Selection Markets

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Oxford, MPhil IO, MT 2015

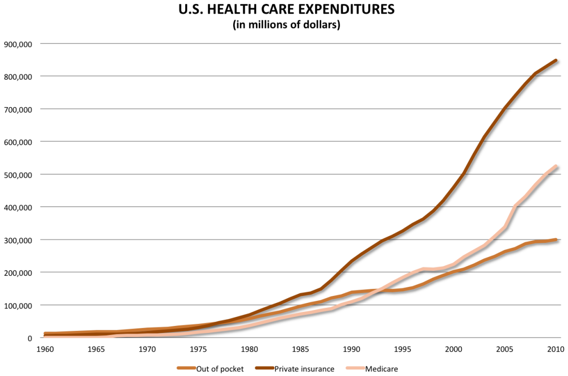
Outline

What are selection markets?

- Consumers have heterogeneous and non-contractible "values"
  - only car salesmen know the quality of their cars (Akerlof (1970))
  - some health insurance buyers like to exercise, others don't
  - pre-existing health conditions might be observable but not contractible
  - social networks cannot directly target the most popular consumers
- Demand and cost are closely linked
  - often the costliest consumers have higher demand (adverse selection)
  - firms must offer the same contracts to heterogeneous individuals
  - in equilibrium, people may self-select into contracts in a way that is costly to the firm

Health

- We will focus on health provision and health insurance
  - tools and lessons generalize to other markets



Lots of controversy

Print Close

'Repeal every word': Potential GOP 2016 rivals hammer ObamaCare, IRS at Iowa summit

By Barnini Chakraborty

Published January 25, 2015 | FoxNews.com

DES MOINES, Iowa – Conservative heavyweights joined with up-and-comers in hammering President Obama Saturday over everything from the health care law to his immigration policies as they played to a sold-out Iowa crowd in what amounted to the opening bell of the Republican presidential campaign.

They spoke at the Iowa Freedom Summit in Des Moines, held in the first-in-the-nation caucus state at a time when big-name Republicans are getting close to announcing whether they'll seek the presidency.

While nobody at the summit has definitively declared a 2016 bid, nearly a dozen of the summit's speakers are flirting with one. Testing their message on the conservative Iowa crowd, they took a hard line in their prescriptions for the country.

"The most important tax reform we can do is abolish the IRS," Texas Sen. Ted Cruz told the fired-up audience.

Lots of controversy

DAILY Intelligencer / THE NATIONAL INTEREST

4 New Studies Show Obamacare Is Working Incredibly Well

By **Jonathan Chait** Follow @jonathanchait

Photo: Linda Davidson/The Washington Post

A week ago, Sen. Charles Schumer said his party made a political mistake by passing the Affordable Care Act rather than some unspecified economic measure. Put aside the dubious political logic (in reality, Congress's appetite for additional stimulus had been completely exhausted with the passage of the original version). Also put aside the brutally cold moral logic (that politicians should prioritize keeping power over enacting

Outline

Main ideas

- 1963 was simpler time: just text, a little math in the appendix
  - lots of great ideas
- Health just like other goods?
  - if everything is priced, competitive equilibrium is Pareto optimal
  - every optimal state follows from some distribution of income
- Health is different?
  - there may be externalities: contagion
  - imperfect information: knowledge is a commodity, doctors know best
  - demand for healthcare is irregular and unpredictable
  - doctors are supposed to be altruistic; price competition is frowned upon
  - product quality/results are uncertain
  - there are subsidies to entry by doctors, and also rationing
  - there is significant price discrimination by income
  - hospitals have increasing returns (but also congestion?)
  - group policies seem less costly than individual policies
  - Community rating.
    - insurers pool unequal risks into the same contract - inefficient?
    - motivated by redistribution?
    - avoids long-term reclassification risk (major focus of recent papers)

Value of insurance

[34] A striking illustration of the desire for security in medical care is provided by the expressed preferences of *émigrés* from the Soviet Union as between Soviet medical practice and German or American practice; see Field [14, Ch. 12]. Those in Germany preferred the German system to the Soviet, but those in the United States preferred (in a ratio of 3 to 1) the Soviet system. The reasons given boil down to the certainty of medical care, independent of income or health fluctuations.

- Already 1963: debate of US vs European healthcare
- Two sources of risk
  - healthcare cost
  - healthcare outcomes (not a big focus recently)
- Insurance increases welfare
  - allocates risk to those most willing to bear it (risk neutral insurers)
  - pooling risk reduces total risk ($\approx$ network externalities?)

A simple insurance model

- Initial wealth W, possible loss X with probability q
- Linear insurance: pay p for each £ paid in case of loss
- Individual chooses D (demand) to maximize

$$\underbrace{(1-q)\cdot u(W-pD)}_{\text{no loss}}+\underbrace{q\cdot u(W-pD-X+D)}_{\text{loss}}$$

- Demand $D(p)$ satisfies

$$-p(1-q)\,u'(W-pD)+qu'(W-pD-X+D)(-p+1)=0$$

- If $p=q$ (actuarially fair price), individual buys full coverage:

$$u'(W-pD-X+D)=u'(W-pD)\Rightarrow D=X$$

- If $p>q$, then $D<X$
  - $p<q$ due to market power, administrative costs, etc
  - D increases with q (risk) and $\frac{u''}{u'}$ (risk aversion)

“The theory of Ideal Insurance”

- Loss is a random variable X
- Premium P, payment $I(X) \geq 0$ in case of loss X
- $Y(X)$ is final wealth in state X
- What is the best insurance contract?
  - maximize $\mathbb{E}[U(Y(X))]$, for fixed revenue $\mathbb{E}[p - I(X)] = k$
  - risk aversion:
    - marginal utility of wealth is larger when $Y(X)$ is smaller
    - individual prefers a shift of payments to states with low wealth
  - If $I(X)$ unrestricted, insurer can guarantee same wealth in all states
    - possible taking money in some states ($I(X) < 0$)
  - with $I(X) \geq 0$, the best is a deductible contract
    - a minimum level of wealth $W^\star$ is set
    - if final wealth is above ($Y(X) > W^\star$) nothing is paid
    - if $Y(X) < W^\star$, insurer covers $Y(X) - W^\star$
- Formally: let $Y_{min} = \inf_x Y(x)$. If $Y(X) > Y_{min} \Rightarrow I(X) = 0$
- Other rationales for deductible contracts?
  - small claims are too costly to process

Risk averse insurer

- If the insurer is also risk averse
  - e.g., individual risks are not independent
- If no costs other than coverage of losses
- $\Rightarrow$ then we must have that payments $I(X)$ satisfy

$$0 < \frac{dI(X)}{dX} < 1$$

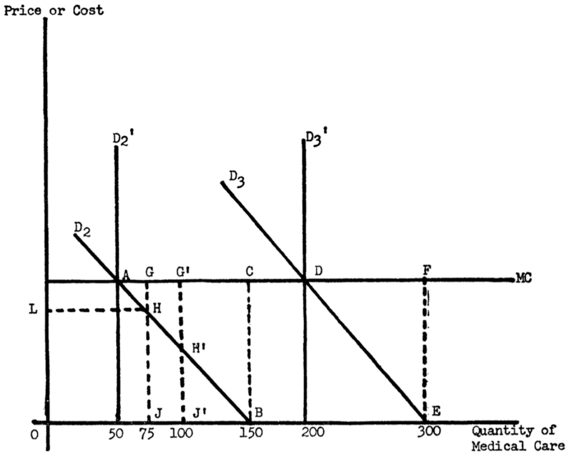
- Any increment in loss will be partly, but not wholly, covered
  - this is a coinsurance contract

Outline

Moral hazard

- Arrow (1963) argues insurance increases welfare
- Some say insurance not always offered because
  - selling costs (eg, advertising)
  - transaction costs
- New justification: moral hazard
  - some risks are not insurable
  - healthcare expenditures are not truly random
  - there is an elasticity of healthcare expenses to insurance
  - ignored by Arrow (1963)
    - only when elasticity is zero, does Arrow's argument hold

Demand under moral hazard



- state 1 (cost 0, prob $\frac{1}{2}$), state 2 (prob $\frac{1}{4}$) and state 3 (prob $\frac{1}{4}$)
- no insurance: $\frac{1}{2}0 + \frac{1}{4}50 + \frac{1}{4}200 = 62.5$
- full insurance: fair premium is $\frac{1}{2}0 + \frac{1}{4}150 + \frac{1}{4}300 = 112.5$
  - might prefer the risk to the insurance

Moral hazard

- With full insurance, act as if price is zero. Prisoner's dilemma:
  - individual captures a small share of her cost savings
  - excessive utilization is dominant strategy
  - $\Rightarrow$ premiums rise $\Rightarrow$ everyone is worse off
- Inconsistency in public healthcare (free at the point of delivery)
  - individuals vote for low-quality hospitals
  - but then hospitals have more demand than they can supply
- Mandatory purchase (recommended by Arrow) creates inefficiencies
- People might differ in their moral hazard elasticity (Einav et al. (2013))
- What risks should be insured?
  - elasticity is small
  - randomness is great
  - COVER catastrophes, hospitalization
  - DO NOT COVER dental, eyeglasses, drugs
- Imperfect insurance might mitigate moral hazard
  - deductible, coinsurance

