ECON 8854: Insurance Markets I

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ESTIMATING WELFARE IN INSURANCE MARKETS USING VARIATION IN PRICES*

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Contributions

- Graphical supply & demand framework for competitive markets with adverse selection
  - Adverse selection shown in slope of average cost curves
  - Welfare loss triangles similar to Econ 101
- Reduced form empirical approach for estimating
  - adverse / advantageous selection
  - welfare loss
- Illustrative application

Pros and Cons Relative to More Structural Approach

Pros

- Fewer assumptions on consumer preferences
- or *ex ante* information
- Relatively simple
  - given exogenous price variation
  - given cost data (often required by insurance regulators)

Cons

- Misses welfare loss from inefficient plan design
- Cannot handle counterfactual changes in insurance plans
- Cannot simulate counterfactual policies

Demand

Demand Model:

- Consumer i has type ζ_i (zeta), with distribution $G(\zeta_i)$
- Chooses low or high coverage contract $\theta_i \in \{L, H\}$
    - Price of incremental coverage p
    - WTP for incremental coverage $\pi(\zeta_i)$
    - Demand for incremental coverage $D(p) = \Pr(\pi(\zeta_i) \geq p)$

Demand Estimation Equation (OLS, equation (11)):

$$D_i = \alpha + \beta p_i + \epsilon_i$$

Price Variation:

- Business unit president whim: salaried accountants in same location different business units face different prices
- Assumed exogenous (not related to $D(p)$)

Figure 5: Demand data in open circles

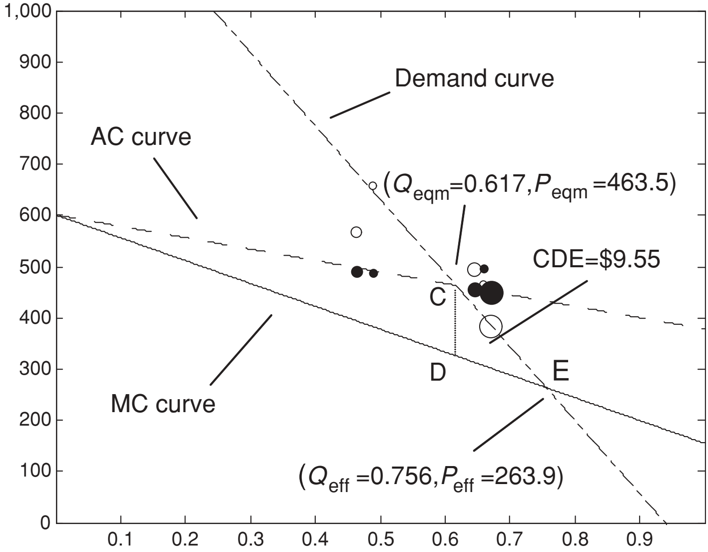


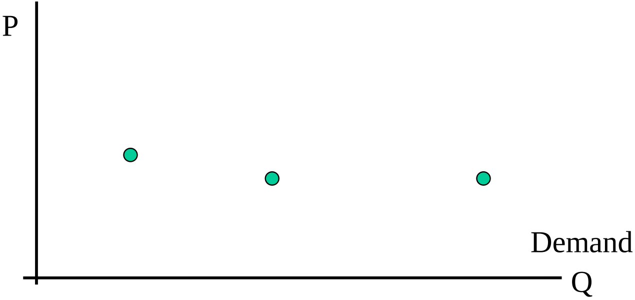
FIGURE V

Efficiency Cost of Adverse Selection—Empirical Analog

Alarm bells ringing anyone?

With such data we can then use the same variation in prices to trace out the $AC(p)$ curve... That is, we do not require a separate source of variation. (p. 893)

Historical Price & Quantity Data:



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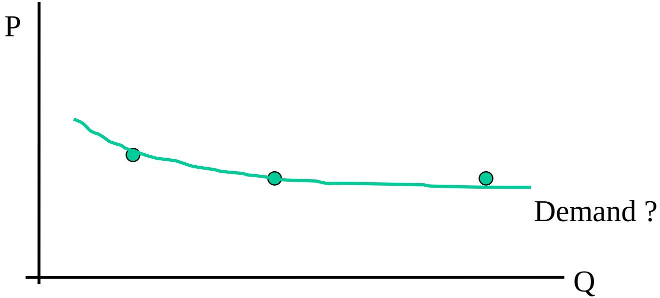
Connect the dots to estimate demand?



