to the US economy, and especially:
  - ν (relative taste for consumption) to match the average share of health expenditure: 16.5%
  - ϕ (preferences for leisure) to match the fraction of time spent in market work: 0.334

Calibration

- Other parameters are calibrated as is standard in the literature

Parameter		Target	US
α	Capital share	Capital/output ratio	0.3
δ	Capital rate of depreciation	Investment/output ratio	0.08
ρ	Discount factor	Interest rate	0.04
γ	Health capital depreciation	Chosen	2
σ	Returns to health investment	Chosen	[0.7 ; 0.9]
z	Scaling parameter	US rate of depreciation	[0.09 ; 0.45]
p	Relative price of health care goods	OECD data	1.24
T_0	Survival probability without health capital	Mortality rates 1810	0.934
ψ	Steepness of the logistic function	Survival probability (age 55 - 64)	0.077
ν	Relative preferences for consumption	Share of health expenditure	0.539
ϕ	Preferences for leisure	Hours worked	0.213

A reduction of hours worked in the US

- What if Americans worked as much as Europeans?
- We re-calibrate preferences for leisure ϕ to match not American but European labor supply
  - We choose the UK as our benchmark European country: $l^{\star}_{uk} = 0.284 < l^{\star}_{us} = 0.334$
- We then solve for the share of medical expenditure and the health capital stock at the steady state

A reduction of hours worked in the US

- In our baseline calibration, if Americans worked as much as Britons, their share of health expenditure would be of 13.9% instead of 16.5%
- The steady state health capital stock also increases, which translates into lower mortality rates and thereby into a greater survival probability
  - Around 140 deaths per thousand of people aged 55-64 per year would be avoided
- We do the same exercise for different values of the rate of depreciation of health capital the returns to medical investment
  - Only when $\delta_h = 1\%$ and $\sigma = 0.9$ the reduction in hours worked actually increases mortality rates

Robustness checks

Specification		Health expenditure[1]	Mortality[2]
	$\sigma = 0.7$	3.2	143
$\delta_h = 1\%$	$\sigma = 0.8$	3.2	50
	$\sigma = 0.9$	3.2	-43
	$\sigma = 0.7$	2.6	220
$\delta_h = 2.5\%$	$\sigma = 0.8$	2.6	138
	$\sigma = 0.9$	2.6	56
	$\sigma = 0.7$	2	298
$\delta_h = 5\%$	$\sigma = 0.8$	2	228
	$\sigma = 0.9$	2	158

[1]: Reduction in the share of health expenditure (p.p.);
[2]: Lives saved per hundred thousand people

Conclusion

- We build an exogenous growth model with elastic labor supply and health capital that depreciates with work to answer several questions
- Theoretically, a higher number of hours worked increases the share of resources devoted to health care and potentially lowers the health capital stock, provided the returns to health investment are not high enough
- The calibrated model predicts that Americans could reduce their share of medical expenditure and improve mortality rates of workers by reducing the number of hours they work

Discussion sur "Health and Working Time: A Macroeconomic Perspective on the American Puzzle"

de Tanguy Le Fur et Alain Trannoy

Par Sidartha Gordon

Université Paris-Dauphine

Mars 2018

Faits stylisés

- Americains travaillent plus
- Sont en moins bonne santé (meurent plus jeunes..)
- Ont plus de dépenses de santé
- Un modèle qui rationalise tout cela par une désutilité moins grande du travail aux EU.

Ingredients

- Le stock de capital santé, qui entre dans la fonction d'utilité
- Travailler dévalue ce stock
- Dépenses de santé renflouent le stock
- Modèle de croissance
- Etat stationnaire
- Statique comparative: avec une désutilite moins grande du travail
  - $\rightarrow$ on travaille plus
  - $\rightarrow$ (1) on dépense plus en santé (pour compenser) OU (2) on a un stock de santé plus faible (OU les deux)
  - Résultats du modèle: (1) est toujours vraie et (2) parfois

Discussion sur les hypotheses

- Modèle de croissance / état stationnaire
- Différent de la littérature (une période ou cycle de vie)
- On aimerait voir les agents mourir dans le modèle !
- Semble important dans le modèle
- Peut se défendre: individu d'âge moyen, encore loin de la mort et ayant déja constitué ses économies.
- Mais peut-on avoir un modèle plus simple qui rationaliserait aussi les faits stylisés ?

$$\max_{l,c,m,h} \ \nu \log(c) + (1-\nu)\log(h) - \phi l$$

$$c + pm \leq l^{1-\alpha}$$

$$h = (h_0 + m^\sigma)\, e^{-zl}$$

Contrainte saturée:

$$(c+pm)^{\frac{1}{1-\alpha}} = l$$

En subsituant:

$$\max_{c,m} \ \nu \log(c) + (1-\nu)\log\left[(h_0 + m^\sigma)\, e^{-z(c+pm)^{\frac{1}{1-\alpha}}}\right] - \phi (c+pm)^{\frac{1}{1-\alpha}}$$

$$\nu \log(c) + (1-\nu)\log(h_0 + m^\sigma) - (1-\nu)\, z\, (c+pm)^{\frac{1}{1-\alpha}} - \phi (c+pm)^{\frac{1}{1-\alpha}}$$

$$\nu \log(c) + (1-\nu)\log(h_0 + m^\sigma) - (1-\nu) z (c+pm)^{\frac{1}{1-\alpha}} - \phi (c+pm)^{\frac{1}{1-\alpha}}$$

Conditions du premier ordre:

$$\frac{\nu}{c} = \frac{((1-\nu) z + \phi)}{1-\alpha} (c+pm)^{\frac{\alpha}{1-\alpha}}$$

$$\frac{(1-\nu)\sigma m^{\sigma-1}}{h_0 + m^\sigma} = p\frac{((1-\nu) z + \phi)}{1-\alpha} (c+pm)^{\frac{\alpha}{1-\alpha}}$$

En divisant:

$$\frac{c m^{\sigma-1}}{p(h_0 + m^\sigma)} = \frac{\nu}{\sigma(1-\nu)}$$

Si $h_0 = 0$,

$$\frac{c}{pm} = \frac{\nu}{\sigma(1-\nu)}.$$

$$\frac{cm^{\sigma-1}}{p\left(h_0+m^{\sigma}\right)}=\frac{\nu}{\sigma\left(1-\nu\right)}$$

Si $h_0 = 0$,

$$\frac{c}{pm}=\frac{\nu}{\sigma\left(1-\nu\right)}$$

Donc quand $\phi \searrow$: $\quad l \nearrow \quad y \nearrow$ mais les **parts des dépenses** c et m ne changent pas.
Or dans le papier, quand $\phi \searrow$: $\quad \frac{c}{pm} \searrow$.
Pour $h_0 > 0$ (mais petit),

$$\frac{c}{pm}=\left(\frac{h_0}{m^{\sigma}}+1\right)\frac{\nu}{\sigma\left(1-\nu\right)}$$

Pour h_0 petit, quand $\phi \searrow$: $\quad m \nearrow$ donc $\frac{c}{pm} \searrow$.

Remarque finale

Aucune source d'inefficacité dans le modèle.
Donc pas de recommendation d'intervention.
Les Américains "choisissent" de mourir plus jeunes !

