# Topic 9: Welfare Analysis of Health Insurance

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[1]Thanks to Raj Chetty and Amy Finkelstein for generously providing their lecture notes, some of which are reproduced here

# Welfare Analysis of Health Insurance

- Significant evidence of adverse selection in health insurance markets
- How does this affect welfare analysis?
  - What are the optimal subsidies or mandates (if any)?
- Begin with static model of Einav, Finkelstein, and Cullen (2010)
- Extend to ex-ante welfare analysis (Hendren, 2018)
- Extend to dynamic models of insurance (Cochrane (1996); Hendel and Lizzeri (2003); Handel, Hendel, and Whinston (2015)
- **Key issue: Realization of information over time $\implies$ Conceptual question of how to define welfare**

# Setup

- Individuals experience utility given by

$$u\left(c, m; \theta\right)$$

  where $c$ is consumption, $m$ is medical expenditure, and $\theta$ is a health shock
- After learning $\theta$, individuals choose $c$ and $m$ subject to a budget constraint
  - Budget constraint depends on whether they are insured
  - Insured budget constraint

$$c^I\left(\theta\right) + x\left(m^I\left(\theta\right); \theta\right) + p_I \leq y\left(\theta\right)$$

  - Uninsured budget constraint

$$c^U\left(\theta\right) + m^U\left(\theta\right) + p_U \leq y\left(\theta\right)$$

    - $p_U$ and $p_I$ are the price of being uninsured and insured respectively
    - $y\left(\theta\right)$ is income (which might be affected by the shock)
    - $x$ is out-of-pocket medical expenses

# Insurance Demand

- Individuals choose whether or not to purchase insurance after learning a signal, $s \in [0,1]$, about their risk
  - WLOG $s$ orders demand so that $s = 0$ is the highest WTP type
- Demand given by $D(s)$, which solves

$$E\left[u\left(y(\theta) - x\left(m^I(\theta);\theta\right) - D(\tilde{s}) - p_U, m^I(\theta);\theta\right)|\tilde{s}\right] = E\left[u\left(y(\theta) - m^U(\theta) - p_U, m^U(\theta);\right.\right.$$

  - Assume does not vary with $p_U$ (only relative price matters)
    - True if CARA utility (exercise to show this!)
  - Fraction of the market purchasing insurance, $s$, solves $D(s) = p_I - p_U$

# Cost Curves

- Following Einav, Finkelstein, and Cullen (2010), define marginal and average cost curves
  - Average cost of enrollees when fraction $s$ of the market is enrolled:

$$AC(s) = E\left[m^I(\theta) - x\left(m^I(\theta);\theta\right)|\tilde{s} \leq s\right]$$

  - Marginal cost of additional enrollees brought in by lowering prices. Note that total cost is $sAC(s)$, so that marginal cost is given by:

$$\begin{aligned} MC(s) &= \frac{d}{ds}\left[sAC(s)\right] \\ &= \frac{d}{ds}\int_{\tilde{s}\leq s} E\left[m^I(\theta) - x\left(m^I(\theta);\theta\right)|\tilde{s} \leq s\right] d\tilde{s} \\ &= E\left[m^I(\theta) - x\left(m^I(\theta);\theta\right)|\tilde{s} = s\right] \end{aligned}$$

  where the last line assumes $m^I$ is not affected by insurance purchase
    - e.g. no Becker and Ehrlich (1972) effects

# Competitive Equilibrium

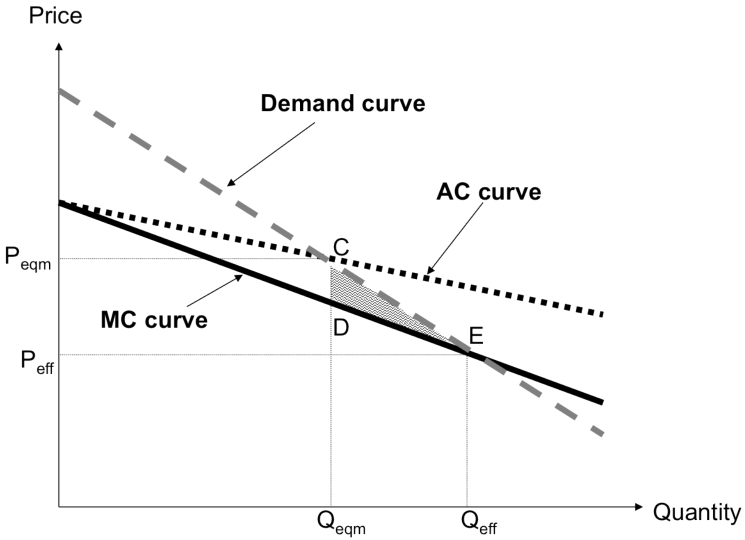
- Suppose there are at least two firms that compete over relative price for $H$ versus $L$ plan
  - Weyl and Viega (2016) discuss issues with multiple plan prices
- Competitive equilibrium from 2-stage game
  - Insurers post prices
  - Individuals choose insurance contracts
- Competitive equilibrium characterized by

$$s^{CE} = max \left\{ s \middle| D(s) = AC(s) \right\}$$

with price $p^{CE} = D\left(s^{CE}\right)$

  - Why the maximum market size?
- Smetters and Scheuer (2016): minimum price not reached (ACA website?)