NO!

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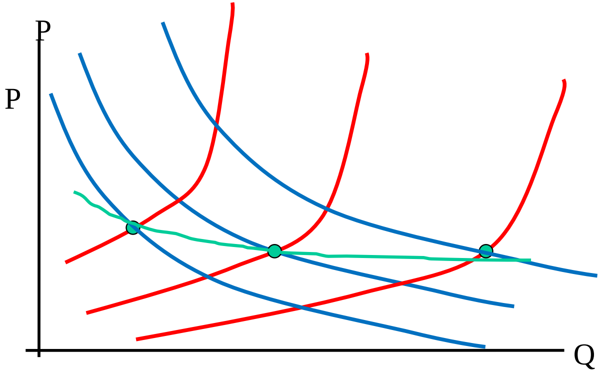

- Both supply and demand shift over time!
- Connecting the dots gives neither demand nor supply

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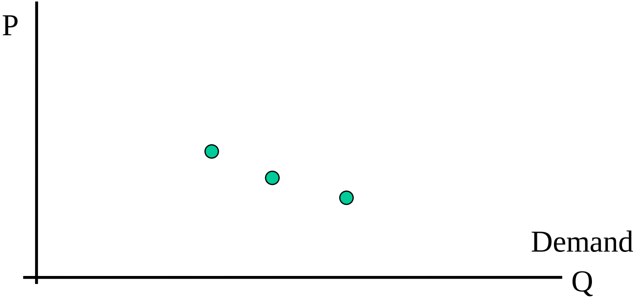
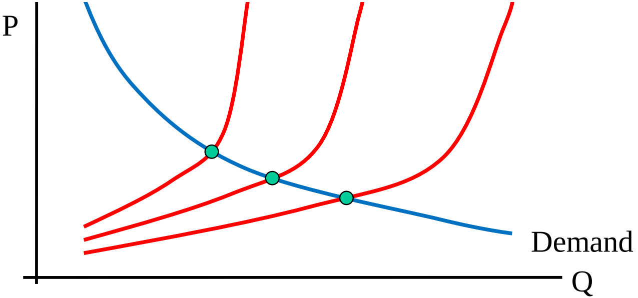
Tracing out demand with supply shocks



- Ideal scenario:
  - Demand is stable
  - There are a series of supply shocks

    
    eg Hurricane Rita shuts down oil production in the Gulf of Mexico without impacting gasoline demand in a city far from the storm
  - Each market price & quantity is a point on the same demand curve
  - Connecting the dots gives the demand curve

Tracing out demand with supply shocks



- Ideal scenario:
  - Demand is stable
  - There are a series of supply shocks
    -  eg Hurricane Rita shuts down oil production in the Gulf of Mexico without impacting gasoline demand in a city far from the storm
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Are cost shocks valid for identifying health insurance demand?

- Paper makes price variation required to identify supply seem easy
  - same variation used for demand works for supply!
  - don't need anything extra to get supply!
- But requirements for identifying demand already unusually high:

  "This price variation has to be exogenous to unobservable demand characteristics... Because expected cost is likely to affect demand, any price variation that is exogenous to demand is also exogenous to insurable cost."
- Why? Health cost $\uparrow \rightarrow$ outside option uninsured $\downarrow \rightarrow$ demand $\uparrow$
- $\Rightarrow$ **cost shocks cannot be used to trace out demand!**
  - What then do we use?

Are cost shocks valid for identifying health insurance demand? **No!**

What then do we use?

