Optimal coverage in basic and supplementary health insurance

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Outline

Basic and supplementary insurance

- Many countries offer a combination of basic and supplementary insurance
  - the Netherlands: basic mandatory insurance and supplementary voluntary insurance on the private market
  - also Obama care has similar features with the essential health care package
- some treatments are covered by basic insurance others not
- latter can be covered by supplemenary insurance
- question is: which treatments should be covered by basic and which by supplementary insurance?
  - recent discussion in the Netherlands: treatment for Pompe, Fabry: high cost per qaly gained
  - treatments to quit smoking, glasses, dentist?

Basic and supplementary insurance (cont.)

- not answered in the health economic literature
- literature features an unhelpful divide:
  - moral hazard and adverse selection
  - cost effectiveness (CE)
- basic insurance should cover treatments that are highly cost effective, that suffer from adverse selection, do not suffer from moral hazard?
- redistribution: basic insurance should cover treatments mainly used by low income and/or high risk people?

Contribution

- standard model: people buy health insurance because they are risk averse
  - co-payments vary with severity of moral hazard for a treatment
  - basic insurance should cover treatments with biggest adverse selection problems
  - adverse selection leads to inefficiency in the private supplementary market
  - to reduce these inefficiencies such treatmemts should be covered by mandatory basic insurance
  - CE plays no role in determining priority for treatments to be covered

Contribution (cont.)

- introduce a model with access to care problems: people buy health insurance to be able to access care when they need it
  - CE determines which treatments should be covered by suppl. insurance
  - co-payments are the same for all treatments in a contract
  - treatments that can be paid out of pocket should not be insured
  - conditions are derived under which basic insurance should cover treatments that are predominantly used by low income/high risk people
  - we find this redistribution result for a planner maximizing total welfare (no equity concerns)

Three systems

- most OECD countries feature a combination of public and private health insurance
- public system addresses imperfections in private insurance market
- Roughly speaking: three systems
  - private and public insurance are substitutes: Australia, Ireland, Spain, The Netherlands before 2006 [Colombo and Tapay, 2004]
  - private insurance is bought in addition to public insurance to get shorter waiting lists, broader choice of providers and treatments: Austria, Denmark and Finland [Mossialos and Thomson, 2004]

Three systems (cont.)

- private insurance is bought to cover treatment for conditions that are not covered by public insurance (physiotherapy, dental care) or to finance co-payment in public system: The Netherlands (after 2006), France, Luxembourg

- we focus on third system
- assume universal public coverage for basic insurance package
- fixed budget to finance public system
- not all treatments can be paid by public system: some treatments covered by private insurance
- simplify: for each condition there is only one treatment
- two questions:
  - should a treatment be insured at all?
  - if so, how (public vs private insurance)

Cost effectiveness

- goal of CE analysis is to maximize the health gain from a given budget [Drummond et al., 2005; Gold et al., 1996]
- rank treatments in terms of life years gained per euro spent
- life years can be quality adjusted (qaly)
- cover the treatments with the highest scores until the budget is spent
- is usually done in the context of public insurance: basic insurance should cover the most cost effective treatments
- other treatments covered by private insurance or not at all [Smith, 2007]

Cost effectiveness (cont.)

- no redistribution considerations unless explicitly added to objective function
- no adverse selection nor moral hazard

Adverse selection

- with second degree price discrimination, market leads to under-insurance of low risk types [Rothschild and Stiglitz, 1976]
- insured know more about their expected costs than insurers, hence insurers try to separate types
- high risk types get efficient insurance
- this analysis has not been done at the treatment level; does not directly address our question
- straightforward to show: basic insurance should cover treatments where adverse selection problems are worst
- CE plays no role at all

Moral hazard

- optimal coverage at treatment level
  - co-payment for treatment k lower the higher the financial risk and the lower the demand elasticity for k [Zeckhauser, 1970]
  - if one treatment saves costs on another treatment (substitutes), co-payment should be lower; with complements: higher [Goldman and Philipson, 2007]
- public vs private insurance (not at treatment level)
  - if the market can only offer linear contracts, mandatory public insurance can create a two-part tariff which tends to raise welfare [Besley, 1989]
  - role for mandatory public insurance because of Samaritan's dilemma [Coate, 1995]
- again CE plays no role

Standard framework: risk aversion

- mean variance utility: health v, stochastic expenditure x

$$U = v - E(x) - \frac{r}{2}V(x) \tag{1}$$

- set of conditions $K = \{1, 2, ..., \kappa\}$
- for each condition $k \in K$ there is exactly one treatment also denoted k
- two types of agents h, l; θ_k^i probability that type i needs treatment k

$$\theta_k^l \leq \theta_k^h \leq \frac{1}{2} \tag{2}$$

- adverse selection: $\theta_k^h / \theta_k^l > 1$

Standard framework: risk aversion (cont.)