# Competitive Equilibrium with Adverse Selection

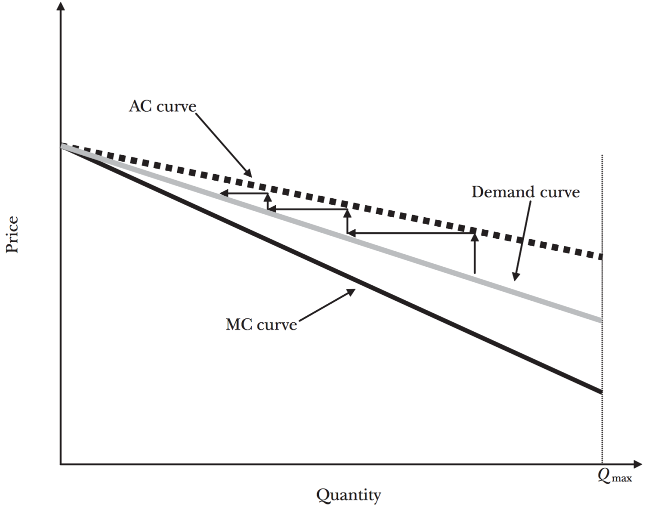



Source: Einav, Finkelstein, and Cullen (2010)

# Competitive Equilibrium with Adverse Selection

*Figure 2 (continued)*

B: Adverse Selection with Complete Unraveling



# Welfare Loss in Competitive Equilibrium

- If prices must reflect average costs, EFC2010 and Akerlof (1970) note that this can lead to some efficient trades not taking place
  - Those with $D(s) \in (MC(s), AC(s))$ are willing to pay their marginal cost of insurance but remain uninsured in a competitive equilibrium
  - "Efficient" for all those with $D(s) \geq MC(s)$ to purchase insurance

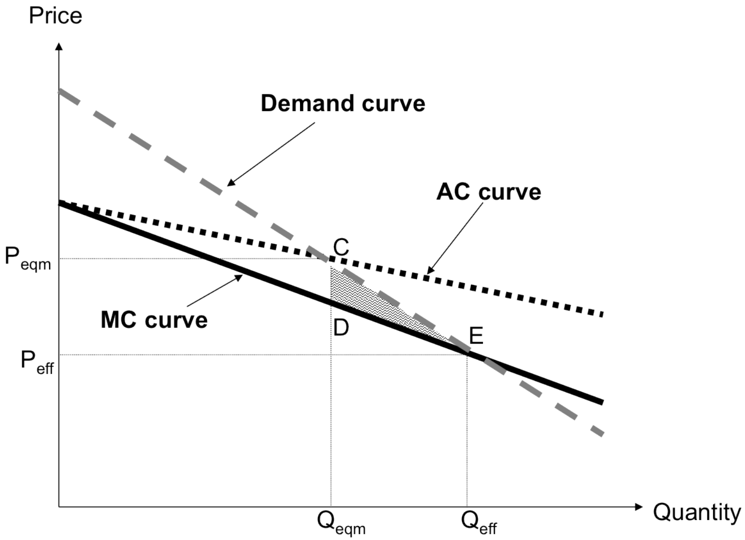
$$D\left(s^{eff}\right) = MC\left(s^{eff}\right)$$

- Can quantify the size of this "deadweight loss" from foregone trades

$$DWL = \int_{s \in [s^{CE}, s^{eff}]} [D(s) - MC(s)] \, ds$$

  - What is the aggregate willingness to pay above costs for trades that go unmet in a competitive equilibrium?

# Competitive Equilibrium with Adverse Selection



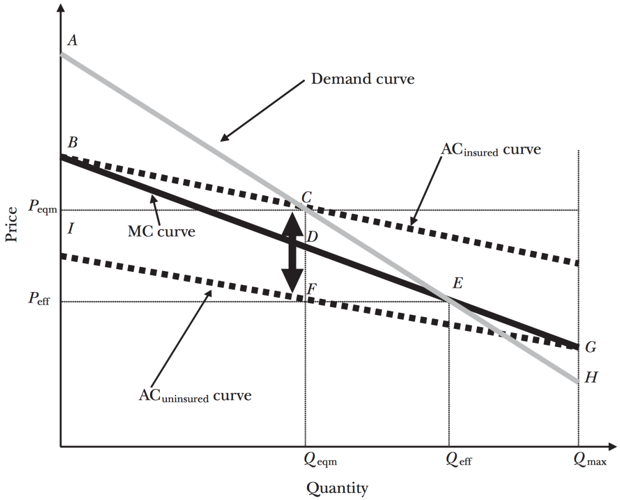

Source: Einav, Finkelstein, and Cullen (2010)

# Separating Moral Hazard from Adverse Selection

- How does the modeling approach deal with moral hazard?
  - Impact of insurance on $m$: $m^I > m^U$
- Can define cost of $s$ type as if they are insured and uninsured
- Cost relevant for the insurer is the cost they pay, $E\left[m^I - x\left(m^I\right)|s\right]$
- But, this could be higher than the costs they would pay if the individual consumed care as if she were uninsured, $E\left[m^U - x\left(m^U\right)|s\right]$
  - Moral hazard of $s$ type is given by $E\left[m^I - x\left(m^I\right)|s\right] - E\left[m^U - x\left(m^U\right)|s\right]$
    - Requires identifying $E\left[m^U - x\left(m^U\right)|s\right]$
    - Tough if $x$ is nonlinear, but if linear (or full insurance) just need to identify cost curve of the uninsured, $E\left[m^U|s\right]$

# Competitive Equilibrium with Adverse Selection

*Figure 5*
**The "Positive Correlation" Test for Selection**



# Einav, Finkelstein, and Cullen (2010 QJE)

- Einav, Finkelstein, and Cullen (2010 QJE) note that one can estimate these costs using exogenous variation in prices
  - Can estimate BOTH demand and cost curve
    - Demand = fraction that buy at posted price
    - Cost = added cost on policy $H$ versus $L$ for those who purchase at posted price
    - Rarely does price variation identify both supply + demand!
- But need some institutional structure that randomly varies prices...
  - Alcoa! (they make aluminum)
  - Business unit heads choose price charged for high versus low coverage plans

