Markets with Hidden Information and Hidden Actions

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How do we

- model
- understand

the effects of

- hidden information (adverse selection)
- hidden actions (moral hazard)

in the market?

Examples

- insurance
- default
- contracts & organization of firms

Adverse Selection in Insurance Markets

Rothschild–Stiglitz (1976)

- risk-neutral insurers
- risk-averse consumers
- consumers face idiosyncratic risk
- high risk consumers, low risk consumers

Equilibrium notion

- contracts offered make non-negative profit

- contracts not offered make non-positive profit

- free entry

R–S: a **unique** candidate equilibrium configuration

- high risk consumers offered/accept complete insurance
- low risk consumers offered/accept contract that leaves high risk consumers indifferent
- prices actuarially fair: zero profit for insurers

Few *high risk consumers* $\Rightarrow$ *not an equilibrium*:

right pooling contract

- attracts **all** consumers
- makes positive profit

Dubey–Geanakoplos (2003): insurance pools

- **contribute** fraction of income to pool
  receive proportion of return on pool

- LLN $\Rightarrow$ pools are riskless

- pools are distinguished by rationing limit on consumers

- in R–S world
  - high risk pool, rationing limit $= 1$
  - low risk pool, rationing limit < 1
  - agents prefer own pool
  - refinement $\Rightarrow$ R–S candidate **always** equilibrium

Is this sensible equilibrium?

- % high risk consumers = 0.0
  $\Rightarrow$ low risk consumers get perfect insurance

- % high risk consumers =0.1
  $\Rightarrow$ low risk consumers get terrible contract

Moral Hazard in Mortgage Markets

Two sources of moral hazard

- voluntary default

- voluntary choices $\rightsquigarrow$ involuntary default

Dubey–Geanakoplos–Shubik: modeling default

- intertemporal asset market
- default choice
- loans only partially collateralized
- default $\rightarrow$ seizure $+$ penalties
- mortgages are pooled

Comment: Kehoe–Levine

D–G–S:

- equilibrium exists
- incomplete markets $\longrightarrow$ default may be Pareto improving

Comment: Zame (1993)

Bisin–Dubey–Geanakoplos–Gottardi–Minelli–Polemarchkis:

moral hazard & adverse selection can be encompassed

if

deliveries are pooled

Ghosal–Minelli–Polemarchakis: Nash–Walras equilibrium

- all markets for contracts
- all deliveries pooled
- strategic behavior: effects economy-wide
- strategic choices affect deliveries, not receipts

Pooled?

- CMO's
- frozen orange juice

Not pooled?

- individual mortgages
- used cars
- individual choices inside small firm

Organization of Firms

incentives within firms $\rightarrow$ actions within firms

$\uparrow$ $\qquad\qquad\qquad\qquad\qquad\qquad$ $\downarrow$

market prices $\qquad \longleftarrow \qquad$ output of firms

Example

2 goods

productive activity requires

- two agents
- input/capita = 3 units of good 1

output of good 2 depends on effort

output/capita =

	W	S
W	27	13
S	13	3

Agents identical

- $e = (5, 5)$
- $u(c_1, c_2) = \sqrt{c_1 c_2}$
- disutility of work $= 3$

Benchmark: 2 agents

ROW's utility =

	W	S
W	$8 - 3 = 5$	$6 - 3 = 3$
S	6	4

$\Rightarrow$ Shirk is dominant strategy

$\Rightarrow$ autarky

Many agents & market

autarkic equilibrium

$\Rightarrow$ all agents consume $(5, 5)$

$\Rightarrow$ prices $= (1/2, 1/2)$

$\Rightarrow$ ROW's utility =

	W	S
W	$17 - 3 = 14$	$10 - 3 = 7$
S	10	5

$\Rightarrow$ Work dominant strategy

$\Rightarrow$ *autarky not equilibrium*

Cannot occur at equilibrium:

- autarky = all stay out
- all enter and Shirk
- all enter and Work

$\Rightarrow$ equilibrium mixed (population)

Unique equilibrium

- some Work
- some Shirk
- some stay at home
- some entrants lucky, some unlucky
- entrants trade with stay-at-homes

General Model

Commodities: $L \geq 1$ perfectly divisible

Commodity space: $\mathbb{R}^L_+$

Prices: $\boldsymbol{\Delta} \subset \mathbb{R}^L_{++}$

Technology

- roles R (*finite*)
- for $r \in R$: skills S_r, actions A_r (*compact metric*)
- outcomes Ω *finite*
- input/output mapping

$$y : \Omega \to \mathbf{R}^L$$

- conditional probabilities

$$\pi : (S_1 \times A_1) \dots (S_R \times A_R) \to \mathbf{P}(\Omega)$$

Profit-sharing plan

$$D : R \times \Omega \times \mathbf{\Delta} \to \mathbf{R}$$

$$\sum_r D(r, \omega, p) = p \cdot y(\omega)$$

Firm = technology + profit-sharing plan

Agents

- choice set
  - firms/roles/actions
  - outcome-dependent consumption plans
- endowment
- skills
- utilities: depend on everything

Economy

- finite # commodities
- finite # firm types
- distribution on agent characteristics

Equilibrium

- prices for commodities
- wages for each role in each firm
- distribution on characteristics $\times$ choices $\times$ beliefs

such that

- individuals optimize given prices and beliefs
- markets for commodities, jobs clear
- beliefs correct

What about beliefs for firms that do not form?

- roles are produced objects

- individuals do not take aggregate supply into account when they optimize

Refinements rule out beliefs that others are stupid

Interpretation

- shocks are private
- Law of Large Numbers applies
- non-exclusive contracts
- insurance only through firms

Theorem 1

With (weak) technical assumptions

equilibrium (and refined equilibrium exists)

Theorem 2

- NO adverse selection

- NO moral hazard

- NO idiosyncratic uncertainty

$\Rightarrow$ equilibrium is fully Pareto efficient.

Otherwise equilibrium may **not** be Pareto efficient

Theorem 3

One commodity *and*

- NO adverse selection
- NO two-sided moral hazard
- NO idiosyncratic uncertainty

$\Rightarrow$ (refined) equilibrium is incentive-efficient.

Otherwise equilibrium may **not** be incentive-efficient

Market Screening

1 good

Agents

- $e = 1$
- $u(x) = x$
- skills $s \in [0, 1]$ uniformly distributed

Firms

- 2 agents; no action choices
- output = 1 with probability $p = \min\{1, s_1 + s_2\}$
- output = 0 with probability $1 - p = 1 - \min\{1, s_1 + s_2\}$
- Profit-sharing plans
  - Type A: profit shared equally
  - Type B: one agent owns firms

Type A firms only

- random matching
- social gain $= 80/192$

Type B firms only

- $s \in [0, 1/2] \rightarrow$ workers
- $s \in [1/2, 1] \rightarrow$ owners
- random matching of owners with workers
- wage $= 3/8$
- social gain $= 88/192$

Type A and Type B firms

- $s \in [0, 1/4] \rightarrow$ workers in Type B firms
- $s \in [1/4, 3/4] \rightarrow$ Type A firms
- $s \in [3/4, 1] \rightarrow$ owners of Type B firms
- wage = 3/8
- social gain = 91/192

Dynamic model ??

- resolution of uncertainty
- intertemporal transfers

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