Discussion of price variation requirement on p. 898 gives ideas of variation that would work elsewhere (with IV)

- state insurance price regulation
- tax subsidy variation
- field experiments
- idiosyncratic firm pricing (current study)
- changes in competitive environment (if exogenous)
- administrative cost shifters that don't affect outside option

Average Cost Curve (moral hazard version in *my* notation)

- Consumer i has medical expenditure $m_{\theta,i} = m(\theta, \zeta_i)$ on contract θ.
  - medical expenditure m_i for chosen $\theta = \theta_i$
- Total insurable cost is $c_\theta(m_{\theta,i})$
- Incremental insurable cost is $c_i = c_H(m_i) - c_L(m_i)$
  - $c_i^H = c_H(m_{H,i}) - c_L(m_{H,i})$
  - $c_i^L = c_H(m_{L,i}) - c_L(m_{L,i})$
- Average incremental cost

$$AIC_H(p) = E\left[c_H(m_{Hi}) - c_L(m_{Hi}) \mid \text{choose } H\right]$$
$$AIC_L(p) = E\left[c_H(m_{Li}) - c_L(m_{Li}) \mid \text{choose } L\right]$$

- Baseline model: no moral hazard
  $\rightarrow m_{L,i} = m_{H,i} = m_i \rightarrow AIC_L = AIC_H = AIC$
- Empirical specification