# Results

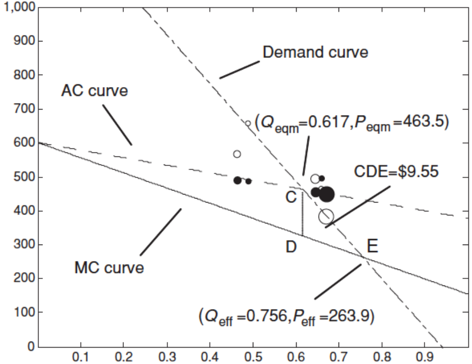



FIGURE V
Efficiency Cost of Adverse Selection—Empirical Analog

Source: Einav, Finkelstein, and Cullen (2010)

# Results (II)

- Results suggest welfare loss is “small”
    - \$9.55/employee ($\sim$2% of the average price)
- Beautiful paper - starts with theoretical graph and maps empirical objects directly onto this graph
- But a few limitations:
    - Paper takes contracts as given
        - Perhaps the contracts were inefficient? (Rothschild and Stiglitz 1976)
        - Multiple insurance contracts: Equilibrium existence problems (Azavedo and Gottlieb, 2016; Weyl and Viega, 2016)
    - Would competition on other dimensions unravel the market in practice?
- Main question: does the welfare cost of foregone trades correspond to maximizing utilitarian welfare?

# Ex-Ante versus Ex-Post Welfare

- Insurance demand depends on knowledge/beliefs of risk
- Individuals often have some knowledge about risk when measuring demand, generating adverse selection
- Value of foregone trades is unstable measure of welfare (Hirshleifer, 1971)
    - Hendren (2017): Can be misleading for optimal policy analysis

# Motivating Example (Hendren, 2017)

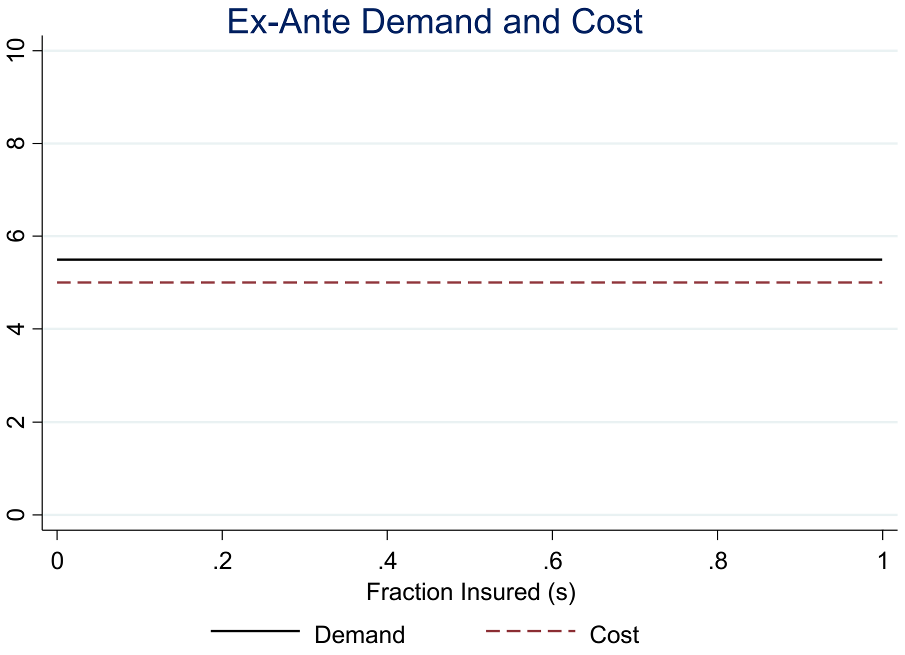
- Begin with simple example to illustrate issue and a solution

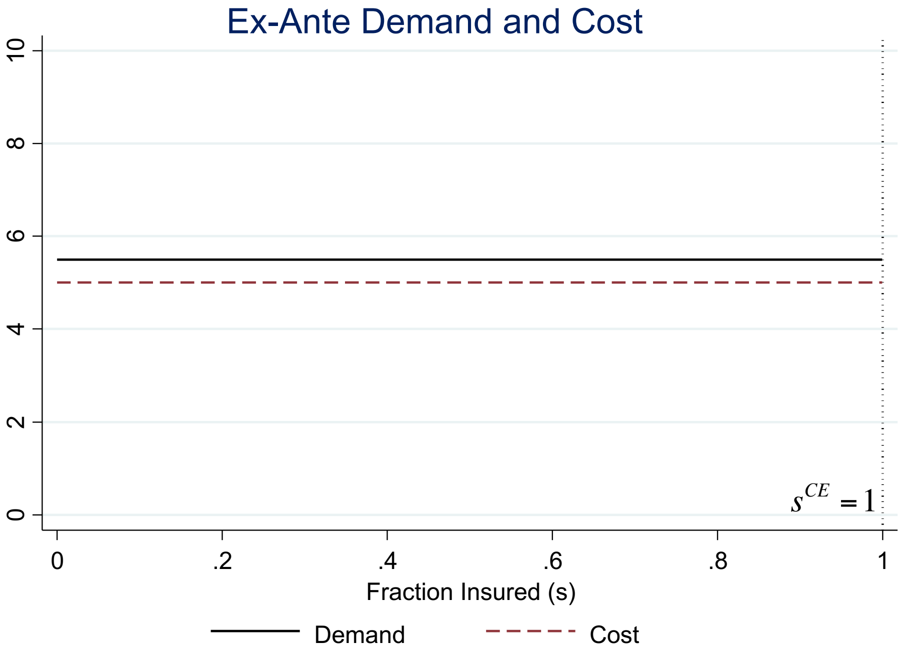
- Individuals have $30

- Face a risk of losing $m, uniformly distributed between 0 and 10

- Willing to pay $0.50 markup for full insurance if CRRA is 3
  - Indifferent between roughly $24.50 versus uniformly distributed consumption on [ 20 , 30 ]
  - Would be “efficient” for everyone to have $25 with certainty
    - Value of insurance market is $0.50

- How does this map to demand and cost curves?