Outline

WTP

- (see Appendix of Veiga and Weyl (Forthcoming))
- Utility $U(w, \theta)$
  - final wealth w
  - U increasing concave
  - vector θ: risk, risk aversion, initial wealth, cognitive ability
- Consumers face a verifiable wealth shock $l \in \mathbb{R}$ with density $g(l, \theta) > 0$
- Insurer pays $G(l, x)$ if loss is l
  - x parameterizes the generosity of insurance
  - $G \equiv l$ is full insurance
  - $G \equiv 0$ is no insurance
  - $G < 0$ or $G > l$ would give perverse incentives if l was not verifiable
- No moral hazard: $g(l, \theta)$ independent of x
- Initial wealth w_0

Marginal WTP for insurance

- WTP for x is: the price $p = u(x,\theta)$ that equates expected utility with and w/o insurance:

$$\mathbb{E}_l \left[\mathcal{U}\left(w_0 - l + G(l,x) - u(x,\theta),\theta\right) \mid \theta\right] = \mathbb{E}_l \left[\mathcal{U}\left(w_0 - l,\theta\right) \mid \theta\right].$$

- Differentiating with respect to x yields

$$\mathbb{E}_l\left[\mathcal{U}'\frac{\partial G}{\partial x} \mid \theta\right] - \mathbb{E}_l\left[\mathcal{U}' \mid \theta\right]\frac{\partial u}{\partial x} = 0$$

$$\underbrace{\frac{\partial u}{\partial x}}_{\text{marginal WTP}} = \underbrace{\mathbb{E}_l\left[\frac{\partial G}{\partial x} \mid \theta\right]}_{\text{expected marginal cost}} + \underbrace{\frac{Cov_l\left[\mathcal{U}', \frac{\partial G}{\partial x} \mid \theta\right]}{\mathbb{E}_l\left[\mathcal{U}' \mid \theta\right]}}_{\text{marginal risk premium}}$$

- x is insurance if $Cov\left[\mathcal{U}', \frac{\partial G}{\partial x} \mid \theta\right] > 0$: x makes G larger when U' larger
- Insurance = redistribution (across states, not people)
  - behind the veil of ignorance: states=people

A useful/simple parameterization

- CARA preferences: $\mathcal{U}(c) = -e^{-ac}$
  - a is the CARA parameter
- Gaussian wealth shocks $l \sim \mathcal{N}(\mu, \sigma^2)$
- Coinsurance: insurers absorbs a share $x \in (0,1)$ of the shock
- WTP is

$$u = \underbrace{x\mu}_{\text{expected cost}} + \underbrace{\frac{1}{2}\left(1-(1-x)^2\right)a\sigma^2}_{\text{risk premium}}$$

- Also common, CRRA: $\mathcal{U}(c) = \frac{c^{1-\gamma}}{1-\gamma}$
  - especially in empirical work

Outline

Motivation

- Graphical illustration and generalization of Akerlof (1970)
  - generalization to advantageous selection
  - intuitive quantifying of distortions from selection
  - (simpler exposition in Einav and Finkelstein (2011))

Firms

- Symmetric insurers
- Perfectly competitive: free entry, zero profit
- Risk-neutral
- Big assumption: 1 fixed insurance contract
  - fixed quality
  - for instance: covers x% of medical bills, deductible is £x
  - firms compete in prices
- Later we will look at endogenous quality
  - Rothschild and Stiglitz (1976)
  - Veiga and Weyl (Forthcoming)
- Costs = expected payment to each individual

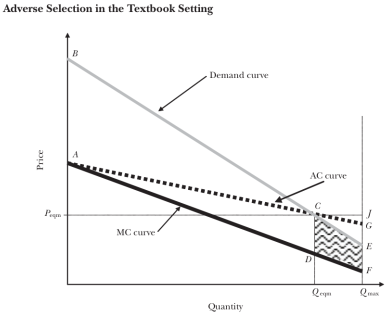
Individuals

- Mass 1
- Binary choice: choose whether or not to purchase insurance
- Expected cost, which we will call MC, is privately known
- WTP increasing in MC
  - WTP = MC + risk premium

Textbook Setting

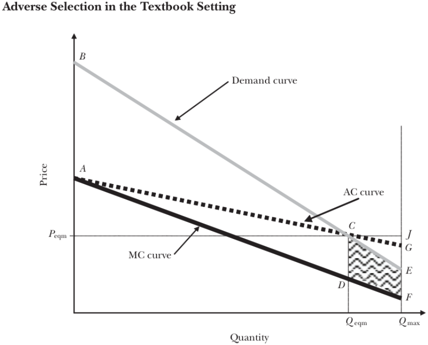
- Heterogeneous privately-known probability of loss
- Homogeneous in everything else, like risk aversion
- No other frictions
    - administrative
    - claim-processing
    - no moral hazard

Textbook Setting: Graphical Analysis



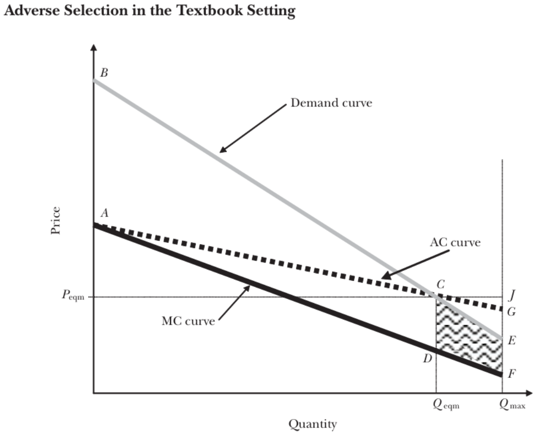
- (Inverse) demand $P(Q) = WTP(Q) = Q^{th}$ quantile of WTP
- $MC(Q)$ is expected loss of consumers in Q^{th} quantile of WTP
  - link between demand and cost
  - risk aversion+no frictions⇒ WTP=MC+risk premium>MC
  - $P(Q) > MC(Q) > 0$
- $AC(Q)$ average cost among those with WTP>$WTP(Q)$
  - $MC(0) = AC(0)$= cost of most eager individual
  - AC(1) = average cost of all individuals

Adverse Selection = decreasing MC



- $MC(Q)$ = expected loss of individuals in Q^{th} percentile of WTP
  - WTP = MC + risk premium
  - heterogeneity only in cost
  - high WTP $\Leftrightarrow$ high MC
  - $\Rightarrow$ MC downward sloping
  - AC > MC

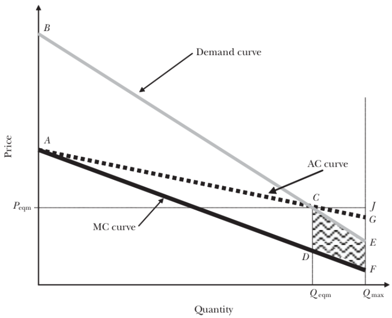
Equilibrium



- Symmetric equilibrium
- Free entry $\Rightarrow$ profit $= Q\,(P - AC) = 0 \Rightarrow$ P = AC

Optimum

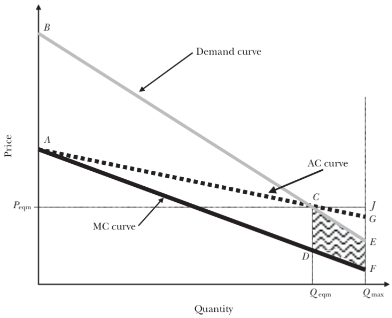
Adverse Selection in the Textbook Setting



- Risk aversion + no other frictions $\Rightarrow$ $WTP > MC$
- Optimum: $P = MC$ and $Q^{\star} = 1$
  - shift everyone's risk to the risk-neutral insurer

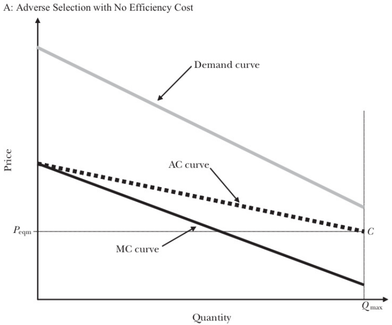
Welfare loss

Adverse Selection in the Textbook Setting



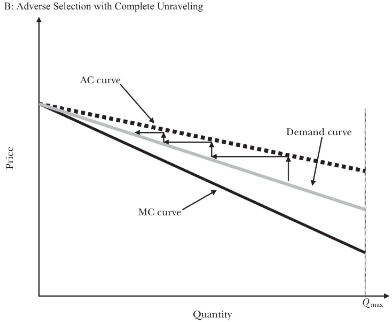
- Adverse Selection $\Rightarrow$ AC $>$ MC$\Rightarrow$ P is too high $\Rightarrow$ under-insurance
- The $1 - Q^{\star}$ individuals with lowest expected costs remain uninsured
  - they have C<WTP<AC=P
  - Adverse selection $\Rightarrow$ firms cannot insure these individuals & break even
  - welfare loss $= \int_{\{uncovered\}} (WTP - MC)$
  - negative (informational) externality from infra-marginals to marginals

Welfare loss can be small



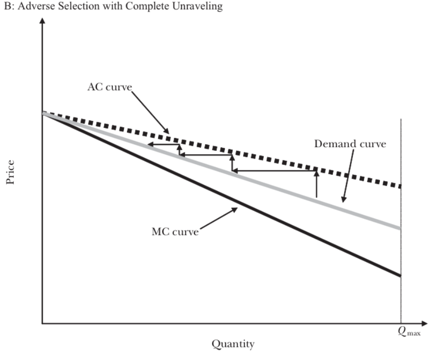
- Adverse selection & no welfare loss. For instance:
  - MC decreasing, equilibrium is P=AC>MC
  - But AC<WTP always, so $Q^\star = 1$
- When could this happen?
  - low heterogeneity in risk (MC and AC relatively flat)
  - high risk aversion (WTP >> MC)

Welfare loss can be large



- There can be complete market shutdown:
  - MC decreasing, but AC> WTP>MC
- When can this happen?
  - some have sure loss ⇒ zero risk premium ⇒ WTP=MC
- Massive welfare loss, as emphasized by Akerlof (1970)

Death Spiral

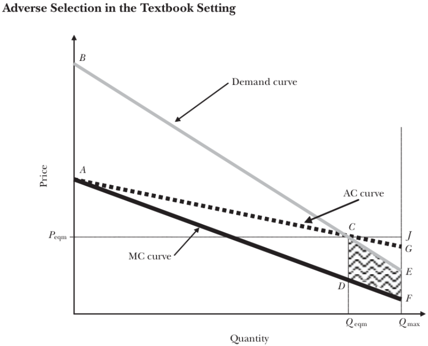


- Insurance prices often adjust dynamically
  - first set prices according to some estimate
  - dynamically adjust price to reflect AC from the previous period
  - can result in market collapse
- Described empirically by Cutler and Reber (1998)

Regulation?