Health insurance and social welfare: To what extent the *ex-ante* and the *ex-post* approaches differ? An empirical case based on a French employer mandate

Aurélie Pierre (Irdes & PSL Research University, Université Paris-Dauphine, Leda-Legos), Florence Jusot (PSL Research University, Université Paris-Dauphine, Leda-Legos & Irdes), Denis Raynaud (Irdes), Carine Franc (Inserm, Irdes)

Context

- **In France, despite the existence of the Public health insurance, OOP expenditures can be very high for some individuals and for some types of care (physicians visits, dental and optical care)**
- **Access to health care depends greatly on having or not a Complementary Health Insurance (CHI) (Buchmueller et al., 2004; Dourgnon et al, 2012 ; Jusot et al., 2013)**
  - Individual or collective policies
  - Public schemes to facilitate access to CHI (CMU-C, ACS, tax exemptions)
  - The proportion of uninsured is quite low (5% in 2012)
  - But inequalities remain in access, level of coverage, costs

Context

- **Policy makers want to generalize access to good CHI for the whole population without increase of public expenses**
- **The "*Ani reform*" (Accord national interprofessionnel) (January 2013)**
  - Negociated by trade unions in return to greater flexibility on the labour market
  - Mandates all private sector employers to offer a CHI to all of their employees (and their former employees during one year) since January 1st, 2016
  - Employers have to paid at 50% least of premiums

What are the likely effects of the reform ?

This reform

- is not likely to reduce inequalities in coverage, since employees were among the most covered populations before the reform (Pierre & Jusot, 2017)
- decreases the cost of CHI for employees of the subsidy amount, but only if wages are not adjusted = in the very short term
- may decrease or increase the cost of CHI for those who switch from individual CHI to collective, since individual CHI premiums increase with age and not collective CHI premiums
- prevents employees choosing their optimal level of coverage (Manning & Marquis, 1996; Butler, 1999; Doiron et al., 2008 ; Marquis & Long, 1995 ; Engelhardt & Gruber, 2010)
- may affect premiums paid by non employed since the individual insurance market may become more risky (in terms of health status)

Aims of the study

- **To simulate the likely effects of the Ani reform on the social welfare**
- **Counterfactual analysis estimated on the basis of data observed for 2012** (no available data allow to provide an real evaluation after the reform)
- **Evaluation based on exogeneous behaviors**
  - No impact of the reform on insurance demand (for those who are not covered by their employer)
  - No impact on insurance change on health care use
  - No impact of the reform on the demand and supply of labor
  - The reform only impacts the CHI status of employees, and thus on out-of-pocket payments, and the premiums paid by both employees and those who remain individually insured
- **Using several normative frameworks**

Normative approaches for assessing social welfare

- **Consequentialism: judgments based on individual consequences**

(*versus* judgments based on the morality of actions as in deontological ethics)

- **Which individual outcomes ?**
  - Individual utility (cardinal, interpersonally comparable): Utilitarism
  - Objective conditions of the good life, taking account preferences : Welfarism
  - Primary goods or capabilities (without preferences) : Non welfarism

- **Which aggregation of individual outcomes ?**
  - Sum of individual utilities: Utilitarism
  - Aversion to inequality: Egalitarism

Assessing social welfare of risky situations

- **Measuring social welfare of risky situations requires dealing with two dimensions: states of nature and individuals (Fleurbaey, 2010)**

- **The *ex-ante* approach measures social welfare by**
  - firstly aggregating outcomes in the various states of nature at the individual level
  - secondly aggregating expected outcomes over individuals

- **The *ex-post* approach measures social welfare by**
  - firstly measuring social welfare between individuals in each state of nature
  - secondly aggregating those conditional social welfare measures over the distribution of the states of nature

Ex-ante utilitarian approach

- Social welfare is assessed at the individual level by the **expected utility** EU_n of the individual *n* given his level of disposable income y_n in the various states on nature i and the associated probabilities p_i

$$SW_n = EU_n = \sum_{i=1}^{I} p^i U_n(y_{in}) \qquad for\ all\ n = 1,2, \dots \dots \dots, N$$

- The social planner maximizes the **sum** of individual expected utilities

$$SW = \sum_{n=1}^{N} EU_n \quad with\ \ for\ all\ n,\ EU_n = \sum_{i=1}^{I} p^i U_n(y_{in})$$

$$SW = \sum_{n=1}^{N} U_n(CE_{nt}) \quad with\ for\ all\ n,\ U_n(CE_{nt}) = \sum_{i=1}^{I} p^i U_n(y_{in})$$

⇒

- Individuals are supposed to have VNM preferences
- Cardinal and interpersonally comparable utilities
- No specific aversion of the social planer toward inequality

(despite the concavity of the utility function at the individual level)

Ex-ante egalitarian approach

- Social welfare is assessed at the individual level by the **certainty equivalent** $EC_{n,}$ which correspond to the certain income that gives the same level of utility than the distribution of states on nature (y_{in}) they are faced. It also corresponds to the expected gain adjusted from the risk premium, i.e. the willing to pay to obtain a certain income instead for a risky income

$$SW_n = CE_n \qquad with,\ U_n(CE_{nt}) = \sum_{i=1}^{I} p^i U_n(y_{in})$$

- The social planner maximizes a **social welfare function of individual certainty equivalents**

$$SW = U(CE_1, \ldots CE_n, \ldots CEN)$$

➡
- Respect of individual risk aversion (value of insurance is taken into account)
- Individuals are supposed to have VNM preferences
- Respect of individual ordinal income preferences (and not cardinal preferences nor interpersonnally comparable) ?
- Aversion of the social planer toward inequality

Ex-post egalitarian approach

- For each potential state of nature i, the social welfare is assessed at the individual level by the **disposable income of the individual i in the realized state on nature y_{in}**

$$SW_{in} = y_{in}$$

- The ex-post distribution of the outcomes y_n within the population corresponds to the expected distribution given the probabilities p_i

- The social planner maximizes the **weighted distribution of the social welfare function in each state of nature**

$$SW = \sum_{i=1}^{I} p^i U\left(y_{i1}, \ldots., y_{in,} \ldots.. y_{iN}\right)$$

  - Individuals aren't supposed to have VNM preferences, or to manage probability distributions
  - Insurance value is not taken into account
  - ⇨ Respect of individual ordinal income preferences
  - Aversion of the social planer toward inequality
  - SW is more sensitive to catastrophic outcomes since the social planer utility function applies to each potential y_{ni} and not to EU_n

Theoritical framework

- At each period t, the **disposable income** of the individual n in the state of nature i is equal as the difference between initial household income by consumption unit minus the premium paid per capita and minus the out-of-pocket payment after reimbursement by the Public Health Insurance and the Complementary Health Insurance:

$$y_{int} = Household\ Income_{nt} - Premium_{nt} - OOP_{nt}^{i}$$

- Gains and losses of social welfare induced by the reform correspond to the **variation in social welfare** before and after the reform

$$\Delta SW = SW_{After} - SW_{before}$$

Analytical strategy

1/ Simulation of the difference in social welfare after and before reform within the ex-ante utilitarian approach