Ex-Ante Demand and Cost
0
2
4
6
8
10
0
.2
.4
.6
.8
1
Fraction Insured (s)
Demand
Cost


Ex-Ante Demand and Cost
0
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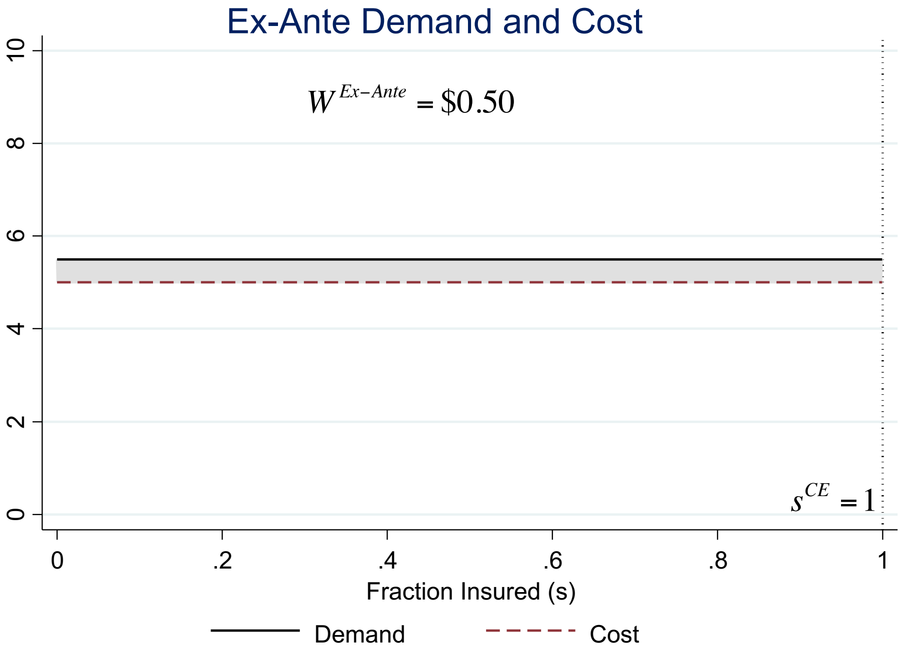
6
8
10
$s^{CE} = 1$
0
.2
.4
.6
.8
1
Fraction Insured (s)
Demand
Cost



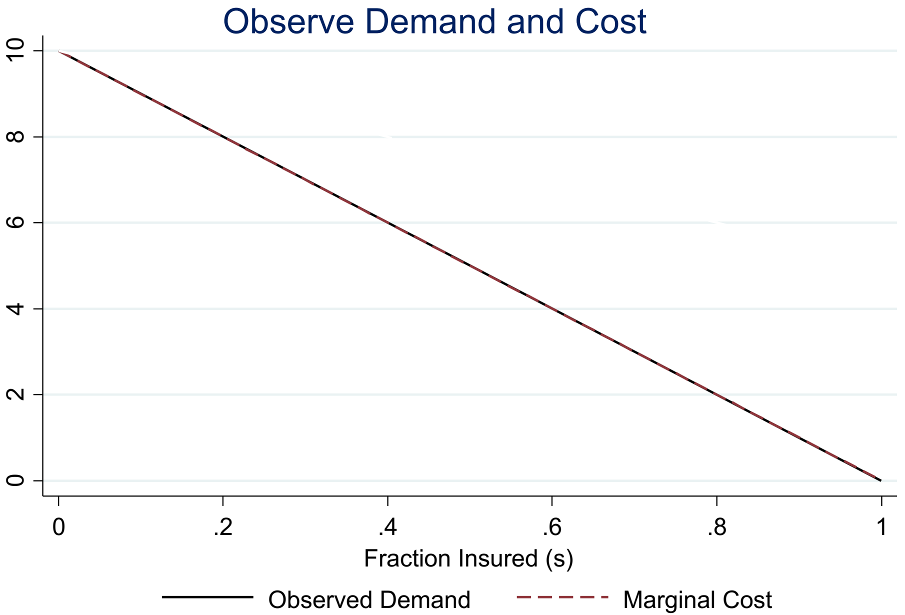
Ex-Ante Demand and Cost
$W^{Ex-Ante} = \$0.50$
$s^{CE} = 1$
0
2
4
6
8
10
0
.2
.4
.6
.8
1
Fraction Insured (s)
Demand
Cost

# Motivating Example

- What if people have information about their risk when we measure demand?