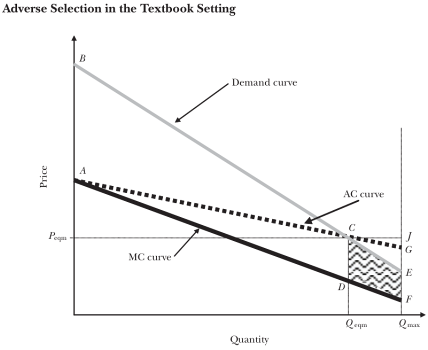
- Common forms of regulating health insurance markets
  - mandate
  - subsidies
  - community rating
  - risk adjustment

Regulation in the Textbook Case: mandate



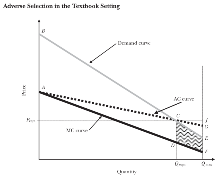
- Everyone must purchase insurance
  - like the Affordable Care Act (ACA) in the US
  - produces efficient outcome
- Welfare benefit can vary: depends on the extent of market failure ex ante

Regulation in the Textbook Case: subsidies



- Subsidize insurance purchase with lump sum transfer
  - also happens under the ACA for some people
  - shifts demand out
  - higher equilibrium quantity, less under-insurance, higher welfare
  - a large enough subsidy produces efficiency (Q=1)

Regulation in the Textbook Case: community rating



- What characteristics can firms price discriminate?
  - age, geography, gender, race, height, pre-existing conditions?
  - creates several markets
- What are the cost and demand curves in each resulting market?
  - perfect price discrimination ⇒ all MC curves flat ⇒ efficiency
  - Imperfect discrimination ⇒ resulting setup can be better or worse than pooled market
    - more about this in Levin (2001) and in my JMP

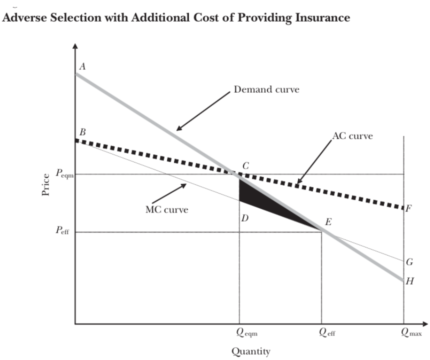
Beyond the Textbook Setting

- So far we assumed:
    - private information only about risk/expected loss
    - optimum is $Q = 1 \Rightarrow$ there is never over-insurance
    - mandatory insurance produces efficiency
- A little more realism challenges these results:
    - administrative costs of providing insurance ("loads")
    - richer preference heterogeneity (for instance, in risk aversion)

Loading factor

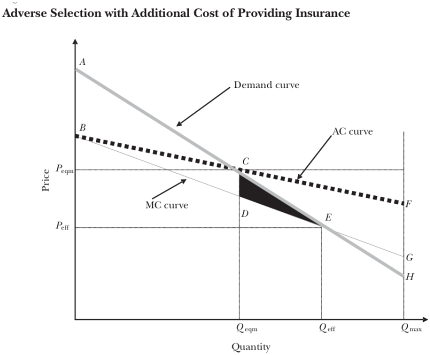
- Loading sources
  - administrative cost,
  - advertising and marketing
  - verifying and processing claims
- Implies an upward shift in MC and AC
- $Q = 1$ is not necessarily efficient
  - individuals are still risk averse
  - cost of providing insurance might be larger than WTP
    - WTP=MC+risk premium
    - total cost = MC + load
  - might be optimal to leave some individuals uninsured

Loading Factor



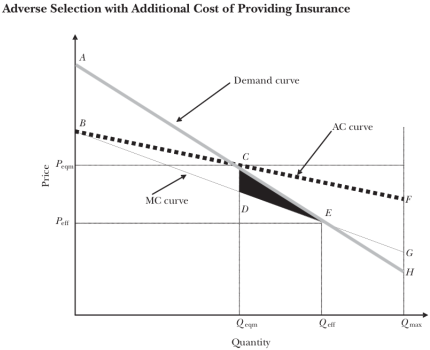
- MC crosses demand at Q<1
  - this intersection is the optimal allocation (P=MC)
  - on the left, WTP >MC; on the right, WTP < MC
  - equilibrium is still P=AC

Loading Factor & Welfare



- equilibrium P=AC; optimum P=MC
- decreasing MC $\Rightarrow$ under-insurance ($Q^{\star} < Q^{eff}$) as before
- How should we regulate?

Loading Factor & Welfare: mandate

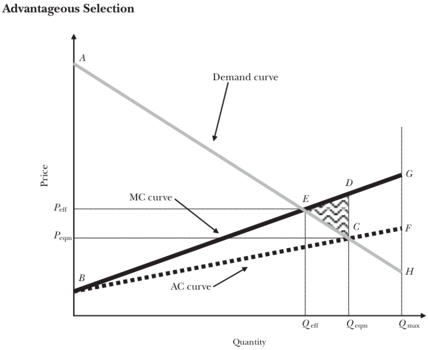


- Mandate no longer produces efficiency
  - Mandate can produce excessive insurance
  - fixes the welfare loss of under-insurance
  - may cause over-insurance (covering those with WTP<MC)
  - final effect depends on the sizes of the two welfare losses
- What would happen with a subsidy?

Richer Types

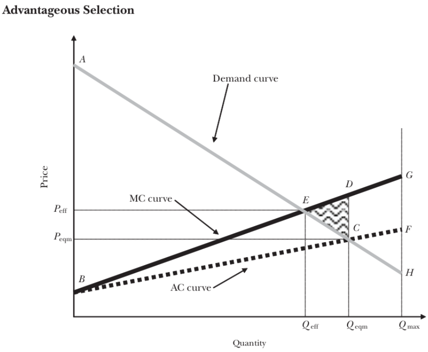
- Empirical work has documented substantial preference heterogeneity as well
  - Finkelstein and McGarry (2006) (risk aversion)
  - Fang, Keane and Silverman (2008) (many, especially cognitive ability)
- Consider risk aversion:
  - WTP is increasing in risk and risk aversion
  - risk increases costs, but risk aversion does not
  - the most profitable consumers have low risk, high risk aversion
  - This opens the possibility of advantageous selection

Advantageous Selection



- Advantageous selection:
  - negative correlation between risk and risk aversion
  - low risk & high risk aversion $\Rightarrow$ high WTP & low risk

Advantageous Selection = increasing MC

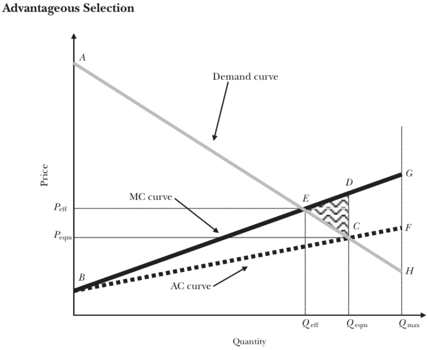


- Advantageous selection corresponds to increasing MC
  - marginal individual has higher MC than infra-marginals
  - AC<MC

Advantageous Selection + no loads: efficiency

- no loads + advantageous selection $\Rightarrow$ efficiency
  - we still have WTP=MC + risk premium
  - no loads $\Rightarrow$ MC<WTP
  - so equilibrium is P=AC<MC<WTP
  - corner solution, covered market, efficiency
- The possible problem with advantageous selection:
  - infra-marginals are cheap $\Rightarrow$ firms make a profit on them
  - perfect competition pushes firms to dissipate these profits
    - firms compete over profitable infra-marginal consumers
  - causes firms to serve marginal users with low WTP relative to cost
  - with loads, there might be excessive insurance

Advantageous Selection + loads



- insurance loads + advantageous selection $\Rightarrow$ excessive insurance
  - the $Q^{\star} - Q^{eff}$ individuals are inefficiently covered in equilibrium
  - competition for profitable infra-marginals pushes firms to cover high cost marginal consumers
- De Meza and Webb (1987): advantageous selection$\Rightarrow$ over-investment
  - more on this in Mahoney and Weyl (2013)