2/ Simulation of the difference in social welfare after and before reform within the ex-ante egalitarian approach

3/ Simulation of the difference in social welfare after and before reform within the ex-post egalitarian approach

Data

- **2012 Health and Health Insurance survey linked to the administrative data of the National Health Fund**
- **Representative of French households**
  - Health, SES, CHI (lack of coverage, individual/collective, opinion on quality)
  - Risk preferences: 'In terms of your attitude regarding risk, where would you place yourself on a scale from 0 to 10, from very cautious to very advanturous'
  - OOP expenditures after reimbursements of the PHI
- **Sample - 6,122 individuals (15 years old and over)**
  - 4.5% uninsured, 60% individual CHI, 35.5% collective CHI
  - 42% are targeted by the reform (3.7% uninsured, 31% individual CHI)

Assumptions and imputations

- **Social welfare function**

→ Functional form chosen according to the literature: Utilitarian (Pierre et al., 2018)+ Atkinson social welfare function (Samson et al., 2017, Thébaut et Wittwer, 2017)

- **Individual utility function** (for the utilitarian and thd ex-ante egalitarian approaches)

→ Functional form chosen according to the literature: CRRA

→ Imputation of risk aversion, based on data

- **Income** → Observed in the data
- **CHI premiums**
- **The financial exposure to risk**

} Imputation of CHI level, , based on data
Assumptions on the Ani implementation

Assumptions : Social welfare function

- **Utilitarian approach: Sum of the individual expected utilities**

$$\text{SW} = \sum_{n=1}^{N} EU_n \quad with \quad for\ all\ n,\ EU_n = \sum_{i=1}^{I} p^i U_n(y_{in})$$

- **Ex-ante and the ex-post approaches: Atkinson social welfare function**

$$\text{SW}= U(y_n) = \frac{1}{1-\rho} \sum_{n=1}^{N} {y_n}^{1-\rho} \qquad \text{if} \quad \rho \neq 1$$

$$\text{SW}=U(y_n) = \sum_{n=1}^{N} \log(y_n) \qquad \text{if} \quad \rho = 1$$

- Where y_n corresponds the certainty equivalent or the individual disposable income

- Where ρ corresponds to the degree of social planner aversion to inequality :

  - ρ =0 corresponds to the case of absence of aversion to inequality

  - ρ >0 corresponds to the case of aversion to inequality

Assumpt. and imput. : Individual utility function

- **A Constant Relative Risk Aversion function (CRRA)**

$$U_n(y_n) = \frac{1}{1-\gamma} {y_n}^{(1-\gamma)} \quad \text{if} \quad \gamma \neq 1$$
$$U_n(y_n) = \log(y_n) \quad \text{if} \quad \gamma = 1$$

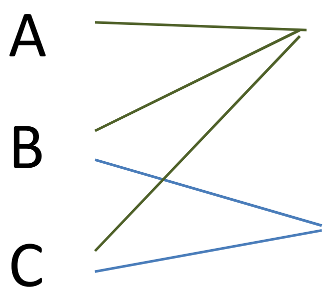
- Imputation of γ comparing the distribution of the subjective scale of risk attitude collected in our survey with the distribution of γ measured by Arrondel and Calvo in France in 2008, based on a Holt and Laury measure

	Parameter of the relative risk aversion ɣ										
	<1 (the least risk-averse)			2<ɣ<=1	3.76<ɣ<= 2		ɣ>3.76 (the most risk-averse)				
ɣ distribution (Arrondel and Calvo)											
% in the population by group	4.9%			10.2%	26.6%		58.3%				
Risk behaviour note	10	9	8	7	6	5	4	3	2	1	0
% in the sample	1%	1.2%	5%	9.1%	8.8%	22.9%	9.7%	11.8%	11.8%	7.5%	11.2%
% in the sample by group	7.2%			9.1%	31.7%		52%				
Average ɣ per group (Barsky et al.)	0.7			1.5	2.9		15.8				
Attributed value of ɣ	**0.5**	**0.7**	**0.9**	**1.5**	**2.5**	**3.3**	**6.8**	**12.8**	**15.8**	**19.4**	**26.5**

Assumpt. and imput.: CHI before the reform

- **CHI level of coverage (before the Ani reform)**

3 coverage levels	*Ministry survey*		*Imputation*
A, B, C	Collective Policies (53%, 39%, 9%)	→	Opinion on CHI level + Company size
B, C	Individual Policies (49%, 48%)	→	Opinion on CHI level + Income



- **CHI premiums (before the Ani reform)**
  - We know the CHI premiums for individual and collective policies (DREES Survey, 2012)
  - We assume that employers paid 50% of the CHI premium for their employees and their dependants (PSCE, 2009)

Assumpt. and imput.: CHI after the reform

- The employers will offer the minimum coverage requires by law (C+)
- CHI coverage remains the same for people not affected by law

Path	Before the reform	After the reform	%
1	Collective A	Collective A	19%
2	Collective B	Collective B	13%
3	Collective C	Collective C+	3%
4	Individual B	Individual B	21%
5	Individual B	Collective C +	6%
6	Individual C	Individual C	26%
7	Individual C	Collective C +	7%
8	No CHI	Collective C +	2%
9	No CHI	No CHI	3%