- Begin with extreme case: suppose individuals learn their loss

  - Willingness to pay equals cost, $D(s)=m(s)$


Observe Demand and Cost
10
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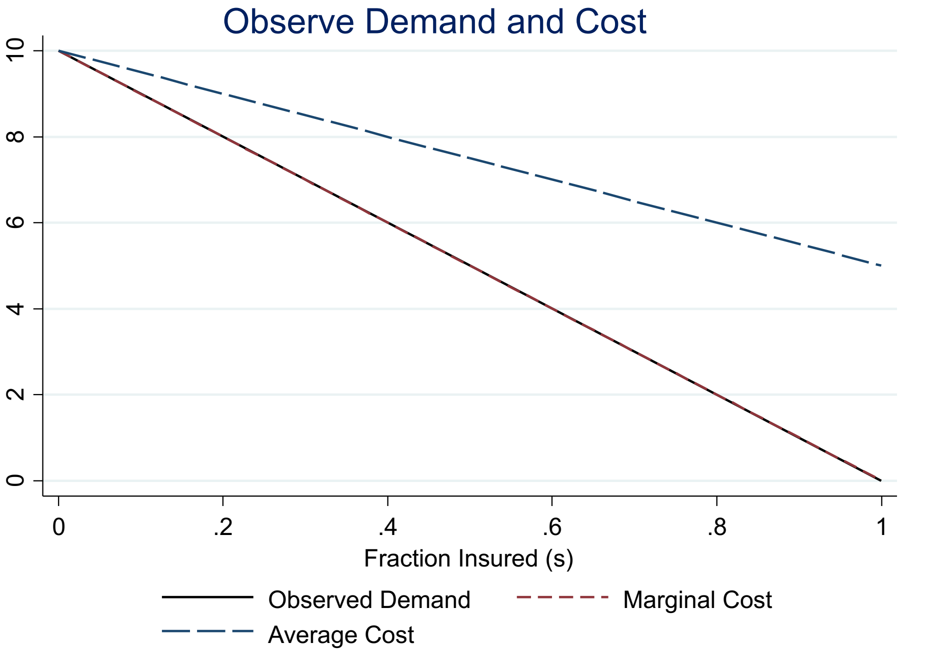
.8
1
Fraction Insured (s)
Observed Demand
Marginal Cost


Observe Demand and Cost
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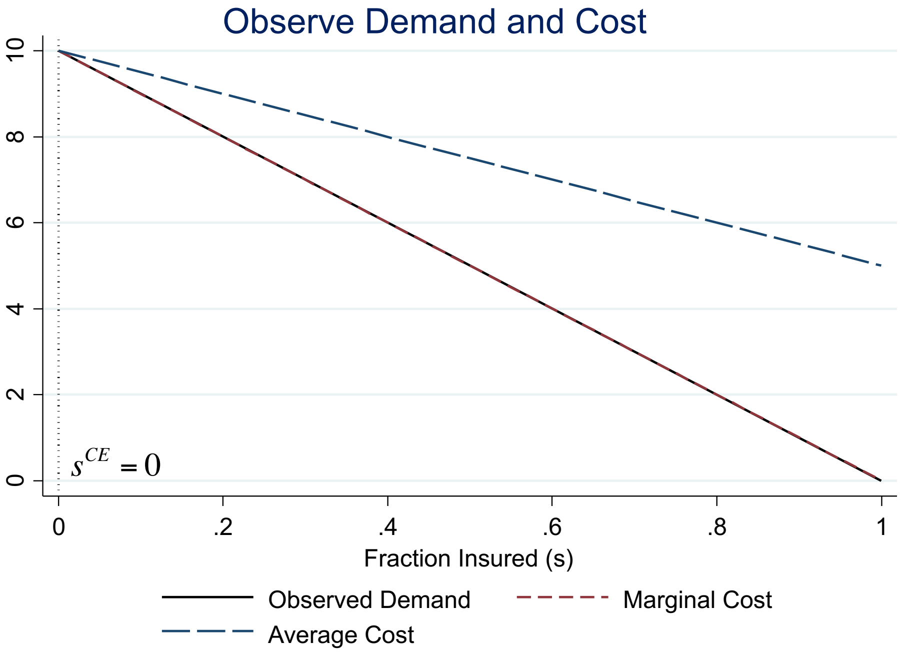
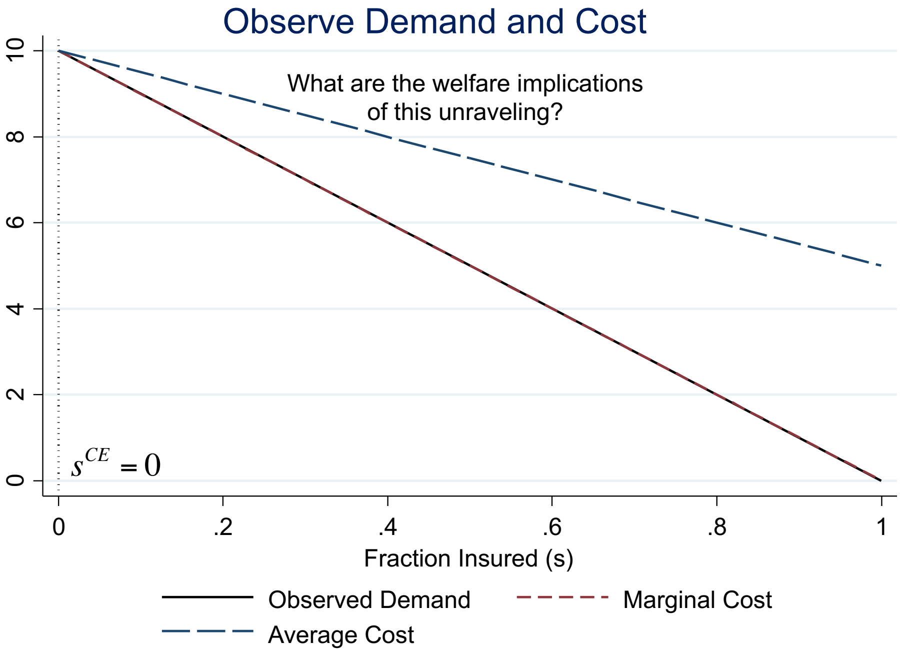
1
Fraction Insured (s)
Observed Demand
Marginal Cost
Average Cost