Advantageous selection & regulation

- Opposite solutions of those used with adverse selection
  - tax existing insurance policies
  - outlaw insurance coverage
- Of course, there is a chance of overshooting and ending up with too little insurance

Outline

Main Idea

- Adding behavioral component to Einav, Finkelstein and Cullen (2010)
- People misunderstand
  - their expected loss
  - the contract
  - the variance of their loss
  - etc...
- Welfare estimates from revealed preference might not be true
  - how do policy interventions interact with behavioral consumers?
  - Einav, Finkelstein and Cullen (2010) find small welfare loss from adverse selection

Model

- Competitive market as in EFC, single price p
- revealed value $\hat{v}_i$: i buys insurance when $\hat{v}_i > p$
  - demand is $q = D(p) = 1 - F_{\hat{v}}(p)$
- true value v_i: i should buy insurance when $v_i > p$

$$\epsilon \equiv \hat{v}_i - v_i$$

- Define the Marginal Value at p as

$$MV(p) = \mathbb{E}[v \mid p = \hat{v}]$$

- The wedge between $MV(p)$ and $D(p)$ determines the bias by a policy maker that uses revealed preference (RP)

Results: structure of MV(p) and D(p)

- Suppose that frictions cancel out overall, so $\mathbb{E}[\epsilon] = 0$.
- Then, using the demand curve
  - overestimates insurance value for the insured
  - underestimates insurance value for the uninsured

$$\mathbb{E}[\epsilon \mid \hat{v} > p] \geq 0 \geq \mathbb{E}[\epsilon \mid \hat{v} < p], \forall p$$

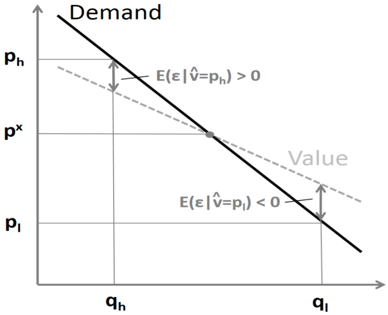
- Intuition:
  - if you're buying, you tend to have high ϵ
  - if you're not buying, you tend to have low ϵ
  - this is an effect of consumer selection, even though there is no bias "on average"

Stronger result

- We can get a stronger result if we assume MLRP
  - $\frac{f(v_1|\epsilon_1)}{f(v_1|\epsilon_2)} > \frac{f(v_2|\epsilon_1)}{f(v_2|\epsilon_2)}$, for $v_1 > v_2$ and $\epsilon_1 > \epsilon_2$

$$\frac{\partial}{\partial p}\mathbb{E}\left[\epsilon \mid \hat{v} = p\right] \geq 0$$

- Higher $\hat{v}$ always implies stronger overestimation of true values.



- RP underestimates the marginal value of insurance more when q large

Welfare

- expected cost to insurer is π_i:

$$\hat{v}_i = v_i + \epsilon_i = \pi_i + r_i + \epsilon_i$$

- Average cost: $AC(p) = \mathbb{E}[\pi \mid \hat{v} \geq p]$
  - equilibrium is $AC(p^c) = p^c$
- Marginal cost: $MC(p) = \mathbb{E}[\pi \mid \hat{v} = p]$
  - optimum is $MC(p^\star) = MV(p^\star)$

Welfare losses

- True welfare loss is

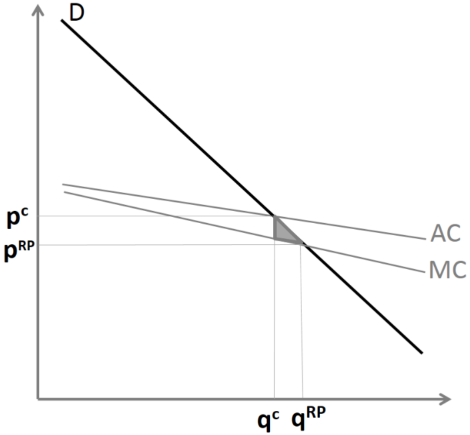
$$\Gamma = \left\| \int_{p^{\star}}^{p^{c}} \left[MV(p) - MC(p) \right] dD(p) \right\|$$

- A revealed preference designed perceived a welfare loss of

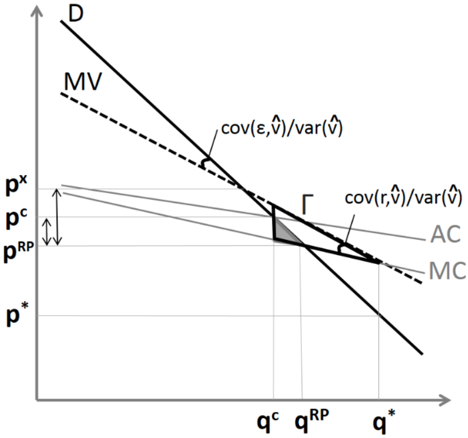
$$\Gamma^{RP} = \int_{p^{RP}}^{p^{c}} \left[p - MC(p) \right] dD(p) > 0$$

- Two differences:
  - wrong pool of inefficiently uninsured
  - misunderstands welfare loss from being inefficiently uninsured

Graph: RP policy maker



Graph: true welfare loss



- With adverse selection and MLRP, $\Gamma > \Gamma^{RP}$
  - extent of under-insurance is worse: $p^{\star} < p^{RP}$
  - insurance value to the uninsured is higher: $D(p) < MV(p)$ for $p \in [p^{\star}, p^{c}]$

Costs of mandate vs subsidies

- Mandate cost: includes some for whom insurance isn't socially desirable
  - more frictions ϵ increases welfare gains from mandate
  - more frictions implies higher marginal value of insurance
    - (higher gain from the uninsured infra-marginals)
- With frictions, mandate becomes relatively more desirable than subsidies

Outline

Motivation

- So far: perfect competition
- Evidence of market power in health insurance
  - Dafny, Duggan and Ramanarayanan (2012)
  - Dafny (2010)
  - Starc (2014)
- What's the interaction between selection & market power?
- Given market power, do we want reduce selection?
  - should employers risk-adjust?
- Given selection, do we want to reduce market power?
  - should insurers/banks merge?

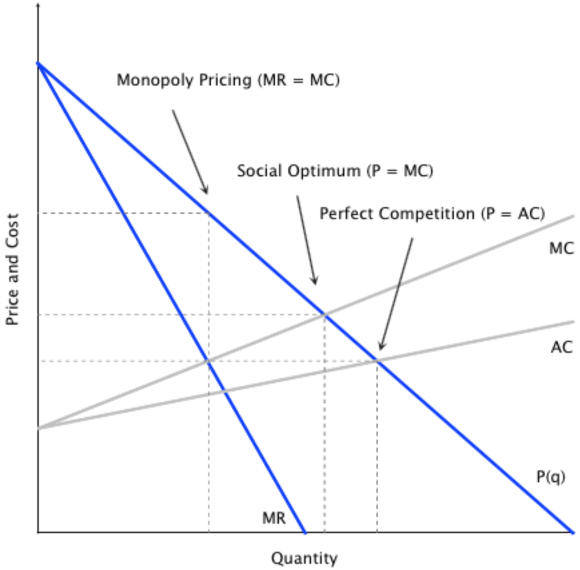
Basic Setup

- Imperfect competition in prices, fixed quality
- Symmetric firms
  - health insurance (probable adverse selection)
  - auto loans (probable advantageous selection)
- $q \in [0, 1]$ consumers buy
- Inverse demand $P(q)$
- Marginal cost $MC(q)$
- Average cost $AC(q)$
- Selection is
  - adverse: $MC'(q) < 0$
  - advantageous: $MC'(q) > 0$

Pricing

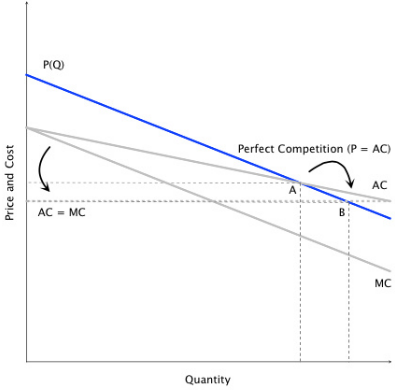
- Optimum:
$$P(q) = MC(q)$$
- Competitive:
$$P(q) = AC(q)$$
- Einav, Finkelstein and Cullen (2010): competitive price can be too high or too low
- Monopolist:
$$P(q) = MC(q) + MS(q)$$

Example of Pricing (advantageous selection)



Changing selection: cost rotations

- Less selection: AC(q) approaches $AC\,(1)$ at every q
    - makes everyone more similar to market average
- Adverse selection: AC rotates counter-clockwise



- Advantageous selection: AC rotates clockwise

Parameterizing market power: θ

- Conduct parameter $\theta \in (0, 1)$ captures market power
  - following Bresnahan (1989); Weyl and Fabinger (2013)

$$P = \theta \underbrace{(MC + MS)}_{\substack{\text{monopoly}\\ \text{pricing}}} + (1 - \theta) \underbrace{AC}_{\substack{\text{competitive}\\ \text{pricing}}}$$

- Accommodates several modes of competition
  - symmetric Cournot with n firms has $\theta = \frac{1}{n}$
  - symmetrically differentiated Bertrand
- Requires many symmetry assumptions (see Weyl and Fabinger (2013))
  - symmetric distribution of types
  - symmetrically differentiated firms
  - switching margin representative of buyers