$$c_i = \gamma + \delta p_i + u_i$$

Figure 3a: Total (in-network) OOP versus m_i

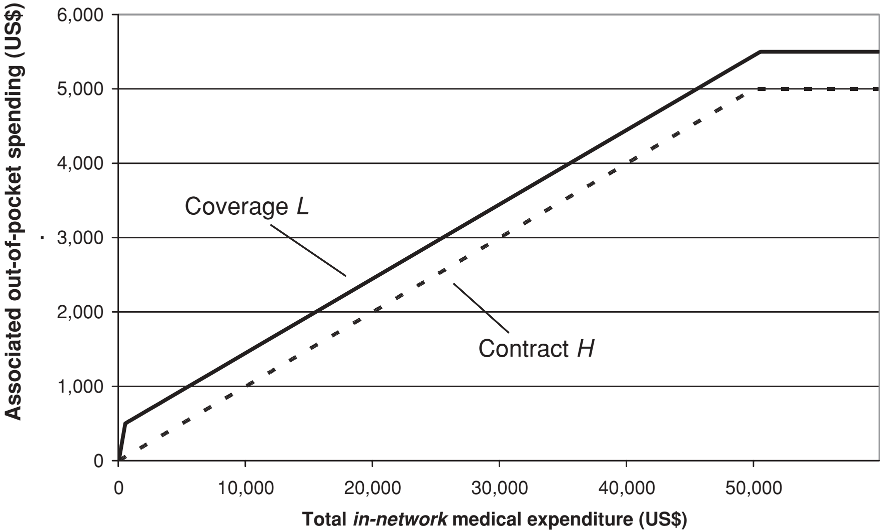


Figure: Total (in-network) insurer cost versus m_i

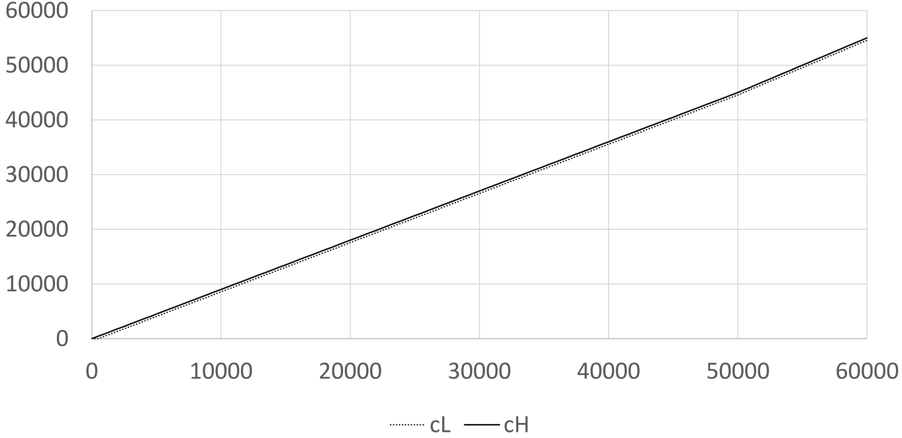


Figure 3c: Incremental (in-network) insurer cost versus m_i

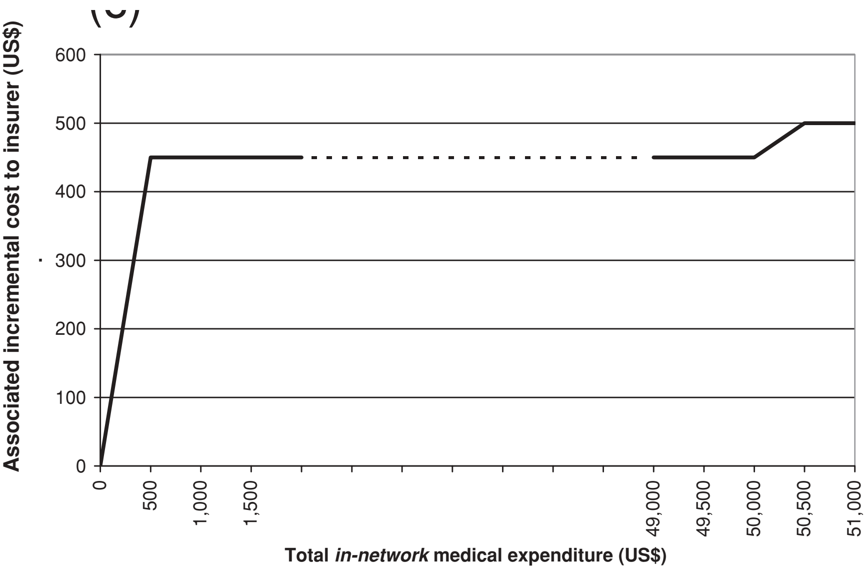


Figure 4: Incremental insurer cost distribution

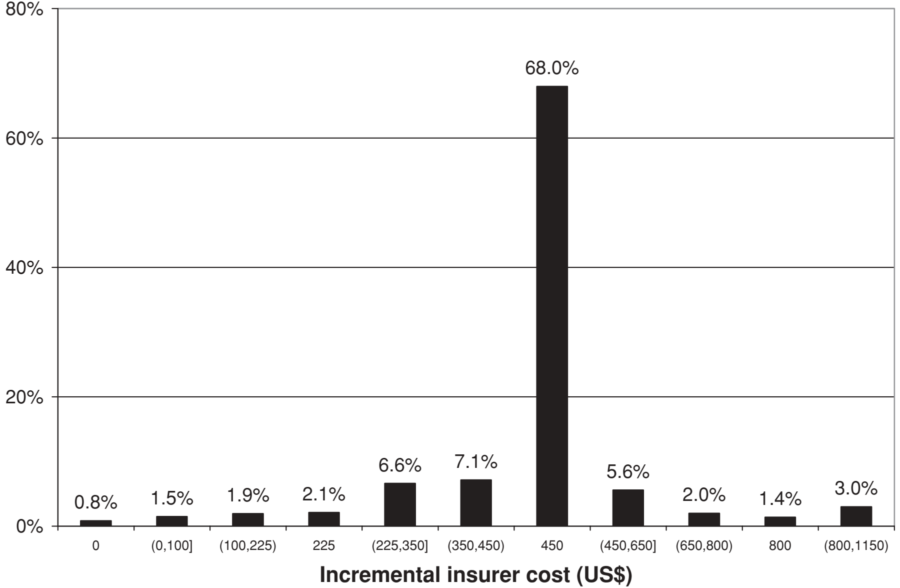


Figure 5: AIC data in solid circles