- fraction of θ^l types: ϕ
- in standard framework: conditions are distributed independently
- in access to care model: an agent can suffer from only one condition (suffering from k and l is redefined as "new" condition "m")
- conditions are contractable by physician and insurer
- severity of condition is not verifiable by physician: patient reports symptoms
- treatment costs δ_k
- patient can be in either of two states, probability state 0 equals ψ_k

Standard framework: risk aversion (cont.)

- if patient is in state 1 (0), benefit equals $v_{1k}(v_{0k}) > 0$ with

$$\begin{aligned} v_{1k} - \delta_k &> 0 \\ \psi_k v_{0k} + (1-\psi_k) v_{1k} - \delta_k &< 0 \end{aligned}$$

- use of treatment in state 0 reduces social surplus: moral hazard
- to prevent this, co-payment at least equal to v_{0k} is needed for treatment k
- v_{0k} measures "severity" of moral hazard problem associated with k
- agent can buy suppl. insurance from one private insurer only

Standard framework: risk aversion (cont.)

- government can enforce that private insurers set co-payments $c_k \geq v_{0k}$ for treatments covered by basic insurance
- if basic insurance covers treatment k, cost for the patient becomes $\gamma_k \in [c_k, \delta_k\rangle$
- government budget constraint:

$$\sum_{k \in K} (\phi \theta_k^l + (1-\phi)\theta_k^h)(1-\psi_k)(\delta_k - \gamma_k) \leq B \qquad (3)$$

Market

- We follow Rothschild and Stiglitz [1976] in defining perfect competition equilibrium in supplementary insurance market:
  - each offered contract makes non-negative profits
  - given the equilibrium contracts, it is not possible to introduce a new contract that makes strictly positive profits
- θ^h agents get suppl. insurance with co-payments equal to v_{0k} for each $k \in K$
- co-payment varies with severity of moral hazard
- θ^l gets insurance with higher co-payments to separate her contract from θ^h
- this is inefficient since θ^l is risk averse

Government policy

- planner maximizes $\phi U^l + (1-\phi)U^h$ subject to government budget constraint
- planner should cover treatments with highest θ_k^h/θ_k^l in basic insurance until the budget runs out
- mandatory basic insurance can "solve" adverse selection
- reduces inefficiencies in the suppl. private market
- moral hazard v_{0k} plays no role (on the extensive margin): equally problematic in public and private insurance
- on the intensive margin: higher v_{0k} implies less insurance or equiv. higher co-payment
- CE score v_{1k}/δ_k plays no role (except that it is bigger than 1)

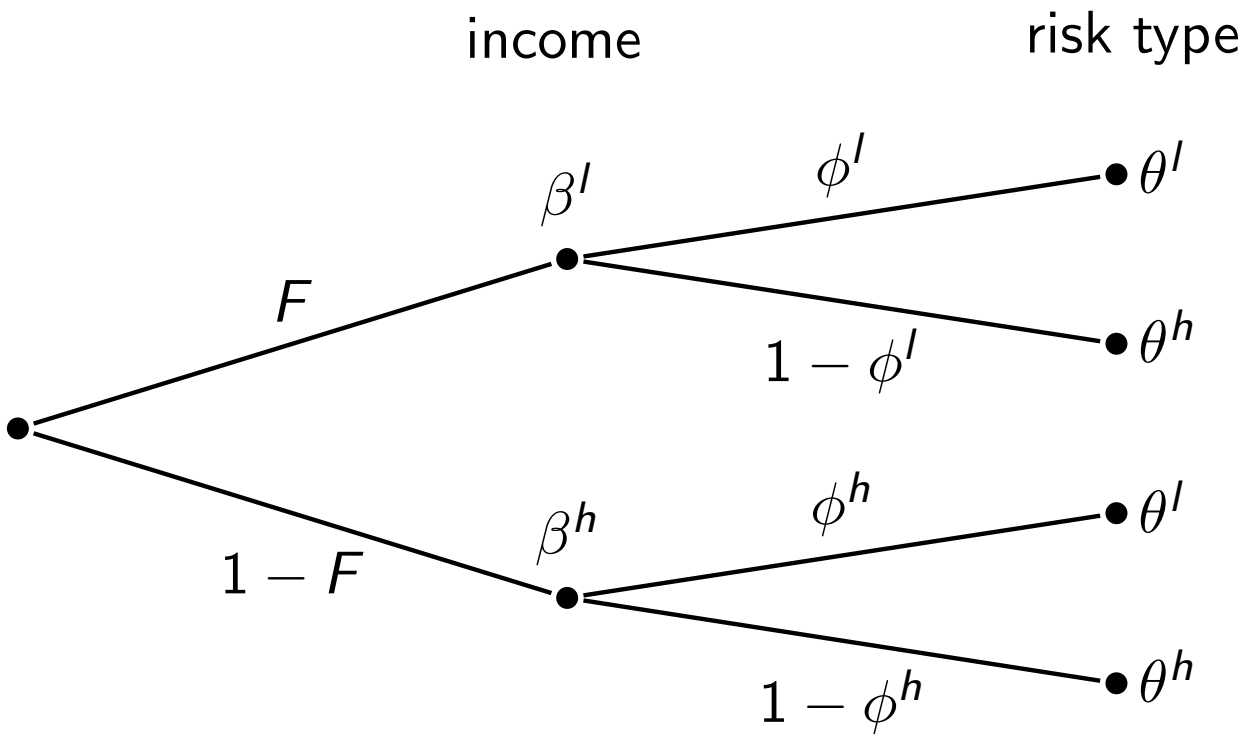
Government policy (cont.)