Parameterizing selection: σ

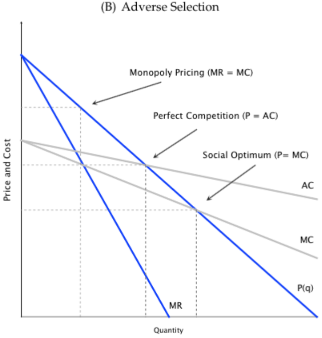
- Less selection: AC, MC flatter and closer to $AC(1)$
- $\sigma = 0$ is zero selection; $\sigma = 1$ is full selection
  - $1 - \sigma$ captures the amount of risk adjustment in a market
- Firm's perceived costs become:

$$\text{average cost} = \sigma AC(q) + (1 - \sigma) AC(1)$$

$$\text{marginal cost} = \sigma MC(q) + (1 - \sigma) AC(1)$$

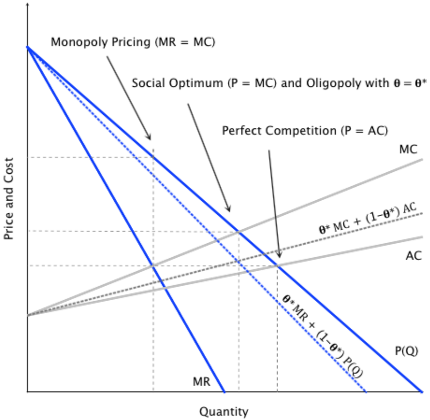
- Applies to both types of selection
- Requires symmetry: firms obtain a representative sample of buyers at equilibrium and in any deviation
- $\sigma \to 0$ means AC(q), MC(q)$\to AC(1)$ at every q

Optimal market power with adverse selection



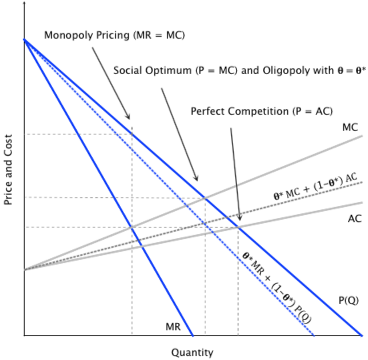
- Market power decreases welfare:
  - adverse selection + perfect competition ⇒ under-provision of insurance
  - market power further reduces provision
- Market power cannot restore a collapsed market
  - not true in models with endogenous quality (Rothschild and Stiglitz (1976); Veiga and Weyl (Forthcoming))
- With adverse selection, market power is undesirable (as usual)

Optimal market power with advantageous selection



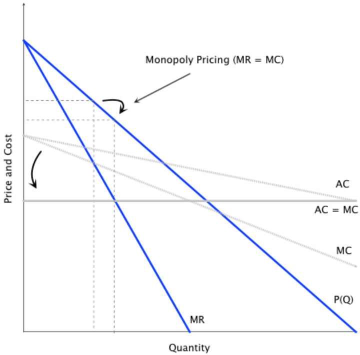
- Welfare is inverse-U-shaped in market power:
  - optimum is P=MC
  - monopoly $\Rightarrow$ under-provision (P=MC+MS)
  - perfect competition (+ loads) $\Rightarrow$ over-provision
  - there is an optimal θ between monopoly and perfect competition

Optimal market power with advantageous selection



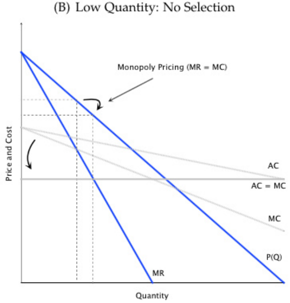
- Optimal θ increasing in degree of advantageous selection (σ)
  - excess production due to advantageous selection is increasing in σ
  - market power offsets this incentive

Reducing adverse selection under monopoly



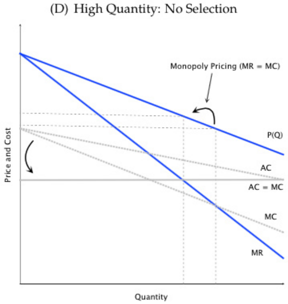
- Reducing adverse selection raises profits
  - envelope theorem: monopoly's optimal quantity is fixed
  - infra-marginals more costly than marginals
  - reducing selection$\Rightarrow$ lowers infra-marginal costs $\Rightarrow$ higher profit
- What about consumer surplus?

Reducing adverse selection under monopoly - low q



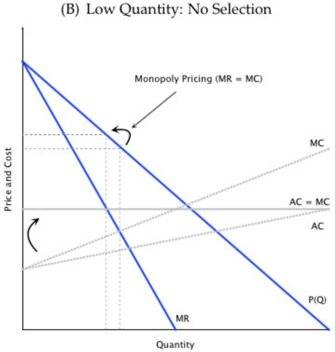
- Equilibrium quantity low
  - MC decreasing: q low means $AC(1) < MC(q)$
  - market is working poorly
- Reducing selection: $MC(q) \rightarrow AC(1), \forall q$
  - low $q \Rightarrow$ lowers MC
  - monopoly's price determined by MC $\Rightarrow$ lowers price
  - reduce under-provision

Reducing adverse selection under monopoly - high q



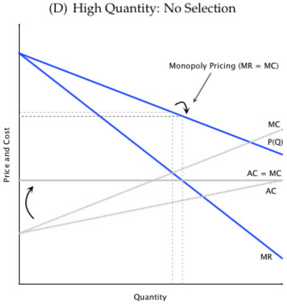
- Equilibrium quantity high: $AC(1) > MC(q)$
- reducing selection: $MC(q) \to AC(1), \forall q$
  - high q $\Rightarrow$ raises MC $\Rightarrow$raises price
- Reducing adverse selection can lower welfare if q is very high
  - buyers are nearly representative of the entire population
  - less selection $\Rightarrow$ large increase in MC $\Rightarrow$ large reduction in CS
  - less selection $\Rightarrow$ small change in AC $\Rightarrow$ small increase in profit
  - (requires regularity conditions on the demand)

Reducing advantageous selection under monopoly - low q



- Advantageous selection: low quantity means $MC(q) < AC(1)$
  - reducing selection $\Rightarrow$ increasing MC(q) $\Rightarrow$ price increases
  - might reduce over-provision

Reducing advantageous selection under monopoly - high q



- Advantageous selection: high quantity means $MC(q) > AC(1)$
  - reducing selection $\Rightarrow$ decrease MC(q) $\Rightarrow$ lower price

Optimal selection under competition

- Perfect competition $\Rightarrow$ zero profit
  - only consumer surplus matters
- Adverse selection: MC, AC decreasing
  - $AC(q) > AC(1)$
  - reducing selection $\Rightarrow$ lower $AC(q)$ $\Rightarrow$ lowers prices
  - higher CS, higher welfare
- Advantageous selection: MC, AC increasing
  - $AC(q) < AC(1)$
  - reducing selection $\Rightarrow$ higher $AC(q)$ $\Rightarrow$ higher prices
  - lower CS, lower welfare

Outline

Community Rating

- Community rating (CR):
  - giving groups with different expected risks the same price
  - as opposed to "experience rating"
- Adopted by "Blue" (Blue Cross & Blue Shield) plans
  - later dropped due to competition from experience rating plans
- When is CR a good idea?

Distortions from community rating

- Recall simple insurance model of Arrow (1963)
- Individual chooses D (demand) to maximize

$$\underbrace{(1-q)\cdot u\left(W-pD\right)}_{\text{no loss}}+\underbrace{q\cdot u\left(W-pD-X+D\right)}_{\text{loss}}$$

- If $p=q$ (actuarially fair price), individual buys full coverage:

$$u'\left(W-pD-X+D\right)=u'\left(W-pD\right)\Rightarrow D=X$$

- Suppose there are two types of risk: q_h (share s_h) and q_l (share s_l)
    - Actuarially fair prices are $p_h=q_h$ and $p_l=q_l$
    - Actuarially fair community rating price is

$$q_l<p=\frac{s_h q_h+s_l q_l}{s_h+s_l}<q_h$$

- Over consumption by q_l, under consumption by q_h

Thoughts

- CR leads to redistribution
  - from the healthy to the sick - is this socially desirable?
  - is this an efficient form of redistribution?
- CR can provide lifetime insurance against reclassification risk
  - this might be undermined by short-term plans doing experience rating
  - those with bad health shocks stay in the CR plans (adverse selection)
- Information flow is not free
  - might be good to have fewer contracts than types
- Does CR increase the usage of healthcare?
  - if it does, there is moral hazard!
  - CR increases usage for some, but decreases for others
  - even if usage increases overall, does it increase for those who value it most?
  - it's unlikely, given that CR is such a blunt way of achieving this change in consumption
- Possible that neither CR nor experience rating alone achieves efficiency

Outline

Community Rating

- Two markets: high cost h, and low cost l
  - $i \in \{h, l\}$
- when should we implement community rating?
- Full community rating:

$$\bar{p} = \frac{\sum Q_i(\bar{p}) A_i(\bar{p})}{\sum Q_i(\bar{p})}$$

Full Discrimination is good

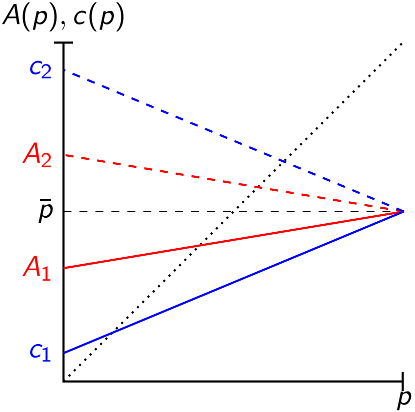


Figure : Full discrimination is good. As $p \to A$, also $p \to c$.