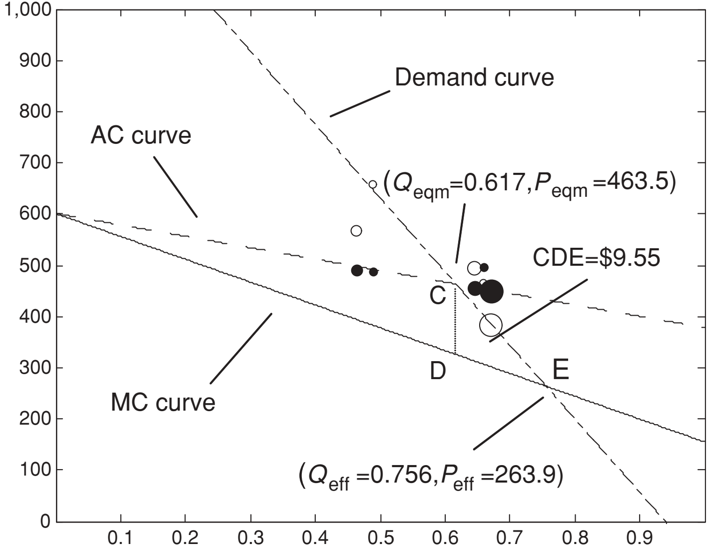
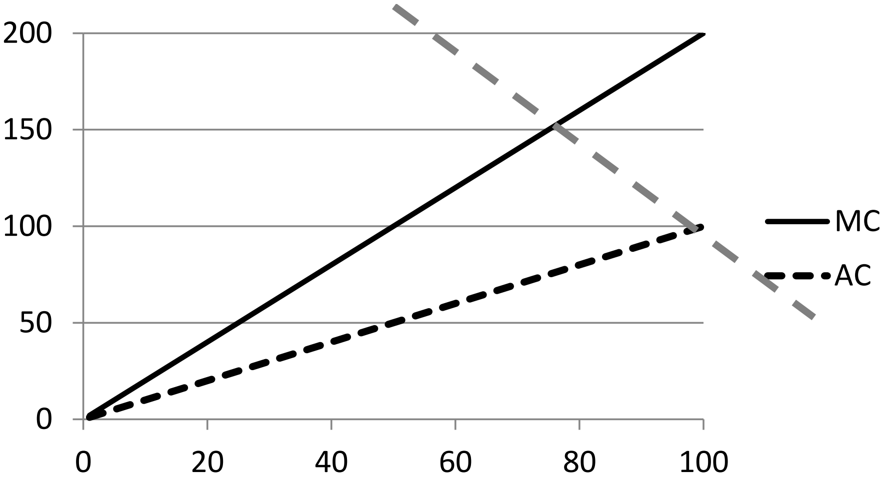


FIGURE V

Supply and Demand: Econ 101 market for widgets



- Where is equilibrium?
- Why? Why not sell one more (or less)?

Supply and Demand: EFC 2010 market for health insurance

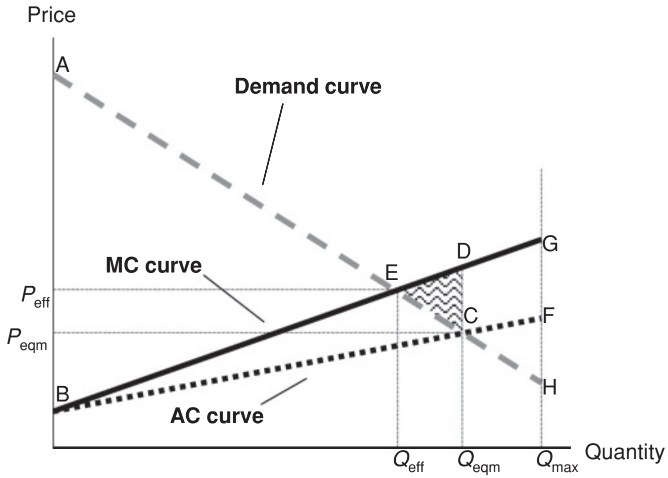


FIGURE II
Efficiency Cost of Advantageous Selection

- Why is equilibrium now at intersection of demand and AC?