Those who may remain insured by an collective CHI

Those who may remain insured by an ind. CHI

Those who may switch from an ind. CHI to a coll. CHI

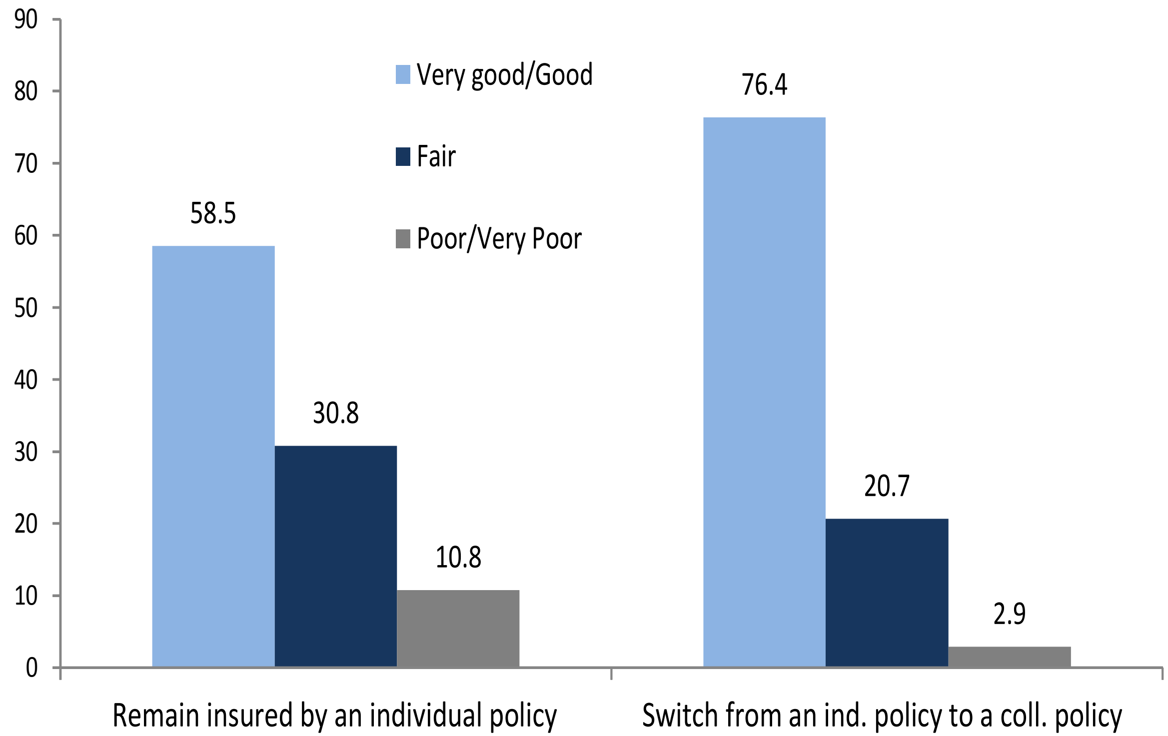
Those who may gain CHI

Those who may remain uninsured

Assumpt. and imput.: premiums after the reform

- **Concerning the collective CHI policies premiums:**
  - Scenario 1: The employers will offer the minimum subsidy requires by law (50% of collective premium) without changing wages (Short term)
  - Scenario 2: The employers will reducing wages by the subsidy amount

- **Concerning the individual CHI policies premiums:**
  - Scenario 1: no increase
  - Scenario 2: increase of 10% (due to increase in OOP +cross subsidies)

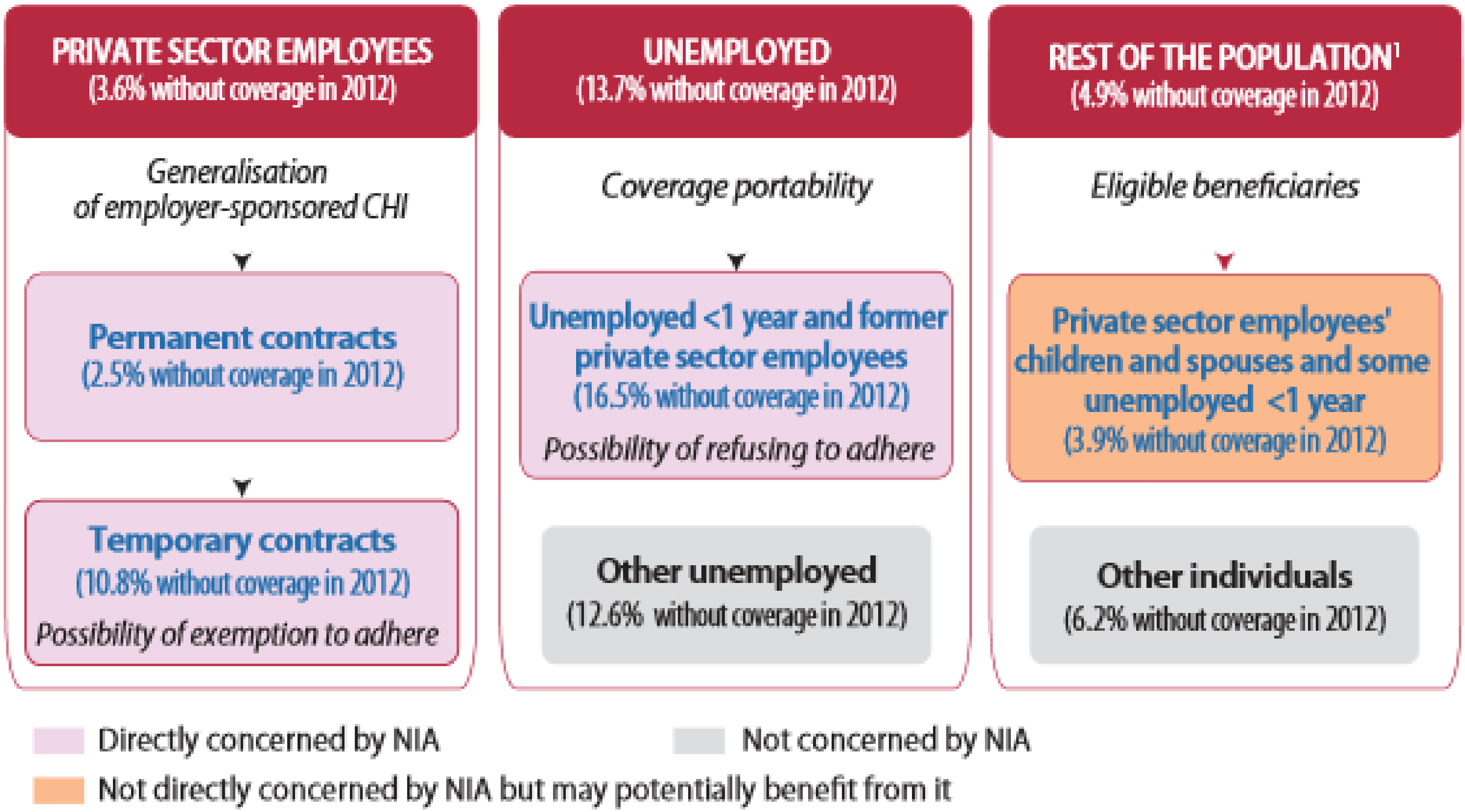


Assumptions and imputations: OOP

- **The financial exposure to risk corresponds to the OOP distribution of individuals with the same age and health status**
  - Quantiles regressions (99 percentiles)
  - Y: OOP if everybody were insured with a CHI policy A, B, C (or 0)
  - X: age, self-assessed health status, ALD scheme

S

Populations concerned directly or indirectly by the NIA



[1] Public sector employees, self-employed, students, retirees and other inactive

Source: ESPS 2012, Irdes. **Realisation:** Irdes.

Results: Ex-ante utilitarian social welfare

	Absolute Variation	Relative Variation
Initial value of social welfare		
No substitution between wage and premium		
No increase in ind. premiums	30,81	0,10%
10% increase in ind. premiums	16,07	0,05%
Substitution between wage and premium		
No increase in ind. premiums	-24,91	-0,08%
10% increase in ind. premiums	-39,65	-0,13%

➡ Negative impact of the reform primarily driven by substitution

Results: Ex-ante egalitarian social welfare

Absolute variation	RHO_0	RHO_05	RHO_1	RHO_15	RHO_2	RHO_25	RHO_3	RHO_35	RHO_4
Initial social welfare	12167	4171	3394	-2393	-3976	-5248	-6510	-7982	-9878
No substitution No increase	31	6	21	5	17	36	65	105	163
No substitution 10% increase	4	1	2	0	0	-3	-10	-24	-50
Substitution No increase	2	0	2	0	2	5	11	20	35
Substitution 10% increase	-25	-5	-17	-4	-15	-35	-65	-110	-178

➡ Negative impact of the reform primarily driven by increase in premiums of individually insured