Observe Demand and Cost
10
8
6
4
2
0
$s^{CE} = 0$
0
.2
.4
.6
.8
1
Fraction Insured (s)
Observed Demand
Marginal Cost
Average Cost


Observe Demand and Cost
What are the welfare implications
of this unraveling?
$s^{CE} = 0$
0
2
4
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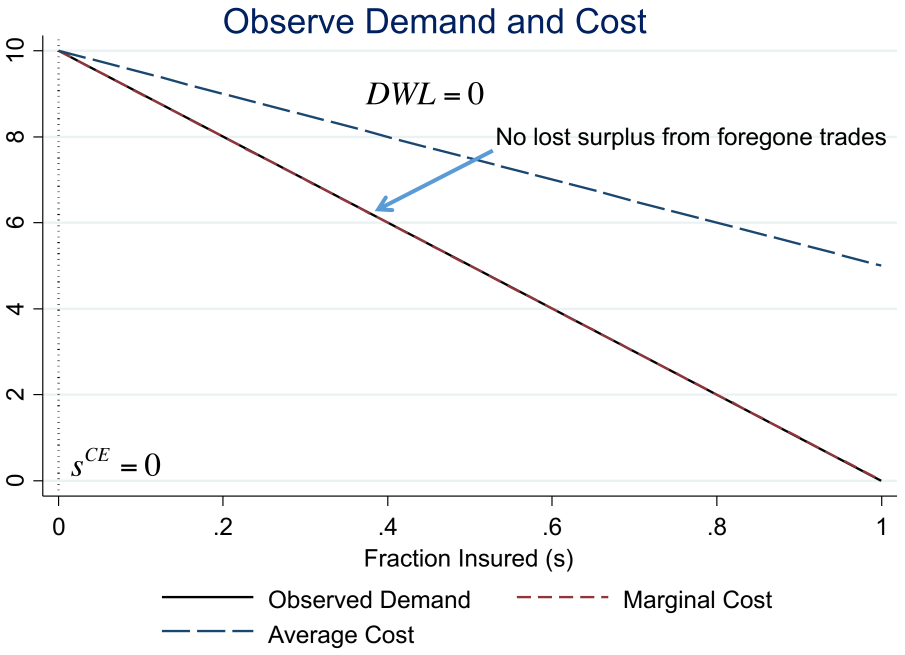
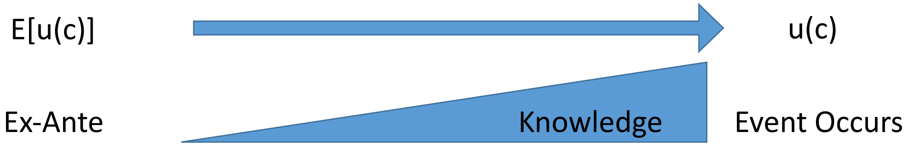
.8
1
Fraction Insured (s)
Observed Demand
Marginal Cost
Average Cost



Observe Demand and Cost
$DWL = 0$
No lost surplus from foregone trades
$s^{CE} = 0$
10
8
6
4
2
0
0
.2
.4
.6
.8
1
Fraction Insured (s)
Observed Demand
Marginal Cost
Average Cost

# Timeline of Information Revelation and Insurance Purchase



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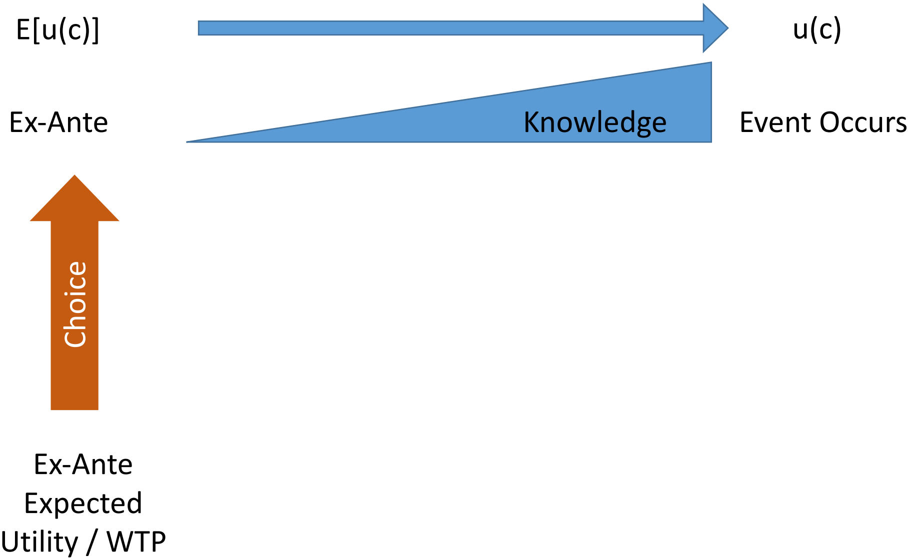

