Social insurance with competitive insurance markets and risk misperception

Helmuth Cremer[1] Kerstin Roeder[2]

[1]Toulouse School of Economics

[2]University of Augsburg

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Motivation I

- Significant part of government intervention can be justified by redistributive considerations
- Large variety of instruments: taxation, transfers, price subsidies, in-kind transfers, pension benefits, health and long-term care and more generally social insurance
- This appears to be at odds with Atkinson and Stiglitz (AS) theorem: any (incentive compatible) Pareto-efficient allocation can be implemented by using only a general income tax
- Extra instrument is valuable only if it provides "better" information and improves screening

Motivation II

- This may be the case when individuals differ in two or more unobservable characteristics
- Which instruments should be used to supplement income tax?
- In this paper we focus on social insurance
- Private insurance redistributes ex post, between states of nature; premiums reflect individual risk
- Only social insurance (or a suitable regulated private system) can effectively redistribute between ex ante heterogenous risk types (insure against the "risk of being a bad risk")

Motivation III

- Rochet (1991) and Cremer and Pestieau (1996): when private insurance is fair, social insurance is desirable if and only if productivity and risk are negatively correlated, *i.e.*, when less productive individuals face the higher risk
- Negative correlation is ok for many health risks but not for risks which increase with longevity such as dependency (LTC)
- Additionally for LTC risk misperception appears to be significant
- Cremer and Roeder (2013): under positive correlation, social insurance remains redundant even when there is risk misperception

Motivation IV

- Results assume that private insurers have superior information
- Fair insurance market no market failure due to
  - ✓ adverse selection
  - ✓ risk misperception
- This paper: role for social insurance (under positive correlation) if failures in private market and/or risk misperception

The Setup I

- Individuals supply labor $\ell \Rightarrow$ labor disutility $v(\ell)$
- Ability to generate income differs among individuals, *i.e.*, $w \in \{w_r, w_p\}$ with $0 < w_p < w_r$
- Fraction of low- and high-productivity individuals: ν_p and ν_r
- Individuals face a health risk; monetary value of loss L
- Agents differ also in probability of incurring this loss $\pi \in \{\pi_\ell, \pi_h\}$ with $0 < \pi_\ell < \pi_h < 1$
- Productivity and risk are perfectly correlated
- Each level of w is associated with a unique level of π
- Positive correlation: $\pi_p \equiv \pi_\ell < \pi_r \equiv \pi_h$
- Negative correlation: $\pi_r \equiv \pi_\ell < \pi_p \equiv \pi_h$

The Setup II

- A private insurance market with fair premiums $P = \pi I$ exists
- Social insurance D is financed by income taxation T
- The individual faces the lottery: $X = (w\ell - v(\ell) - P - T, 1 - \pi; w\ell - v(\ell) - P - T - L + I + D, \pi)$
- We use Yaari's dual theory to model risk preferences
- The utility associated with this lottery is

$$\begin{aligned} V(P, I; w, \pi) =& (1 - \phi(\pi))(w\ell - v(\ell) - T - P) \\ &+ \phi(\pi)(w\ell - v(\ell) - T - P - L + I + D) \\ =& w\ell - v(\ell) - T - P + \phi(\pi)(-L + I + D) \end{aligned}$$

where $\phi(0) = 0$ and $\phi(1) = 1$

The Setup III

- Risk aversion is represented by $\phi(\pi) > \pi$
- Individual is not better off when dependent then when healthy: $I + D \leq L$ (no overinsurance)
- Insurers will never pay out more than the effective loss $(L - D)$
- Formally,

$$V(P, I; w, \pi) = w\ell - v(\ell) - T - P + \min[\phi(\pi)(-L + I + D); 0]$$

The Setup IV

- Information structure=Mirrleesian optimal tax models
- Health status and gross income $y = w\ell$ publicly observable. Latter is taxed according to a nonlinear function
- Individual wages, w, labor supply, ℓ, loss probabilities π and private insurance contracts (P, I) are not publicly observable
- We are interested in the desirability and design of social insurance *given* that income taxation is also optimized
- Individuals are offered vectors: $\Omega_i = (y_i, T_i, D_i)$
- We study optimal feasible and incentive compatible mechanism