This decrease in social welfare increase with inequality aversion

Results: Ex-post egalitarian social welfare

Absolute variation	RHO_0	RHO_05	RHO_1	RHO_15	RHO_2	RHO_25	RHO_3	RHO_35	RHO_4
Initial social welfare	11895	16418	3293	-9521	-86	-2316	-41	-1235	-117
No substitution No increase	28	22	18	16	14	13	13	14	15
No substitution 10% increase	1	0	0	-1	-2	-2	-3	-3	-3
Substitution No increase	2	2	1	1	1	1	1	1	1
Substitution 10% increase	-25	-20	-18	-16	-15	-15	-15	-16	-17

➡ Negative impact of the reform primarily driven by increase in premiums of individually insured

This decrease in social welfare increase with inequality aversion

Conclusion

- **The Ani reform may induce a weak increase in social welfare but only under the assumption of absence of substitution between wages and the employer subsidy, and of absence increase in individually premium**

- **Under the hypothesis of an increase in individually premium, the loss of welfare that suffer individuals who remain insured by an individual CHI may be hardly offset by the gain in welfare that benefit private sector employees**

- **The evaluation of the reform is sensitive to the social planer inequality aversion**

- **Under the assumption of aversion of inequality, the decrease in social welfare is larger in the ex-post approach since this approach gives more importance to large losses with small probabilities (catastrophic out-of-pocket payments)**

Thank you for your attention

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Description of the sample

	Sample		Individuals affected by the Ani reform	
	Number	%	Number	%
CHI coverage				
Without CHI	264	4.5	78	3.7
Employer-sponsored CHI policy	2165	35.4	1594	65.7
Individual CHI policy	3693	60.1	706	30.6
Employment status				
Employed	3155	54.8	2283	95.7
Retired	1801	28.8	0	0
Unemployed	293	5.1	95	4.3
Students	390	5.4	0	0
House wife/husband	311	3.3	0	0
Other	167	2.5	0	0
Unknown	5	0.1	0	0
People affected by the Ani reform				
Private secor employees	2283	39.7	2283	95.7
Short term unemployed	95	1.8	95	4.3
All	2378	41.5	2378	100
Income per CU				
<= 650 €	171	2.4	37	1.2
651€/1000€	1071	16	280	10.7
1001€/1400€	1569	25.5	596	24.7
1401€/2000€	1759	30	765	33.3
2001€/3000€	1085	18.4	484	21
> 3000€	467	7.8	216	9.1
Sexe				
Men	2899	46.8	1226	50.1
Women	3223	53.2	1152	49.9

	Sample		Individuals affected by the Ani reform	
	Number	%	Number	%
Age				
15/20 years old	410	5.8	31	1.5
21/30 years old	567	12.2	381	20.6
31/40 years old	882	17.5	590	28.7
41/50 years old	1168	16.7	731	25.5
51/60 years old	1106	16.5	588	21.7
61/75 years old	1339	20.4	56	2.1
Over 75 years old	650	10.9	1	0
Risk preference				
0 (very cautious)	720	11.2	191	7.5
1	452	7.5	138	5.9
2	731	11.8	263	10.9
3	724	11.8	320	13.2
4	594	9.7	268	11.3
5	1383	22.9	552	23.5
6	541	8.8	237	10
7	545	9.1	216	9.2
8	303	5	132	5.7
9	68	1.2	34	1.5
10 (daring)	61	1	27	1.2
Perceived health status				
Very good/Good	4097	68	1814	78
Fair	1566	24.6	490	19.2
Bad/Very Bad	459	7.4	74	2.8
Total	**6122**	**100**	**2378**	**100**

Reimbursement of CHI policies A, B, C and C+

	Policy A	Policy B	Policy C	Policy C+
Specialists	100% actual cost	100% RP	30% RP	30% RP
GPs	100% actual cost	50% RP	30% RP	30% RP
Medical and paramedical procedures	30% RP	30% RP	30% RP	30% RP
Biology	30% RP	30% RP	30% RP	30% RP
Dentures	400% RP	300% RP	100% RP	125% RP
Eyeglasses and lenses				
Frames	150 €	150 €	50 €	50 €
Simple lenses	160€/lense	75€/lense	25€/lense	25€/lense
Simple lense+Complex lense	160€/lense	75€/lense	37,5€/lense	50€/lense
Simple lense+Very complex lense	160€/lense	75€/lense	37,5€/lense	37,5€/lense
Complex lenses	300€/lense	125€/lense	75€/lense	75€/lense
Complex lense+Very complex lense	300€/lense	125€/lense	75€/lense	75€/lense
Very complex lenses	300€/lense	125€/lense	75€/lense	75€/lense
Contact lenses	Actual cost	150 €	100 €	100 €
Hospitalisation				
Daily rate	100% actual cost	100% actual cost	100% actual cost	100% actual cost
Cost of stay	100% RP	100% RP	100% RP	100% RP
Excess fees	100% actual cost	100% RP	30% RP	30% RP

** RP = Regulated Prices*

Imputation of level policies for individual and collective policies

INDIVIDUAL POLICIES			
Opinion on CHI coverage	Revenue per CU	%	Imputation
Very good	< €1,400	7,8	B
Very good	€1,400/€3,000	6,4	B
Very good	> €3,000	0,8	B
Rather good	< €1,400	21,3	C
Rather good	€1,400/€3,000	22,1	B
Rather good	> €3,000	3,3	B
Poor / Very poor	< €1,400	15,6	C
Poor / Very poor	€1,400/€3,000	12,4	C
Poor / Very poor	> €3,000	1,4	C
Unknown	< €1,400	5,2	C
Unknown	€1,400/€3,000	3,4	B
Unknown	> €3,000	0,4	B

COLLECTIVE POLICIES			
Opinion on CHI coverage	Company size	%	Imputation
Very good	> 250	16,2	A
Very good	50/250	5,7	A
Very good	< 50	5,9	B
Very good	Unknown	2,6	A
Rather good	> 250	26,0	A
Rather good	50/250	8,9	B
Rather good	< 50	10,7	B
Rather good	Unknown	5,7	B
Poor / Very poor	> 250	4,3	B
Poor / Very poor	50/250	1,9	C
Poor / Very poor	< 50	3,2	C
Poor / Very poor	Unknown	1,3	C
Unknown	> 250	3,2	A
Unknown	50/250	1,4	B
Unknown	< 50	3,1	C

- **Among insured by an individual policy: 44% B, 56% C**
- **Among insured by a collective policy: 54% A, 37% B, 9% C**

Health insurance and social welfare: To what extent the *ex-ante* and the *ex-post* approaches differ? An empirical case based on a French employer mandate

Aurélie Pierre, Florence Jusot, Denis Raynaud,
Carine Franc

Journée de la Chaire Santé

Université Paris Dauphine, 30 Mars 2018

1. Redistribution entre assurés si les employeurs intègrent le coût de la réforme en réduisant les salaires → *A niveau identique de garantie, les contrats collectifs sont moins (resp. plus) chers que les contrats individuels pour les salariés de 40 ans et plus. (resp. de moins de 40 ans).*

2. Amélioration de la couverture. Est-ce que les individus non couverts avant la réforme l'étaient par choix ou parce qu'ils n'avaient pas accès à une assurance?