Econ 101 vs EFC 2010

- Econ 101:
  - TC, AC, & MC all functions of Q, where $MC = dTC/dQ$.
  - When firm(s) increase production:
    - first turn on factories w/ low MC, later turn on factories w/ high MC
    - change costs by cost marginal factory
- EFC 2010:
  - TC, AC, and MC are all functions of p, plotted as functions of $D(p)$.
  - Marginal cost is not $dTC(Q)/dQ$ but rather $\partial TC(p)/\partial D(p)$

$$MC(p) = \frac{\partial TC(p)}{\partial D(p)} = \frac{\partial (AC(p) D(p))}{\partial D(p)} = \frac{\partial (AC(p) D(p))/\partial p}{\partial D(p)/\partial p} \quad (10)$$

  - Follows from

$$\frac{\partial TC(D(p))}{\partial p} = \frac{\partial TC(D(p))}{\partial D(p)} \frac{\partial D(p)}{\partial p} \rightarrow \frac{\partial TC(p)}{\partial D(p)} = \frac{\partial TC(p)/\partial p}{\partial D(p)/\partial p}$$

Econ 101 vs EFC 2010

- If a firm held p fixed & cut production $Q < D(p)$ (rationing demand)
  - Econ 101 land: Cut production at high cost plant
    $\rightarrow$ Firm reduces costs by $MC(Q)$ (which is higher than $AC(Q)$)
  - EFC 2010: Save $AC(p)$ on each policy not sold.
- Thus, at a fixed price, EFC's $AC(p)$ is actually the firm's MC in the sense of Econ 101 pictures and it is constant in Q.
- Demand=Econ101-MC holds in equilibrium
- Reason: when cutting the number of policies sold, the customers who fail to get policies are not the high cost consumers with cost $MC(p)$, they are random consumers, with expected cost $AC(p)$.

- $AC(p)$ is *estimated* as a function of p (equation (12))

$$c_i = \gamma + \delta p_i + u_i$$

- $AC(p)$ is *plotted* as a function of $D(p)$ (Fig I, II, V)
- Thus when $AC(p)$ is increasing in p, and $\hat{\delta} > 0$ as in Table III and Figure V, the plot of $AC(D(p))$ is downward sloping.
- Follows from

$$\frac{dAC(p)}{dp} = \frac{\partial AC(D(p))}{\partial D(p)} \frac{dD(p)}{dp}$$

  which implies
  - $\frac{dAC(p)}{dp} > 0$ and $\frac{dD(p)}{dp} < 0 \to \frac{\partial AC(D(p))}{\partial D(p)} < 0$.
  - $AC(p)$ vs p upward sloping & $AC(D(p))$ vs $D(p)$ is downward sloping $\to$ adverse selection
  - $p \uparrow \to D(p) \downarrow$ and $AC(p) \uparrow$ as only sick willing to pay high prices.

Efficiency Cost of Adverse Selection

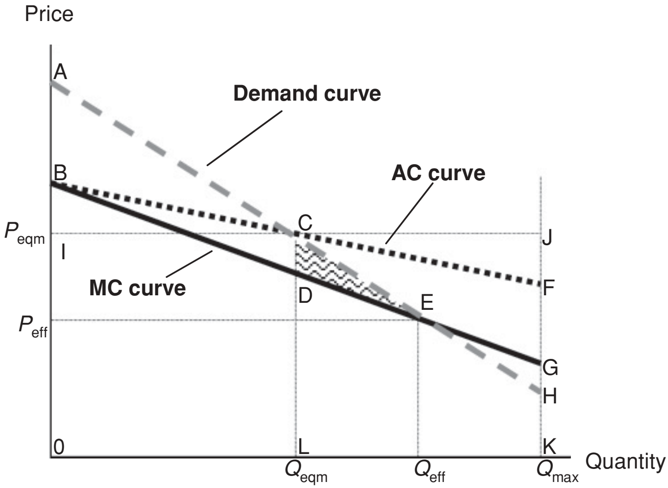


FIGURE I
Efficiency Cost of Adverse Selection

- What is area CDE?