Timing

- Stage 1: government announces a mechanism which consists of two vectors $\Omega_p = (y_p, T_p, D_p)$ and $\Omega_r = (y_r, T_r, D_r)$
- Stage 2: individuals *ex ante* choose one of these vectors
- Stage 3: individuals buy insurance coverage in private market
- Benchmark: insurance companies observe individuals' risk type
- Then, we study Rothschild-Stiglitz (RS) equilibrium
- Insurers know there are two types characterized by (Ω_p, π_p) and (Ω_r, π_r), but do not observe who is who
- Two premium-benefit contracts are offered: $(\pi_p I_p, I_p)$ and $(\pi_r I_r, I_r)$

Benchmark: Full Information I

- Private insurers offer any coverage at fair price
- Individuals fully insure $I^* = L - D$ (Mossin's theorem)

Government:

- The rich must be prevented from mimicking the poor
- Feasible allocations must satisfy incentive constraint (IC)

$$y_r - v\left(\frac{y_r}{w_r}\right) - T_r - \pi_r I_r^* + \phi(\pi_r)(-L + I_r^* + D_r) \geq$$
$$y_p - v\left(\frac{y_p}{w_r}\right) - T_p - \pi_r I_{rp}^* + \phi(\pi_r)(-L + I_{rp}^* + D_p).$$

- I_{rp}^*=insurance coverage of rich when mimicking the poor

Benchmark: Full Information II

- Resource constraint (RC) must hold $\sum_i \nu_i(T_i - \pi_i D_i) = 0$
- Government max. strictly concave transformation of individual utilities $\Psi(V)$ with $\Psi'(V) > 0$ and $\Psi''(V) < 0$
- Max $\nu_p \Psi(V_p) + \nu_r \Psi(V_r)$ s.t. IC and RC

We have

$$\frac{\partial \mathcal{L}}{\partial D_r} \equiv 0$$
$$\frac{\partial \mathcal{L}}{\partial D_p} = \lambda(\pi_p - \pi_r) \lesseqgtr 0$$
$$\frac{\partial \mathcal{L}}{\partial D} = \frac{\partial \mathcal{L}}{\partial D_r} + \frac{\partial \mathcal{L}}{\partial D_p} = 0 + \lambda(\pi_p - \pi_r),$$

where λ is the Lagrangean of the IC.

Benchmark: Full Information III

Results:

- irrespective of correlation $D_r^* \in [0, L] \Rightarrow D_r$ does not relax IC
- Type-r fully privately insured$\Rightarrow$social insurance redundant
- Negative Correlation $\pi_p > \pi_r$: $D_p^* = L$
- Positive Correlation $\pi_p < \pi_r$: $D_p^* = 0$

- This confirms Rochet's results for Yaari's preferences
- Full social insurance desirable if $\pi_p > \pi_r$
- Positive correlation: D_p has negative effect on IC
- It redistributes from poor low-risks to rich high-risks

Benchmark: Full Information IV

Following Analysis

- Restrictive assumption: private insurance better information
- What if private insurance has no information too?
- Full social insurance for negative correlation remains optimal!
- Optimal solution under fair markets remains available
- What changes for negative correlation $\pi_r > \pi_p$?