→ *La réforme devrait faire directement bénéficier à (…) des individus jeunes, de revenu intermédiaire, en bonne santé et peu averses au risque.*

3. Modification du pool de risques couverts via les contrats individuels.

→ *Les individus qui devraient rester couverts par un contrat individuel après l'Ani sont surreprésentés parmi les plus âgés (environ 90 % des plus de 60 ans), les plus pauvres (71,2 %), ceux en mauvaise santé perçue (71,2 %) et ceux avec la plus forte aversion au risque (69,5 %).*

Certains individus bénéficiaient avant la réforme d'un contrat collectif en tant qu'ayant droit d'un membre de leur ménage. Ne faudrait-il pas considérer deux trajectoires supplémentaires?

- collectif A → collectif C+
- collectif B → collectif C+

La réforme prévoit une participation financière des employeurs (50% de la valeur du contrat) et va engendrer des modifications de la répartition des risques. Afin de neutraliser ces deux effets:

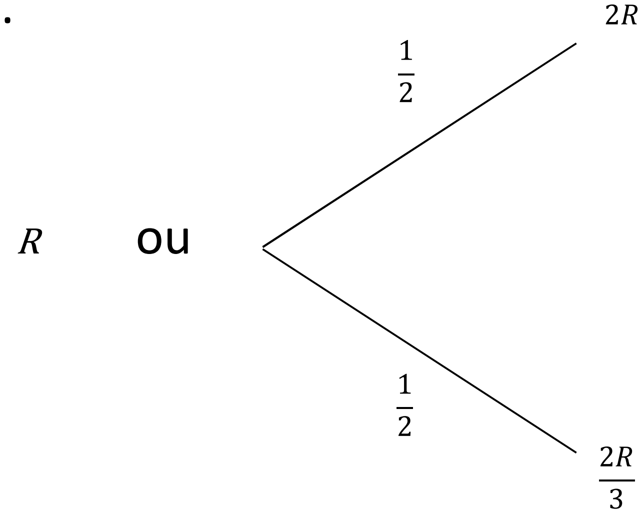
- Les employeurs intègrent le coût de ces contrats dans les salaires des individus concernés
- Hausse de 10% des contrats individuels

Ne faudrait-il pas faire la distinction entre l'esprit de la réforme (les coûts sont répartis différemment entre entreprises, mutuelles et assurés mais s'annulent au final) et ses conséquences réelles?

	Utilité Espérée		Equivalent Certain		Prime de risque		Espérance de gain	
	Variation absolue	Variation relative	Total	Moyenne	Total	Moyenne	Total	Moyenne
Ensemble de l'échantillon (6122)								
Substitution Non								
Hausse des primes Non	30,81	0,10%	308 716 €	51 €	-16 227 €	-3 €	292 489 €	48 €
Hausse des primes Oui	16,07	0,05%	40 044 €	7 €	-9 724 €	-2 €	30 320 €	5 €
Substitution Oui								
Hausse des primes Non	-24,91	-0,08%	19 429 €	3 €	-14 751 €	-2 €	4 678 €	1 €
Hausse des primes Oui	-39,65	-0,13%	-249 244 €	-41 €	-8 248 €	-1 €	-257 492 €	-42 €
Trajectoire 1 (1162) - Coll A / Coll A								
Substitution Non	0,11	0,002%	6 533 €	6 €	-4 €	0 €	6 529 €	6 €
Substitution Oui	0,03	0,001%	1 633 €	1 €	-1 €	0 €	1 632 €	1 €
Trajectoire 2 (799) - Coll B / Coll B								
Substitution Non	0,00012	<0,001%	3 023 €	4 €	-2 €	0 €	3 020 €	4 €
Substitution Oui	0,00003	<0,001%	756 €	1 €	-1 €	0 €	755 €	1 €
Trajectoire 3 (204) - Coll C / Coll C+								
Substitution Non	0,98	0,05%	2 301 €	11 €	-50 €	0 €	2 251 €	11 €
Substitution Oui	0,25	0,01%	576 €	3 €	-13 €	0 €	563 €	3 €
Trajectoire 4 (1308) - Ind B / Ind B								
Hausse des primes Non	0	0%	0 €	0 €	0 €	0 €	0 €	0 €
Hausse des primes Oui	-8,99	-0,15%	-122 774 €	-94 €	869 €	1 €	-121 905 €	-93 €
Trajectoire 5 (321) - Ind B / Coll C+								
Substitution Non	16,27	0,62%	119 107 €	371 €	6 945 €	22 €	126 052 €	393 €
Substitution Oui	-2,72	-0,10%	5 927 €	18 €	7 260 €	23 €	13 187 €	41 €
Trajectoire 6 (1679) - Ind C / Ind C								
Hausse des primes Non	0	0%	0 €	0 €	0 €	0 €	0 €	0 €
Hausse des primes Oui	-5,75	-0,15%	-145 898 €	-87 €	5 633 €	3 €	-140 265 €	-84 €
Trajectoire 7 (385) - Ind C / Coll C+								
Substitution Non	16,9	0,97%	163 467 €	425 €	-10 226 €	-27 €	153 241 €	398 €
Substitution Oui	-4,76	-0,27%	27 682 €	72 €	-9 326 €	-24 €	18 356 €	48 €
Trajectoire 8 (78) - Sans couverture / Coll C+								
Substitution Non	-3,45	-0,21%	14 286 €	183 €	-12 889 €	-165 €	1 397 €	18 €
Substitution Oui	-17,7	-1,08%	-17 145 €	-220 €	-12 670 €	-162 €	-29 815 €	-382 €
Trajectoire 9 (186) - Sans couverture / Sans couverture								
	0	0%	0 €	0 €	0 €	0 €	0 €	0 €

Note de lecture: Parmi les individus de la trajectoire 5, la somme des utilités espérées est amenée à augmenter de 0,62% si l'on considère que les salaires restent inchangés suite à la réforme de l'Ani. Cette hausse de bien-être correspond à un gain monétaire de 371€ en moyenne par individus. 393€ proviennent d'une hausse de l'espérance de gain. 22€ concernent le coût lié à l'augmentation du risque financier.

Mesure de l’aversion au risque des participants (Barsky et al. 1997): regroupement des individus en fonction de l’intensité de leur aversion relative au risque (4 groupes).



Les préférences des individus sont représentées par des fonctions CRRA (aversion relative au risque est constante) :

$$u(x) = \begin{cases} \dfrac{1}{(1-\gamma)} x^{(1-\gamma)} & \text{si } \gamma \neq 1 \\ \log(x) & \text{sinon} \end{cases}$$

où γ décrit l’intensité l’aversion relative au risque

Arrondel et Calvo Pardo (2008) associent un pourcentage de la population à chaque groupe d'aversion relative au risque construit à partir des loteries de Barsky et al. (1997)

- Groupe 1 : $\gamma < 1$ → moyenne : $\gamma = 0{,}7$ → 4,9% de la population
- Groupe 2 : $1 \leq \gamma < 2$ → moyenne : $\gamma = 1{,}5$ → 10,2% de la population
- Groupe 3 : $2 \leq \gamma < 3{,}76$ → moyenne : $\gamma = 2{,}9$ → 26,6% de la population
- Groupe 4 : $\gamma > 3{,}76$ → moyenne : $\gamma = 15{,}8$ → 58,3% de la population

L'enquête Santé et Protection Sociale 2012 :

68. En matière d'attitude à l'égard du risque, placez-vous à l'aide d'une croix sur une échelle de 0 à 10 dans différents domaines de la vie :

0 : personnes très prudentes, qui s'efforcent de limiter au maximum les risques de l'existence et recherchent une vie bien réglée, sans surprise.