- large differences in cost levels between markets
- small heterogeneity within markets (small selection)

Full Community Rating is good

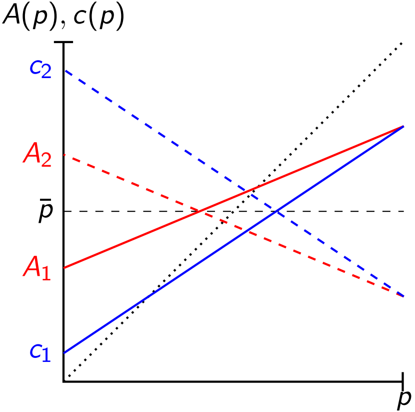


Figure : Full community rating is good. As $p \to A$, we have p moves away from c.

- small differences in average cost level between markets
- large heterogeneity within markets.

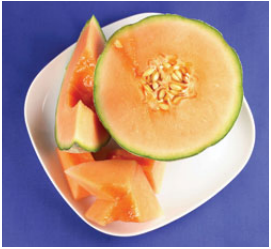
Outline

Motivation

- How does the information structure affect the amount of trade?
  - better private information?
  - better public information?

Model

- 1 good with quality w
- 1 buyer with valuation $b(w)$
- 1 seller with valuation $s(w)$
- 3 equally likely states w: Lemon, Mellon, Huckleberry



- Trade is always efficient: $b(w) > s(w)$
  - as in the insurance case

Information structure

- State of the world w might be unknown
  - possibly to both players
- posted price p
- trade/welfare: ex ante, how many states of the world there is trade in at a price p

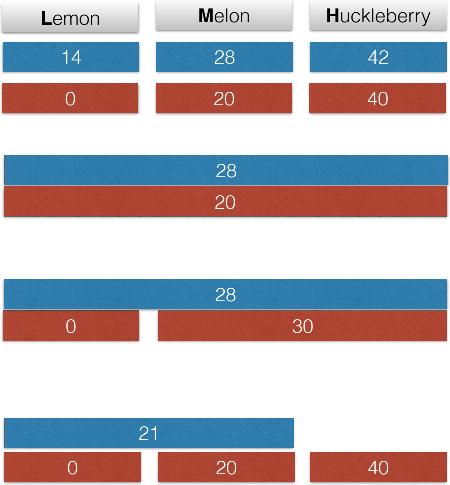
Private information: can make things better or worse

full information:
full trade

No information:
full trade at 20<p<28

Seller sees lemons:
only lemons trade at
0<p<14

Seller fully informed:
lemons & melons trade
at 20<p<21



- First extra private info: seller in the market
  - more info tells her when RP is above the market price $\Rightarrow$ reduces trade
- Second extra private info: seller out of the market
  - lowers RP when melon (previous not traded) $\Rightarrow$ increases trade

Public information

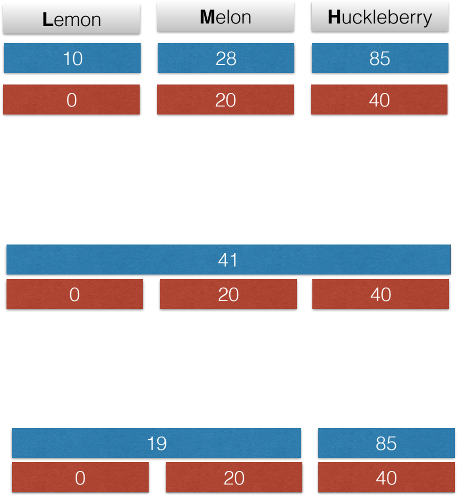
- Maybe the point isn't how much information there
- Is more common knowledge better?
- It depends

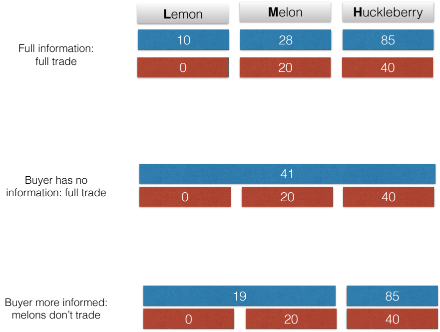
Public information: can make things better or worse

Full information: full trade

Buyer has no information: full trade

Buyer more informed: melons don't trade





- First extra public info: buyer in the market
  - can decrease trade
- Move to full information: buyer out of the market
  - increases trade
- the possibility of H was facilitating trade when buyer was uninformed
  - making it certain collapses trade in other states of the world

More thoughts

- Suppose there are 3 variants of a disease
  - similar symptoms: cannot be distinguished a priori
  - different costs of treatment
- A hospital sets a price to treat people with those symptoms
  - should we allow for a test that identifies the illness prior to admission?
  - what if it distinguishes only certain kinds of the illness from others?
- Grossman and Stiglitz (1980): stock market
  - common values + private information $\Rightarrow$ no trade

Outline

Motivation

- Until now, insurance quality was fixed
- In fact, firms choose combinations of price and quality
  - what is the optimal insurance quality?
  - what is the equilibrium?
  - what are the distortions?
  - what is the role of risk adjustment and market power?

Consumers

- CARA utility with risk aversion a
- Wealth shocks $\sim \mathcal{N}\left(\mu, \sigma^2\right)$
- quality $x \in [0,1]$ is % of loss covered
- As we saw, WTP is:

$$u = \underbrace{x\mu}_{\text{mean risk}} + \underbrace{\gamma\left(x\right)v}_{\text{risk premium}}$$

- This is a slight adaption of Rothschild and Stiglitz (1976)
  - they had general utility & 2 states of world
- $v = a\sigma^2$ is insurance value
- $\gamma\left(x\right) = \frac{1}{2}\left(1-\left(1-x\right)^2\right)$
  - increasing concave
  - maximized at full insurance ($x = 1$)
- no moral hazard

Insurers

- Symmetric
- Risk neutral
- Offer a single contract
  - Rothschild and Stiglitz (1976) actually focuses on the case with multiple contracts
- Choose quality x and price p
- $c = c(x, \mu) = x\mu$ is cost to insurer
- Perfect competition $\Rightarrow p = x\mu$

Homogeneous market (no private information)

- Everyone had the same μ
- Competitive price of coverage is $P(x) = x\mu$
- Individuals choose x following this competitive price schedule

$$argmax_x \left[x\mu + \gamma(x)v - P(x)\right] = argmax_x \gamma(x)$$

- Individuals fully insure: $x = 1$
- everyone pays the actuarially fair price $p = \mu$

Heterogeneous market & no private info

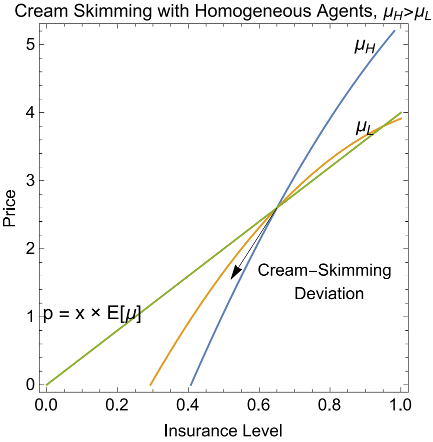
- Observable heterogeneity: $\mu_l < \mu_h$
- No private information: pricing can be made conditional on type
  - effectively there are two different markets
  - each market homogeneous
  - revert back to previous case: $x_i = 1, p_i = \mu_i$

Heterogeneous market: no pooling equilibrium

- μ_l, μ_h is private information
- What (single) contract do firms offer?
- Assume everyone buys
- Price would have to be $p = x\mathbb{E}[\mu]$

Heterogeneous market: no pooling equilibrium

- Graph: indifference curves at a candidate pooling eql
  - "pooling" = all types purchase the same contract



- μ_h is willing to pay more for an increase in x
- local deviation attracts only μ_l types (cream-skimming)

Separating equilibrium

- To solve this, insurer offers 2 contracts:
- Separating equilibrium:
  - unhealthy get full insurance ($x_h = 1$) at $p_h = \mu_h$
  - The healthy get imperfect insurance ($x_l < 1$) at $p_l = x_l \mu_l$
  - x_l is the highest possible conditional on $u_h(x_l, p_l) = u_h(x_h, p_h)$
  - Society obtains insufficient insurance
- But there are problems
  - equilibrium does not always exist
  - no equilibrium with continuum of types: Riley (1979)
  - mixed strategy equilibrium with 2 types: Luz (2012)

Outline

Motivation

- Rothschild and Stiglitz (1976): single dimension of type, μ
- Empirical evidence that individuals differ in many dimensions
  - risk aversion: Finkelstein and McGarry (2006)
  - cognitive ability: Fang, Keane and Silverman (2008)
- How would multidimensional types interact with
  - quality choices?
  - market power?