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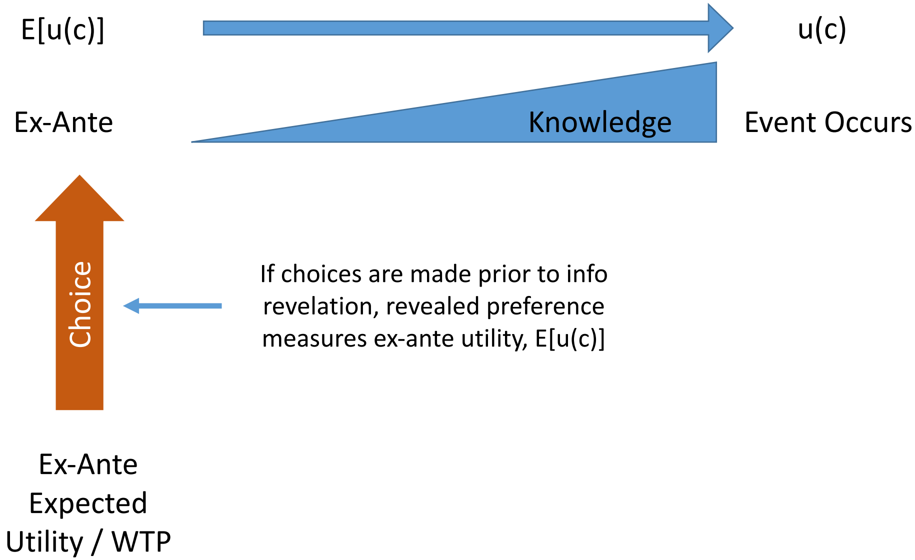

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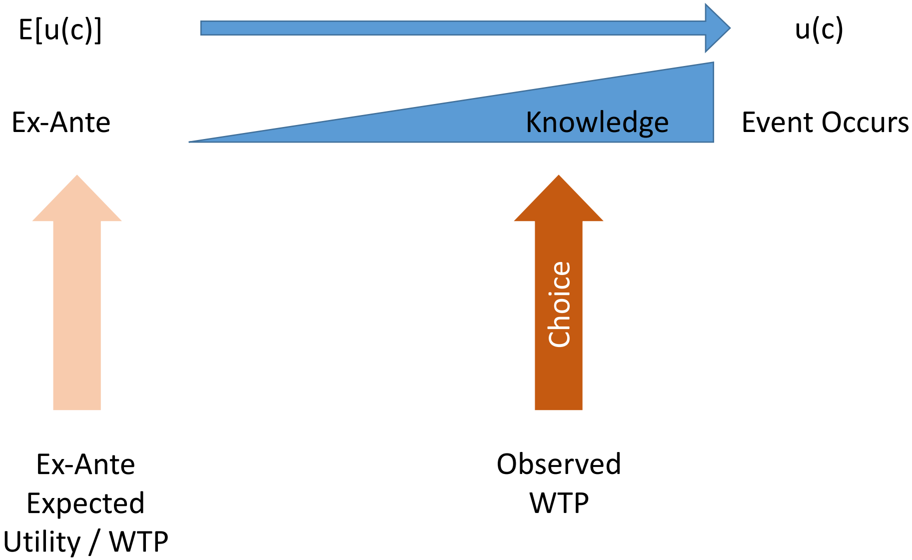

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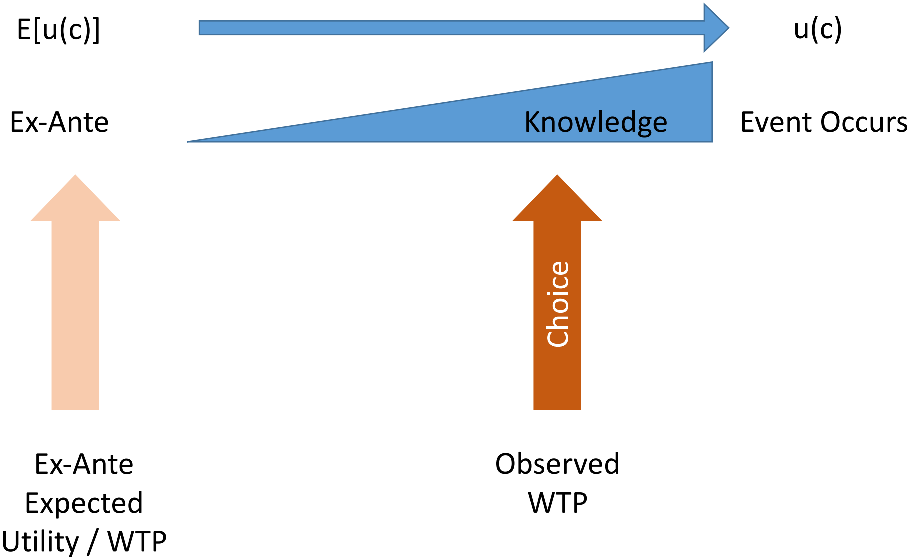

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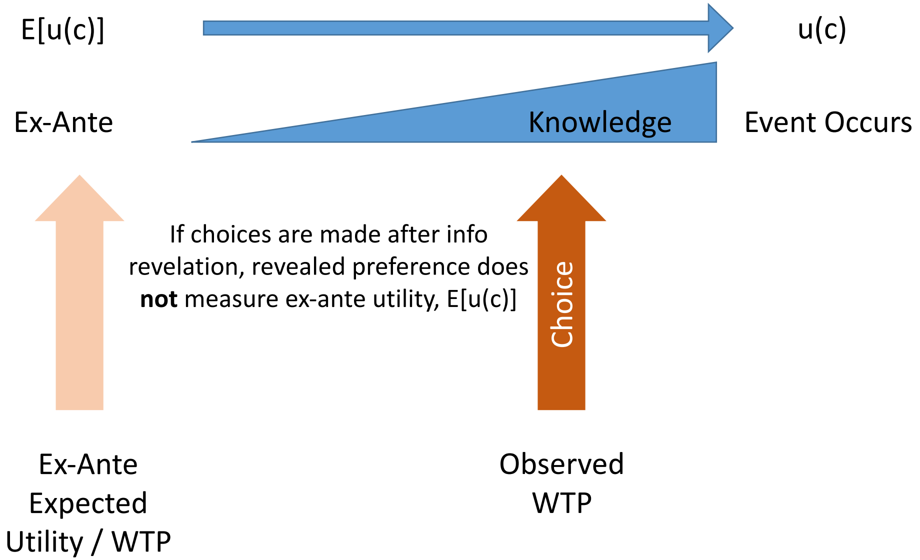