10 : personnes attirées par l'aventure, qui recherchent la nouveauté et les défis, aiment prendre des risques et miser gros dans leur existence.

Globalement, en matière d'attitude à l'égard du risque, où vous placez-vous :

0	1	2	3	4	5	6	7	8	9	10

Prudent — Aventureux

Hypothèse : concordance entre les rangs de la distribution de cette note et la distribution de γ observée par Arrondel et Calvo Pardo (2008). Une valeur de γ est alors attribuée à chaque individu par extrapolation linéaire de manière à retrouver les moyennes estimées par Barsky *et al.* (1997).

	Paramètre d'aversion relative au risque γ										
	<1 (les moins averses)			1≤γ<2	2≤γ<3,76		γ>3,76 (les plus averses)				
Distribution de γ (Arrondel et Calvo)											
% dans la population par groupe		4,9%		10,2%	26,6%				58,3%		
Note vis-à-vis du risque	10	9	8	7	6	5	4	3	2	1	0
% dans l'échantillon	1%	1,2%	5%	9,1%	8,8%	22,9%	9,7%	11,8%	11,8%	7,5%	11,2%
% dans l'échantillon par groupe		7%		9,1%	31,7%				52%		
Moyenne de γ par groupe (Barsky et al.)		0,7		1,5	2,9				15,8		
Valeur imputée de γ	**0,5**	**0,7**	**0,9**	**1,5**	**2,5**	**3,3**	**6,8**	**12,8**	**15,8**	**19,4**	**26,5**

Note : L'imputation de γ a été réalisée en faisant une extrapolation linéaire de la moyenne de γ observée par Barsky (1997) en limitant à 30 la valeur maximale de γ (qui correspond à deux fois la moyenne la plus haute observée par Barsky).

Barsky et al. (1997) ; Arrondel et Calvo Pardo (2008)

- La limité inférieure de γ est fixée à 0. Il n'y a donc pas d'individus qui sont neutres vis-à-vis du risque ou qui le recherchent;

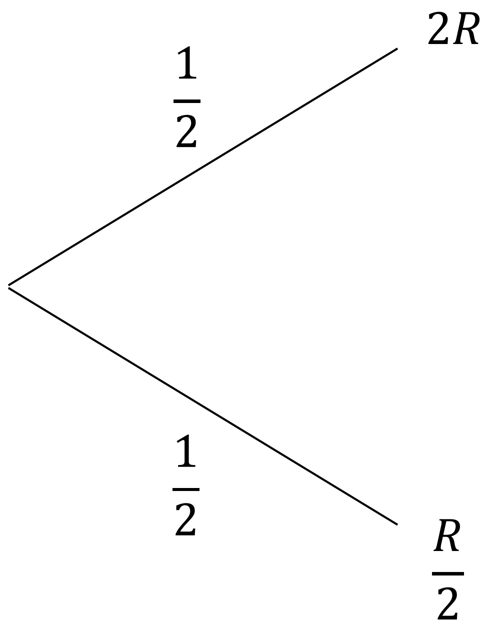
- Choix sans conséquences réelles;

- Loteries présentant des gains et des pertes; or les individus ne se comportent pas de la même façon s'ils sont exposés au risques dans la zone des gains et ou dans la zone des pertes;

- Contextualisation (changement d'emploi);

- Fonction d'utilité CRRA

→ surestimation de l'intensité de l'aversion relative au risque



Quel est l'équivalent certain de cette loterie si $R = 100$ ($R =$ revenu)?

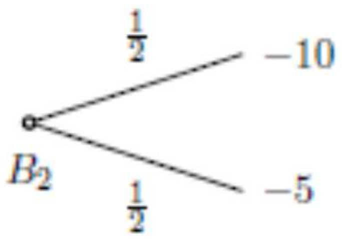
γ	0,5	0,7	0,9	1,5	2,5	3,3	6,8	12,8	15,8	19,4	26,5
%	1%	1,20%	5%	9,10%	8,80%	22,90%	9,70%	11,80%	11,80%	7,50%	11,20%
note ESPS	10	9	8	7	6	5	4	3	2	1	0
EC (contrat C)	112,5	107,4	102,4	88,8	73,3	66,4	56,34	53,02	52,3	51,9	51,37

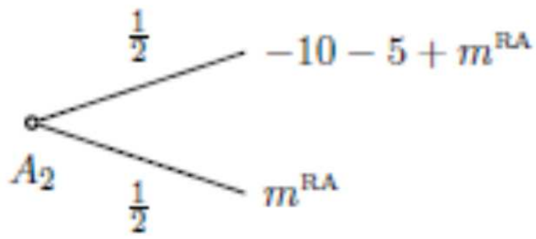
Ebert et Wiesen (2016)

"Less risky" option (B_n)

"More risky" option (A_n)

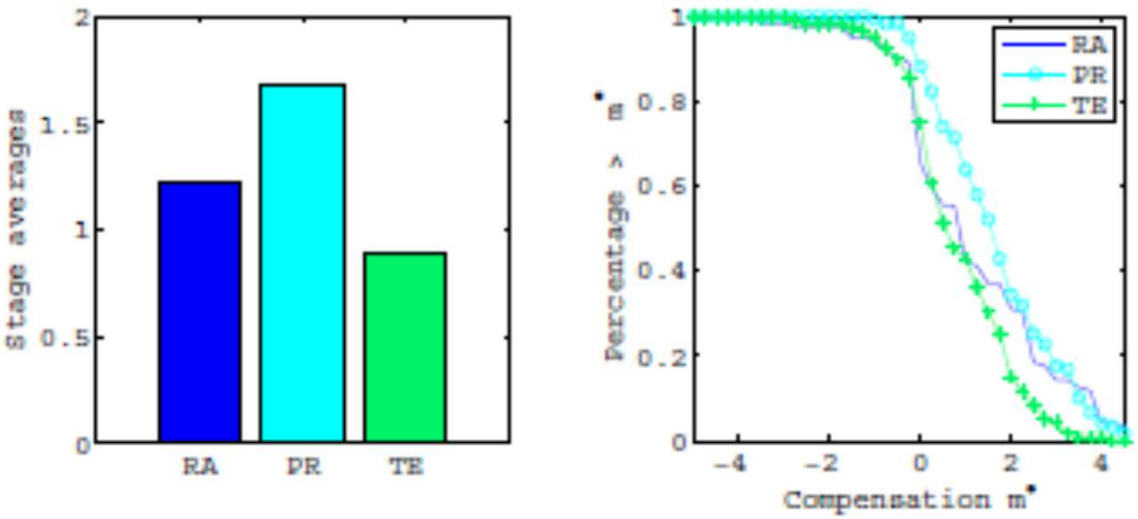
Stage RA





with endowment $x = 25$.