2nd Stage: Private Market Equilibrium I

- Insurers offer 2 contracts: $I_r^* = L - D_r$ and I_p^* satisfies

$$y_r - v\left(\frac{y_r}{w_r}\right) - T_r - \pi_r I_r + \phi(\pi_r)(-L + I_r + D_r) \geq$$
$$y_r - v\left(\frac{y_r}{w_r}\right) - T_r - \pi_p I_p + \phi(\pi_r)(-L + I_p + D_r)$$

- So we have

$$I_p^* = a(L - D_r),$$

where

$$a \equiv \frac{\phi(\pi_r) - \pi_r}{\phi(\pi_r) - \pi_p} < 1$$

2nd Stage: Private Market Equilibrium II

- This defines the insurance coverage for the poor I_p^* as long as it $I_p \leq L - D_p$; otherwise we have $I_p^* = L - D_p$ (and incentive constraint in private market is not biding)
- Formally, I_p^* is defined by

$$I_p^* = \min\left[a(L - D_r), L - D_p\right].$$

- We define the maximum level of D_p for which the incentive constraint in the private market is binding as

$$\widetilde{D}_p = L - a(L - D_r)$$

1st Stage: Optimal Policy I

- Challenge: sequence of IC constraints; relationship between government and insurance market IC constraints
- When r mimicks p in terms of income (in OT problem), he can still choose any contract in private insurance market
- We show that when $D_p > D_r$ mimicker prefers I_p; otherwise he is indifferent between the two contracts
- We can write IC as if mimicking individuals always choose $(\pi_p I_p^*, I_p^*)$

1st Stage: Optimal Policy II

- Max $\nu_p \Psi(V_p) + \nu_r \Psi(V_r)$ s.t. RC and

$$y_r - v\left(\frac{y_r}{w_r}\right) - T_r - \pi_r I_r^* + \phi(\pi_r)(-L + I_r^* + D_r) \geq$$

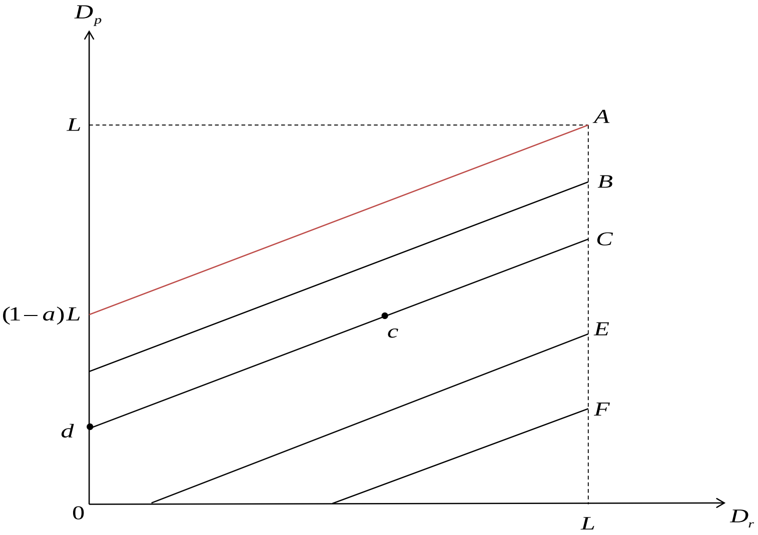
$$y_p - v\left(\frac{y_p}{w_r}\right) - T_p - \pi_p I_p^* + \phi(\pi_r)(-L + I_p^* + D_p)$$

- We have

$$\frac{\partial \mathcal{L}}{\partial D_p} = \underbrace{\nu_p \Psi'_p \left(\phi(\pi_p) - \pi_p\right)}_{\text{insurance term}>0} \underbrace{-\lambda \left(\phi(\pi_r) - \pi_p\right)}_{\text{incentive term}<0}$$

$$\frac{\partial \mathcal{L}}{\partial D_r} = -a \frac{\partial \mathcal{L}}{\partial D_p}$$

$$\frac{\partial \mathcal{L}}{\partial D} = (1 - a) \frac{\partial \mathcal{L}}{\partial D_p}.$$


D_p
L
A
B
C
$(1-a)L$
c
E
F
d
0
L
D_r

1st Stage: Optimal Policy III

Proposition

When the private insurance market is characterized by the Rothschild-Stiglitz equilibrium and the correlation between income and risk is positive, then:
(i) The rich are always fully insured (be it private or public) while the poor may or may not be fully insured.
(ii) It is always desirable to provide some social insurance.
(iii) Depending on the strength of the insurance and incentive effect, social insurance is always redundant for one type of individuals. It is positive for the poor if the insurance effect outweighs the incentive effect and it is positive for the rich otherwise.