- standard model is about financial risk, not about access to care
- independently of whether or how treatment k is insured, agent will use it when needed; hence the value v_{1k} of the treatment plays no role in how to insure a treatment
- if third degree price discrimination is allowed in the suppl. market, equilibrium is efficient
- government does not care which treatments are covered by basic insurance (unless redistribution motives are introduced)

Agents face budget constraints

- In the previous model, an agent can afford any treatment she wants without insurance
- but we know that insurance plays an important role in securing access to care [Cohn, 2007; Schoen et al., 2008, 2010; Nyman, 1999]
- assume an agent has a budget β that she can spend on health care:
  - insurance premium
  - co-payments
  - uninsured treatments
- budgets β and B are small compared to the value of treatments: each agent spends whole budget
- assume agent is risk neutral $r = 0$

Agents face budget constraints (cont.)



Agents face budget constraints (cont.)

- patient needs at most one treatment k
- assume (first) that government enforces co-payment c_k for treatment k in all contracts
- government sets $\gamma_k \in [c_k, \delta_k]$
- if $\gamma_k > c_k$, insurance market can offer to cover $\gamma_k - c_k$, such that patient needs to pay only c_k in case she needs k
- consider agent ij (β^i, θ^j) who sets aside C^{ij}

$$
\begin{aligned}
K_e^{ij} &= \{k \in K | v_{0k} \leq c_k \leq C^{ij} < \gamma_k\} \\
K_i^{ij} &= \{k \in K | v_{0k} > c_k \leq C^{ij} < \gamma_k\} \\
K_n^{ij} &= \{k \in K | \gamma_k \leq C^{ij}\}
\end{aligned} \tag{4}
$$

Agents face budget constraints (cont.)

- agent does not have access to treatments with $c_k > C^{ij}$: high co-payments cause people to forego valuable treatments [Schokkaert and van de Voorde, 2011; Pauly, 2008]
- often efficient care consumption is defined as consumption of treatments that an agent would choose "were she paying for the medical care herself" [Cutler and Zeckhauser, 2000]
- not correct in this model: treatments in K_e^{ij} are efficient but not used without insurance

market

- given c_k, γ_k set by the government
- agent ij chooses $\rho_k \in [0,1], C^{ij}$ to maximize

$$V^{ij} = \beta^i + \sum_{k \in K_e^{ij}} \theta_k^j (1-\psi_k)\rho_k(v_{1k} - \gamma_k) + \sum_{k \in K_i^{ij}} \theta_k^j \rho_k (v_k - \gamma_k) + \sum_{k \in K_n^{ij}} \theta_k^j (1-\psi_k)(v_{1k} - \gamma_k)$$

$$- \lambda^{ij} \left(\sum_{k \in K_e^{ij}} \theta_k^j (1-\psi_k)\rho_k(\gamma_k - c_k) + \sum_{k \in K_i^{ij}} \theta_k^j \rho_k (\gamma_k - c_k) - (\beta^i - C^{ij}) \right)$$

- once agent decides to set aside C^{ij}, it is optimal to have the same co-payment for each treatment
- in access to care model: co-payment does not vary with treatment k

market (cont.)