Figure 4: Average compensations by stage



Les loteries de Holt et Laury (2002) permettent de retrouver des niveaux d'aversion au risque moins extrêmes.

	highly RL	very RL	RL	RN	slighlty RA	RA	very RA	highly RA	stay in bed
γ	< - 0,95	-0,72	-0,32	0	0,28	0,55	0,83	1,17	> 1,37
%	0,01	0,01	0,04	0,13	0,19	0,23	0,22	0,11	0,06
note ESPS	10	9	8	7	6 + 5 + 4		3 + 2	1	0
EC (contrat C)	145	140	132	125			104	100	90

Lorsque le bien-être social égalitariste *ex-ante* est considéré, quels éléments expliquent le fait que les pertes dues à la réformes ne varient pas de façon monotone avec l'indice d'aversion à l'inégalité (ρ)?

Ne serait-il pas plus explicite d'exprimer les pertes dues à la réforme en unités monétaires? ("*equally distributed equivalent level of income*")

Cela permettrait de scinder les différents effets de la réforme: effet augmentation (resp. diminution) des primes de risque, effet risque et effet redistribution avec:

1) Effet augmentation des primes: espérance de gain (tableau 8)
2) Effet risque: primes de risque (tableau 8)
3) Δ welfare exprimé en unités monétaires lorsque ρ augmente.

Results: Ex-ante egalitarian social welfare

Absolute variation	RHO_0	RHO_05	RHO_1	RHO_15	RHO_2	RHO_25	RHO_3	RHO_35	RHO_4
Initial social welfare	12167	4171	3394	-2393	-3976	-5248	-6510	-7982	-9878
No substitution No increase	31	6	21	5	17	36	65	105	163
No substitution 10% increase	4	1	2	0	0	-3	-10	-24	-50
Substitution No increase	2	0	2	0	2	5	11	20	35
Substitution 10% increase	-25	-5	-17	-4	-15	-35	-65	-110	-178

➡ Negative impact of the reform primarily driven by increase in premiums of individually insured

This decrease in social welfare increase with inequality aversion

Mesure du bien-être social égalitariste *ex-post*:

The ex-post approach measures social welfare by

- *firstly measuring social welfare between individuals in each state of nature*
- *secondly aggregating those conditional social welfare measures over the distribution of the states of nature*

Comment procéder à la première étape quand les états de la nature ne sont pas communs aux individus?

L'effet de la réforme sur le bien-être diverge lorsque l'aversion à l'inégalité augmente dans le cadre d'une bien-être égalitariste ex-ante ou ex-post. Peut-on l'expliquer?

Results: Ex-post egalitarian social welfare

Absolute variation	RHO_0	RHO_05	RHO_1	RHO_15	RHO_2	RHO_25	RHO_3	RHO_35	RHO_4
Initial social welfare	11895	16418	3293	-9521	-86	-2316	-41	-1235	-117
No substitution No increase	28	22	18	16	14	13	13	14	15
No substitution 10% increase	1	0	0	-1	-2	-2	-3	-3	-3
Substitution No increase	2	2	1	1	1	1	1	1	1
Substitution 10% increase	-25	-20	-18	-16	-15	-15	-15	-16	-17

→ Negative impact of the reform primarily driven by increase in premiums of individually insured

This decrease in social welfare increase with inequality aversion

Targeting Disability Insurance Applications with Screening

Mathilde Godard, Pierre Koning and Maarten Lindeboom

Discussion par Eve Caroli

Journée de la Chaire Santé Dauphine
Vendredi 30 mars 2018

Objectif

- **Question : les mesures de politique publique atteignent-elles leur cible ?**

- Politique visant à réduire le pourcentage de salariés en incapacité aux Pays-Bas
  - Succès quantitatif [Réduction de la proportion de salariés en incapacité]
  - Succès qualitatif [Ciblage sur les individus qui en ont besoin]

Politiques d’activation

- Remettre les individus au travail lorsque l’on est en présence de hasard moral

- Pays-Bas : Incapacité de travail
  - 12% au milieu des années 1970
  - 8% au début des années 2000.

- France : Chômage
  - Réforme du barème des sanctions 2018

- ✓ Risque : I Daniel Blake…

Méthodologie et Résultats

- Expérience randomisée
  - Sélection de deux régions (Apeldoorn et Hengelo) dans lesquelles les contrôles sont intensifiés à partir de janvier 2003 pour l'entrée dans le dispositif d'incapacité.
  - Groupe de contrôle = le reste des Pays-Bas.

- Résultats : amélioration du ciblage
  - Baisse du taux de demandes (en 2003) tirée par la réduction des demandes pour maladies mentales.
  - Baisse du taux inconditionnel d'acceptation mais + faible que celle des demandes.
  - Demandeurs et bénéficiaires en + mauvaise santé.

Asymétrie d'information

- Pourquoi l'incapacité est-elle si difficile à observer ?
  - Certaines maladies sont plus difficiles à observer que d'autres.
  - Quel est le rôle du médecin ? Collusion avec le patient ? Qui est ce médecin ?
  - Quelle marge pour un meilleur contrôle médical plutôt qu'un contrôle par le système d'assurance ? Problème des co-morbidités.

- En quoi consistent les contrôles accrus ?
  - Dans l'une des régions : contrôle du salarié/ dans l'autre contrôle de l'employeur.
  - Contrôle du salarié : comment ? Convocations ? Visites à domicile ? Harcèlement ?

Administration de la preuve

- Le harcèlement peut-il dégrader la santé ?
  - I Daniel Blake... again.
  - Le pool des bénéficiaires est en + mauvaise santé : provoqué par la procédure ?

- Quel impact sur la santé des non demandeurs ?
  - DID : la santé des demandeurs se dégrade + que celle des non demandeurs dans les 2 régions traités.
  - Question : la santé des non-demandeurs se dégrade-t-elle quand même ?
    - Figure 6 ne montre pas de différences très significatives mais la mortalité semble augmenter à LT et les écarts-types sont larges…

Discussion théorique

➢ Très utile mais …

- Quels sont les mécanismes ?
  - En cas de fraude, réduction de la probabilité de succès
    - Plus ou moins forte selon que la maladie est aisée à vérifier
  - Augmentation du coût anticipé de la demande
    - Plus d'efforts de réintégration à fournir durant la période d'attente.
    - Plus de bureaucratie à affronter lors de la demande d'incapacité. Coût plus faible pour les aptes ? Quelle est l'intuition ?
    - Coût d'opportunité en termes de promotion ou de salaire. De quoi s'agit-il exactement ?
- Quels effets d'équilibre ?

Pour finir…

- Comment/peut-on sortir de l'incapacité ?
  - Pourquoi certains individus candidatent-ils plusieurs fois (les auteurs les retirent de l'échantillon) ?
  - Peut-on revenir à l'activité ? Y-a-t-il un enjeu de politique publique et /ou de santé de ce côté-là ?

- Minor points
  - Contrôles dans le modèle au niveau individuel
    - Age et sexe.
    - Pourquoi pas aussi éducation, statut marital, nombre d'enfants comme dans De Groot et Koning (2016) ?
  - Spécification où l'on introduit Traitement*Year

Merci pour votre attention