Overconfidence and Social Insurance I

- Part of the high risk individuals misperceive their risk
- Formally, we then have three types of individuals indexed by r, o and p and in (strictly positive) proportions ν_r, ν_o and ν_p
- Types r and p are the same as before and we have $w_r > w_p$ and $\pi_r = \pi_h > \pi_p = \pi_\ell$
- Type o individuals are the same as type r except that they are overconfident and think that their risk is π_ℓ while it is π_h
- Assume that social insurance is uniform: $D_p = D_r = D_o = D$
- Private insurance companies cannot screen between overconfident and low-risk agents -> They are pooled

Overconfidence and Social Insurance II

- High-risk individuals get full insurance at fair price
- Low-risk and overconfident agents are underinsured and get contract based on average probability

$$\pi_{po} \equiv \frac{\nu_o \pi_r + \nu_p \pi_p}{\nu_o + \nu_p}$$

- I^*_{po} satisfies

$$y_r - v\left(\frac{y_r}{w_r}\right) - T_r - \pi_r I_r + \phi(\pi_r)(-L + I_r + D) \geq$$
$$y_r - v\left(\frac{y_r}{w_r}\right) - T_r - \pi_{po} I_{po} + \phi(\pi_r)(-L + I_{po} + D)$$

Overconfidence and Social Insurance III

- From the private market IC constraint, I^*_{po} is then defined by

$$I^*_{po} = b(L - D),$$

- where

$$b \equiv \frac{\phi(\pi_r) - \pi_r}{\phi(\pi_r) - \pi_{po}} < 1.$$

Overconfidence and Social Insurance IV

- The government max. $\nu_p \Psi(V_p) + \nu_r \Psi(V_r) + \nu_o \Psi(V_o)$ s.t. RC and 3 ICs
- ICs:
  1. r mimicking p (implied by 2 and 3)
  2. r mimicking o
  3. o mimicking p
- With uniform insurance mimicking individuals will always choose their own contract

Overconfidence and Social Insurance V

- FOC

$$\frac{\partial \mathcal{L}}{\partial D} = \underbrace{\nu_p \Psi'_p \left[\pi_{po} b + \phi(\pi_p)\left(1-b\right) - \pi_p\right]}_{\text{insurance term}>0} \underbrace{-\lambda_2(\pi_r - \pi_p)}_{\text{incentive term}<0}$$

- Incentive term has same interpretation
- Insurance term matters only for p!
- Type r is fully insured by private coverage
- Terms for o cancel out; type o plays an indirect role via $\pi_{po} > \pi_p$

Overconfidence and Social Insurance VI

Proposition

Assume that some of the high-risk individuals are overconfident concerning their health risk
(i) uniform social insurance continues to have a positive insurance and a negative incentive effect. The incentive effect is the same as in the absence of overconfidence, while the insurance term has a different structure.
(ii) overconfident individuals have no direct relevance when it comes to the desirability of uniform social insurance. However, overconfidence comes in indirectly, though because it increases the cost of private insurance for the low-productivity individuals.

Conclusion I

- With adverse selection in the insurance market social insurance does have a role to play, even under positive correlation between risk and productivity
- Extending benefits to the poor (or a universal grant) does have adverse incentive effects, but it also enhances insurance coverage of the previously underinsured.
- Uniform coverage was shown to be desirable only when the insurance benefits outweigh the incentive cost
- A properly designed non-uniform insurance schedule, on the other hand, is always desirable

Conclusion II

- Insurance benefits need to be targeted to one of the types only, and quite surprisingly this may be the high income individuals
- We have also examined how the desirability of social insurance and its design are affected by risk misperception
- We have shown that excess optimism does not affect the incentive term in the expression but makes the insurance term more complex
- Interestingly, the welfare of overconfident individuals is of no direct relevance