Setup

- The paper has a more general setup
  - we will focus on the insurance application
- WTP as before:

$$u = x\mu + \gamma(x)\, v$$

- Now, both μ and v are heterogeneous
  - there is a continuum of both
  - smooth joint density $f(\mu, v)$
- Insurer chooses (p, x)
- Cost is

$$c = c(x, \mu) = x\mu$$

$$\Rightarrow u = c + \gamma(x)\, v$$

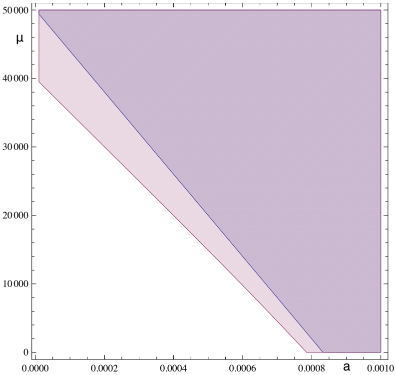
- No moral hazard (wouldn't be hard to add)

Monopoly: buyers and marginals

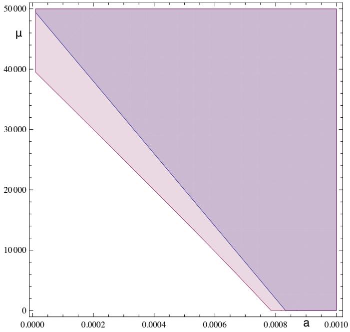
$$u > p \Leftrightarrow \mu > \frac{1}{x}\left[p - \gamma(x)\, v\right] = \mu^{\star}(p, x, v)$$

$$\text{buyers: } \mathcal{B} = \{\mu > \mu^{\star}\}$$

$$\text{marginals: } \mathcal{M} = \{\mu = \mu^{\star}\}$$



Demand



$$Q \equiv \int_{\underline{v}}^{\overline{v}} \int_{\mu^\star(p,x,v)}^{\overline{\mu}} f(\mu, v)\, d\mu dv$$

$$\frac{\partial Q}{\partial p} = \int_{\underline{v}}^{\overline{v}} \left[-\frac{\partial \mu^\star}{\partial p} \right] f(\mu^\star, v)\, dv = -\int_{\underline{v}}^{\overline{v}} \frac{1}{x} f(\mu^\star, v)\, dv = -M$$

- M is the density of marginal people

Monopoly price

- Profit is

$$\Pi \equiv \int_{\underline{v}}^{\overline{v}} \int_{\mu^\star(p,x,v)}^{\overline{\mu}} [p - c] \, f(\mu, v) \, d\mu dv$$

- The monopoly price satisfies

$$p = \underbrace{\mathbb{E}[c \mid \mathcal{M}]}_{\text{marginal cost}} + \underbrace{\frac{Q}{M}}_{\text{markup}}$$

- But the really interesting part is the incentives to choose x...

Monopoly quality

$$\Pi \equiv \int_{\underline{v}}^{\overline{v}} \int_{\mu^\star(p,x,v)}^{\overline{\mu}} [p - c(x,\mu)] f(\mu, v)\, d\mu dv$$

$$\frac{\partial \Pi}{\partial x} \equiv \int_{\underline{v}}^{\overline{v}} \int_{\mu^\star}^{\overline{\mu}} \left[-\frac{\partial c}{\partial x}\right] f(\mu, v)\, d\mu dv + \int_{\underline{v}}^{\overline{v}} \left[-\frac{\partial \mu^\star}{\partial x}\right] [p - c] f(\mu^\star, v)\, dv = 0$$

$$-Q\mathbb{E}\left[\frac{\partial c}{\partial x} \mid \mathcal{B}\right] + \int_{\underline{v}}^{\overline{v}} \frac{1}{x}\frac{\partial u}{\partial x} [p - c(x,\mu^\star)] f(\mu^\star, v)\, dv = 0$$

$$-Q\mathbb{E}\left[\frac{\partial c}{\partial x} \mid \mathcal{B}\right] + M\frac{1/x}{1/x}\frac{\int_{\underline{v}}^{\overline{v}} \frac{\partial u}{\partial x} [p - c(x,\mu^\star)] f(\mu^\star, v)\, dv}{\int_{\underline{v}}^{\overline{v}} f(\mu^\star, v)\, dv} = 0$$

$$-Q\mathbb{E}\left[\frac{\partial c}{\partial x} \mid \mathcal{B}\right] + M\mathbb{E}\left[\frac{\partial u}{\partial x}(p - c(x,\mu)) \mid \mathcal{M}\right] = 0$$

Monopoly quality

$$-Q\mathbb{E}\left[\frac{\partial c}{\partial x} \mid \mathcal{B}\right] + M\mathbb{E}\left[\frac{\partial u}{\partial x}(p - x\mu) \mid \mathcal{M}\right] = 0$$

$$-Q\mathbb{E}\left[\frac{\partial c}{\partial x} \mid \mathcal{B}\right] + M\mathbb{E}\left[\frac{\partial u}{\partial x} \mid \mathcal{M}\right]\mathbb{E}\left[p - c \mid \mathcal{M}\right] + MCov\left[\frac{\partial u}{\partial x}, p - c \mid \mathcal{M}\right] = 0$$

- FOC for p was $p - \mathbb{E}\left[c \mid \mathcal{M}\right] = \frac{Q}{M}$...

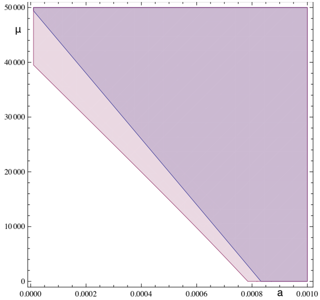
$$-Q\mathbb{E}\left[\frac{\partial c}{\partial x} \mid \mathcal{B}\right] + M\mathbb{E}\left[\frac{\partial u}{\partial x} \mid \mathcal{M}\right]\frac{Q}{M} - MCov\left[\frac{\partial u}{\partial x}, c \mid \mathcal{M}\right] = 0$$

$$\underbrace{-Q\mathbb{E}\left[\frac{\partial c}{\partial x} \mid \mathcal{B}\right]}_{\text{cost}} + \underbrace{Q\mathbb{E}\left[\frac{\partial u}{\partial x} \mid \mathcal{M}\right]}_{\text{Spence}} - \underbrace{MCov\left[\frac{\partial u}{\partial x}, c \mid \mathcal{M}\right]}_{\text{Sorting}} = 0$$

Sorting

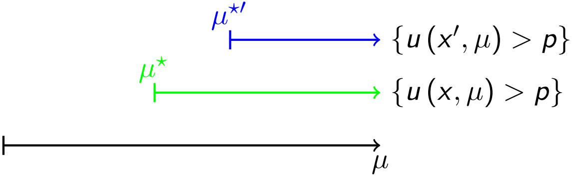
$$\underbrace{-Q\mathbb{E}\left[\frac{\partial c}{\partial x} \mid \mathcal{B}\right]}_{\text{cost}} + \underbrace{Q\mathbb{E}\left[\frac{\partial u}{\partial x} \mid \mathcal{M}\right]}_{\text{Spence}} - \underbrace{MCov\left[\frac{\partial u}{\partial x}, c \mid \mathcal{M}\right]}_{\text{Sorting}} = 0$$

- The Spence (1975) captures shift in the set of marginal consumers
- The sorting term captures rotations of this line



Sorting requires multidimensional types

- 1D types:
  - Margin is a singleton $\Rightarrow Cov = 0$
  - Number of buyers Q determines composition



Sorting vs Selection

- Adverse selection:
  - fix quality x
  - increasing Q decreases MC: $MC'(Q) < 0$
  - depends on correlation between WTP and cost
- Adverse sorting:
  - fix Q
  - increasing x increases MC at Q: $Cov\left(\frac{\partial u}{\partial x}, c \mid \mathcal{M}\right) > 0$
  - depends on correlation between marginal WTP and cost, conditional on marginal buyers

Socially optimal sorting

- Individual contribution to welfare is $\gamma(x)\, v$
- Welfare is $W = \int_{\underline{v}}^{\overline{v}} \int_{\mu^\star(p,x,v)}^{\overline{\mu}} \gamma(x)\, v f(\mu, v)\, d\mu dv$
- Socially optimal price is $p = \mathbb{E}[c \mid \mathcal{M}]$
  - monopoly price was $p = \mathbb{E}[c \mid \mathcal{M}] + \frac{Q}{M}$
- Monopoly quality

$$-Q\mathbb{E}\left[\frac{\partial c}{\partial x} \mid \mathcal{B}\right] + Q\mathbb{E}\left[\frac{\partial u}{\partial x} \mid \mathcal{M}\right] - MCov\left[\frac{\partial u}{\partial x}, c \mid \mathcal{M}\right] = 0$$

- Socially optimal quality is

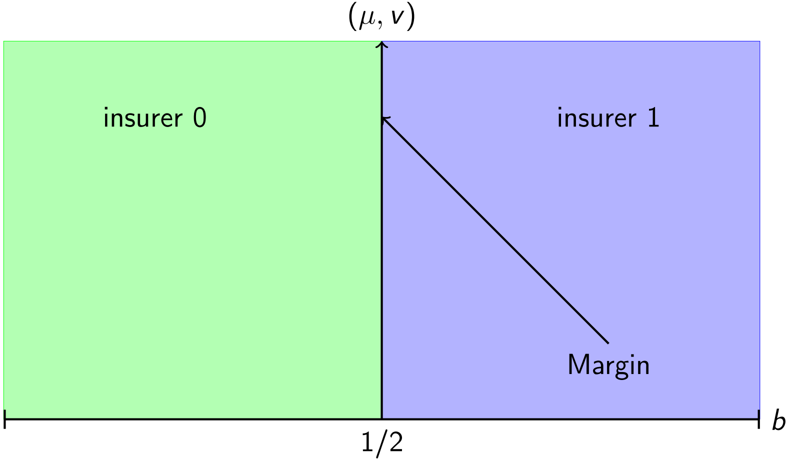
$$\underbrace{-Q\mathbb{E}\left[\frac{\partial c}{\partial x} \mid \mathcal{B}\right]}_{\text{cost}} + \underbrace{Q\mathbb{E}\left[\frac{\partial u}{\partial x} \mid \mathcal{B}\right]}_{\text{Spence}} - \underbrace{MCov\left[\frac{\partial u}{\partial x}, c \mid \mathcal{M}\right]}_{\text{Sorting}} = 0$$