Calculating MC

- Marginal cost is not $dTC\left(Q\right)/dQ$ but rather $\partial TC\left(p\right)/\partial D\left(p\right)$

$$MC\left(p\right)=\frac{\partial TC\left(p\right)}{\partial D\left(p\right)}=\frac{\partial\left(AC\left(p\right)D\left(p\right)\right)}{\partial D\left(p\right)}=\frac{\partial\left(AC\left(p\right)D\left(p\right)\right)/\partial p}{\partial D\left(p\right)/\partial p} \quad (10)$$

- Given linear demand and AIC

$$D_i=\alpha+\beta p_i+\epsilon_i \quad (11)$$
$$c_i=\gamma+\delta p_i+u_i \quad (12)$$

MC is

$$MC(p)=\frac{\alpha\delta}{\beta}+\gamma+2\delta p \quad (13)$$

Figure 5: Complete picture

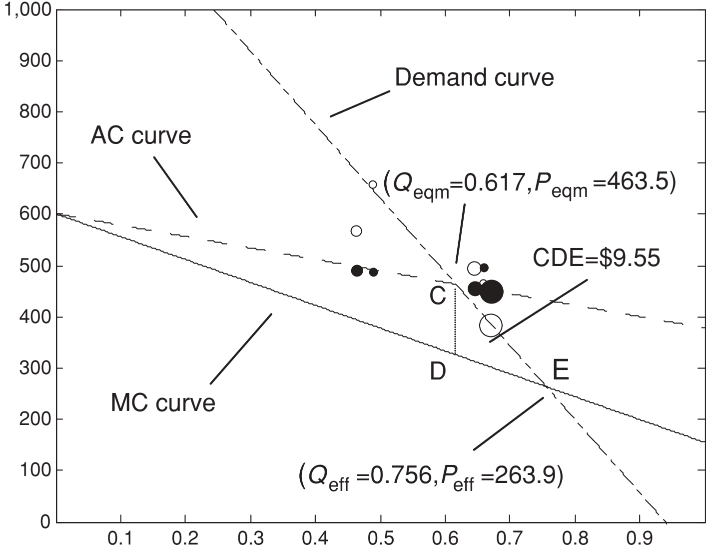
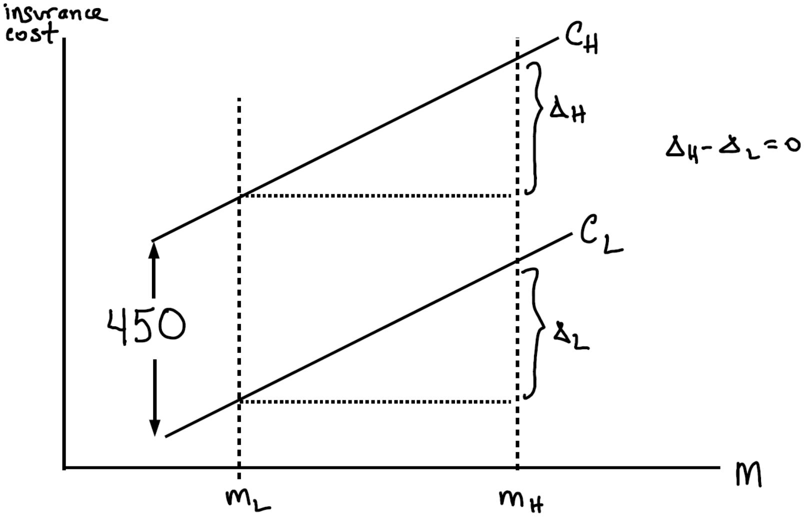


FIGURE V

Minor Comments

- Point E is outside range of data
  - Area CDE depends on linear functional form assumption
  - Remember this when we put "fewer assumptions..." under "Pros"
- Why is area CDE of interest to Alcoa?
- Moral hazard from the "insurer's perspective"
  - Social cost moral hazard: $\Delta_H = c_H(m_H) - c_H(m_L)$
  - $\Delta_L = c_L(m_H) - c_L(m_L)$ borne by provider policy L (e.g. medicare)
  - medicare advantage insurer only responsible for incremental cost $\Delta_H - \Delta_L = MC_H - MC_L$
  - Social planner or Alcoa should both care about entire Δ_H.
  - See guidance for handling moral hazard on the problem set.

Moral hazard from the "insurer's perspective"



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Einav, L., A. Finkelstein, and M. R. Cullen (2010). Estimating Welfare in Insurance Markets Using Variation in Prices. *The Quarterly Journal of Economics 125*(3), 877–921. doi:10.1162/qjec.2010.125.3.877.