- assume government sets $c_k = c$ for each k
- with second degree price discrimination, at most 2 IC constraints are binding: within each income class, θ^h wants to mimic θ^l
- marginal utility of income: $dV^{ij}/d\beta_i = 1 + \lambda^{ij}$

government policy

- assume that no IC constraint is binding
- insurance does not cover treatments with $\delta_k < c$
- treatments with $v_{0k} \leq c < \delta_k$ are ranked on the basis of

$$\frac{F\phi^l\theta_k^l\rho_k^{ll}(1+\lambda^{ll}) + F(1-\phi^l)\theta_k^h\rho_k^{lh}(1+\lambda^{lh}) + (1-F)\phi^h\theta_k^l\rho_k^{hl}(1+\lambda^{hl}) + (1-F)(1-\phi^h)\theta_k^h\rho_k^{hh}(1+\lambda^{hh})}{F\phi^l\theta_k^l\rho_k^{ll} + F(1-\phi^l)\theta_k^h\rho_k^{lh} + (1-F)\phi^h\theta_k^l\rho_k^{hl} + (1-F)(1-\phi^h)\theta_k^h\rho_k^{hh}}$$

- basic insurance covers treatments ($\gamma_k = c$) with the highest ranking until budget B runs out
- Insurers rank treatments $k \in K_e$ (not covered by basic insurance) on the basis of their CE score

$$\frac{v_{1k} - \delta_k}{\delta_k - c}$$

Interpretation

- suppl. insurance covers treatments with the highest CE scores till agent's ij's budget runs out
- basic insurance targets treatments that are mainly used by agents with high λ
- if $C^{ij} = C$ for all ij then basic insurance targets treatments used by agents with low income and/or low health status
- if IC constraints binding, two things change
  - focus of basic insurance on treatments used by θ^h types reinforced
  - suppl. insurance ranking for θ^l types distorted to take IC into account

Contrast to CE literature

- CE literature suggests that basic insurance should cover treatments with highest v_k/δ_k
- in access to care model, CE score does play a role, but not like this
- government trying to maximize health should subsidize treatments that are used by people who at the margin buy the most valuable treatments (λ^{ij})
  - as people first cover most valuable treatments, there are decreasing returns
  - people with low income that have to buy "expensive" insurance, have highest return at the margin

Contrast to CE literature (cont.)

- we get redistribution result without introducing it into planner's objective function
- adverse selection θ_k^h/θ_k^l plays a role
- supplementary insurance ranks on the basis of CE score $(v_{1k} - \delta_k)/(\delta_k - c)$
  - inverse U relation between δ_k and coverage by suppl. insurance
  - no coverage if $\delta_k \leq c$
  - coverage for sure if $\delta_k > c$ close to c
  - coverage falls as δ_k increases
  - treatments with severe moral hazard ($v_{0k} > c$) not covered at all

Example: basic insurance and CE

- second degree price discrimination
- $\beta^l = 1, \phi^l = 0.5, \beta^h = 2, \phi^h = 0.5$
- no moral hazard ($v_{0k} = 0$ for each k), $c = 0$
- initially $B = 0$

K	v_{1k}	δ_k	θ_k^h	θ_k^l
1	30	10	$\frac{1}{10}$	$\frac{1}{10}$
2	20	10	$\frac{1}{5}$	0
3	15	10	$\frac{1}{5}$	$\frac{1}{5}$

- in equilibrium: $\rho_1^{ll} = \rho_1^{lh} = 1$ and $\rho_2^{ll} = \rho_2^{lh} = \rho_3^{ll} = \rho_3^{lh} = 0$
- $\rho_1^{hh} = 1, \rho_2^{hh} = 0.5, \rho_3^{hh} = 0$

Example: basic insurance and CE (cont.)

- $\rho_1^{hl} = 1, \rho_2^{hl} = 0, \rho_3^{hl} = 0.5$
- suppose government has small budget $B > 0$, what should be covered by basic insurance?
- CE literature: treatment 1
- but covering treatment 2 yields a bigger increase in welfare/health

Example: focus on low risk agent

- agents freely choose co-payment c
- both risk types, same income $\beta = 2$
- low risk agents have highest λ, basic insurance should focus on them:

K	v_{1k}	v_{0k}	δ_k	θ_k^h	θ_k^l
1	50	0	10	$\frac{2}{10}$	0
2	40	1	10	$\frac{3}{4}$	$\frac{3}{4}$
3	30	0	10	$\frac{1}{10}$	0

- $c^h = C^h = 0, \rho_1^h = 1$
- $c^l = C^l = 1, \rho_2^l = 4/30$
- if government has small budget $B > 0$, cover 2 by basic insurance

Conclusion

- In an access to care model, CE scores play a role in determining whether and how a treatment should be covered
- basic insurance should cover treatments that are pre-dominantly used by people with the highest health gain per euro spent
- suppl. insurance covers treatments with the highest CE score, corrected for co-payments

Conclusion (cont.)

- the value of government subsidy is higher in an access to care model
  - in standard model this value is related to income risk caused by adverse selection problems, which may be small compared to moral hazard problems
  - in access to care model, this value is related to the value of treatment itself

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