- Spence distortion, but no monopoly sorting distortion!
  - the social value of marginals is their contribution to profit

Competition: Setup

- Now we introduce competition
- Two insurers, $i \in \{0, 1\}$ on the Hotelling unit interval
  - each chooses x_i and p_i, otherwise symmetric
- Consumers location is $b \in [0, 1]$
  - travel cost $\begin{cases} tb & \text{, insurer 0} \\ t(1-b) & \text{, insurer 1} \end{cases}$
  - t is market power
  - travel cost fungible with price
- b distributed uniformly on $[0, 1] \Rightarrow$ independent of (μ, v)
- market is covered (often true by law)
- Focus on local symmetric equilibria

Competition: Setup



Welfare maximum

- Total welfare (forgetting about travel costs) is

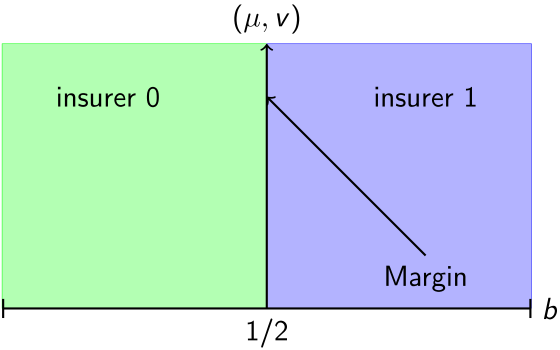
$$W = \int_{\underline{v}}^{\overline{v}} \int_{\underline{\mu}}^{\overline{\mu}} \gamma(x)\, v f(\mu, v)\, d\mu dv = \gamma(x)\, \mathbb{E}[v]$$

- Maximization of welfare prescribes full insurance:

$$\gamma'(x)\, \mathbb{E}[v] = 0 \Rightarrow x = 1.$$

- (Recall $\gamma(x)$ maximized at $x = 1$)

Equilibrium



- Symmetric equilibrium: $\mathcal{M} = \left\{b = \frac{1}{2}\right\}$, $Q_i^\star = \frac{1}{2}$ and $M^\star = \frac{1}{2t}$
- $\mathbb{E}\left[\cdot \mid \mathcal{M}\right] = \mathbb{E}\left[\cdot \mid \mathcal{B}\right] = \mathbb{E}\left[\cdot\right]$, and same for $Cov\left[\cdot, \cdot \mid \mathcal{M}\right]$

Imperfect competition (t>0)

- For $t > 0$, a unique $x^\star \in (0, 1)$ satisfies the symmetric profit FOC

$$\underbrace{-\frac{1}{2}\mathbb{E}\left[c'\right]}_{\text{cost}} + \underbrace{\frac{1}{2}\mathbb{E}\left[u'\right]}_{\text{Spence}} - \underbrace{\frac{1}{2t}Cov\left[u', c\right]}_{\text{sorting}} = 0$$

$$\gamma'\left(x^\star\right)\mathbb{E}\left[v\right] = \frac{1}{t}Cov\left[u', c\right].$$

- Compare to welfare maximization:

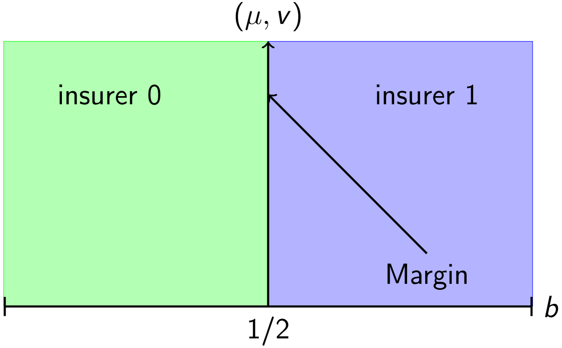
$$\gamma'\left(x\right)\mathbb{E}\left[v\right] = 0$$

- No Spence distortion, since $\mathbb{E}\left[\cdot \mid \mathcal{M}\right] = \mathbb{E}\left[\cdot \mid \mathcal{B}\right]$
- There IS a sorting distortion due to competition!

Sorting distortion due to competition

$$\gamma'(x^\star)\,\mathbb{E}[v] = \frac{1}{t} Cov\left[u', c\right].$$

- Distortion vanishes with market power ($t \to \infty$)
- Monop. internalizes cream-skimming externalities, competitors do not



Competitive limit (as $t \to 0$)

$$\gamma'(x^{\star})\,\mathbb{E}[v] = \frac{1}{t} Cov\left[u', c\right]$$

- In the limit as $t \to 0$, any (local) equilibrium must have

$$Cov\left[u', c\right] \to 0.$$

- $x = 0 \Rightarrow c = 0$ always satisfies this
- With 2D types, there is a second candidate $x^{\star}$:

$$Cov\left[\mu + (1 - x^{\star})\,v, x\mu\right] = 0 \Rightarrow x^{\star} = 1 + \frac{\mathbb{V}[\mu]}{Cov[v, \mu]}$$

- We can have $x \in (0, 1)$ if $\frac{Cov[v,\mu]}{\mathbb{V}[\mu]} < -1$
- In Rothschild and Stiglitz (1976) $Cov[v, \mu] = 0$: no local pooling equilibrium

Market power raises quality

$$0 < \gamma'(x^\star)\,\mathbb{E}[v] = \frac{1}{t} Cov\left[u', c\right]$$

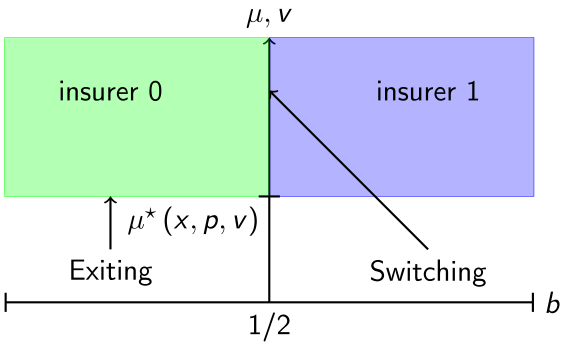
- Market power increases coverage:

$$\frac{dx^\star}{dt} \geq 0.$$

- Intuition:
  - sorting is adverse at eql $\Rightarrow$ downward pressure on x
  - $\mathbb{E}[\gamma'(x)\,v] = \frac{1}{t} Cov[u', c]$: t reduces the importance of sorting
- Here, t always increases welfare
  - no moral hazard
  - no Spence distortion
  - market covered (market power does not reduce quantity)

Quantity/Quality trade-off

- In reality, in a partly covered market:
  - exiting margin (like monopoly)
  - switching margin (like covered market competition)

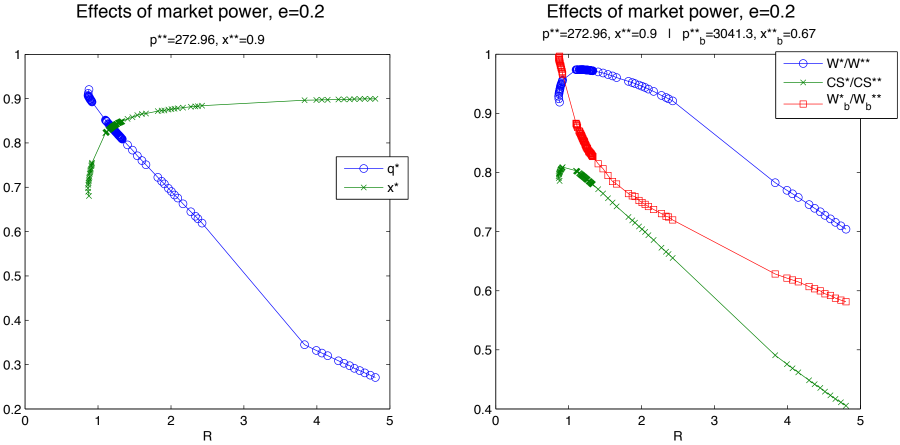


- Increasing t: increases x, but reduces Q
  - what is the optimal $t^\star$ (which implies $x^\star$ and $p^\star$)

Quantity-quality trade-off: calibration

- Proceed using numerical calibration
- $f(\mu, v)$ calibrated from Handel, Hendel and Whinston (2015)
- with moral hazard (full insurance no longer optimum)
- Also considered consumers who over-estimate their risk aversion
  - too much insurance is bought
  - optimal level of x is lower in this case
- R measures markup $\frac{p-\mathbb{E}[c|\mathcal{B}]}{\mathbb{E}[c|\mathcal{B}]}$

Quantity-quality trade-off: calibration



- interior optimal level of markup (with behavioral consumers) ≈ 80%

Highlights

- New sorting effect: $MCov\,[u', c \mid \text{margin}]$
  - requires multidimensional types
  - quantifies quality-setting incentives in selection markets
  - quantities distortion from competition
- Market power
  - reduces quantity
  - improves quality

Thank you!

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