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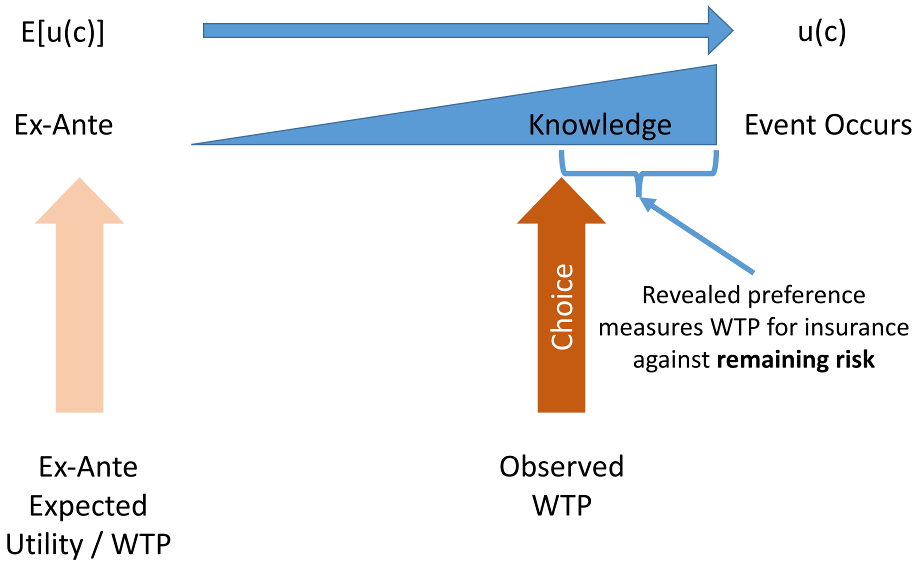

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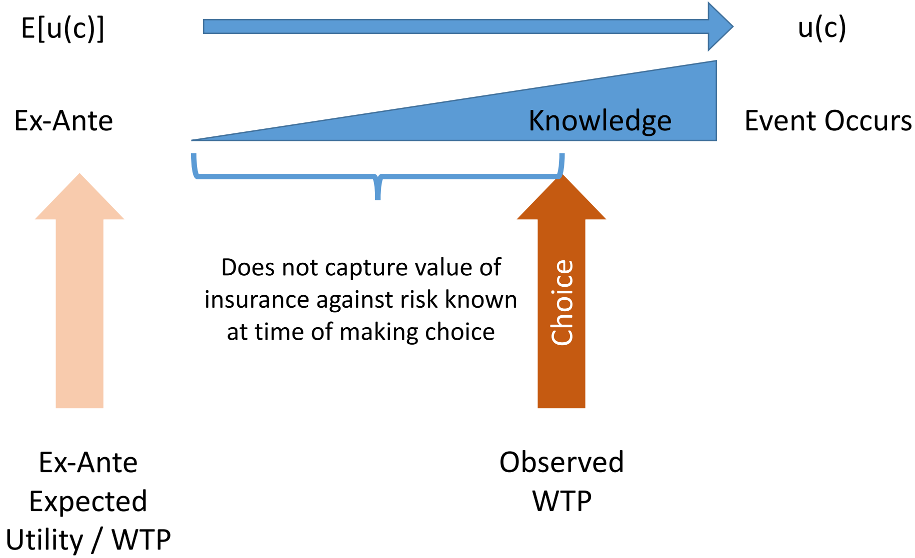

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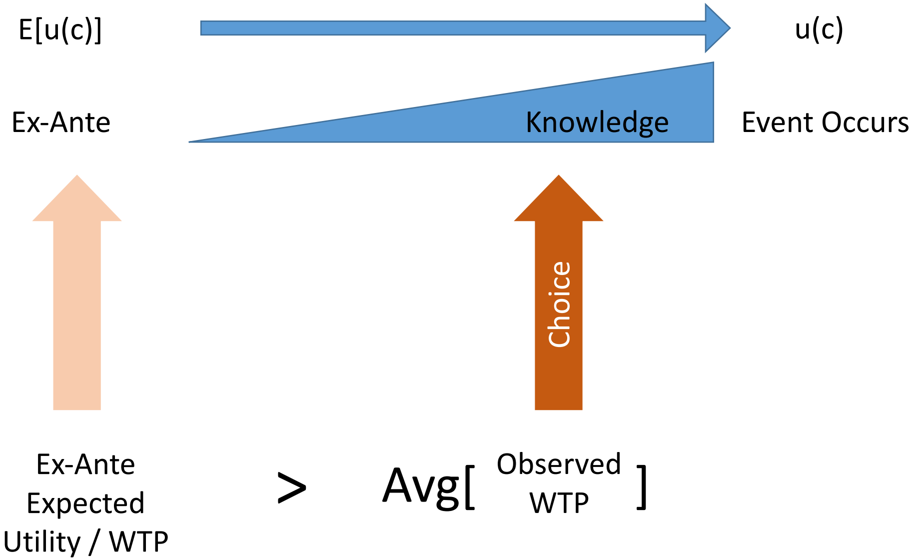
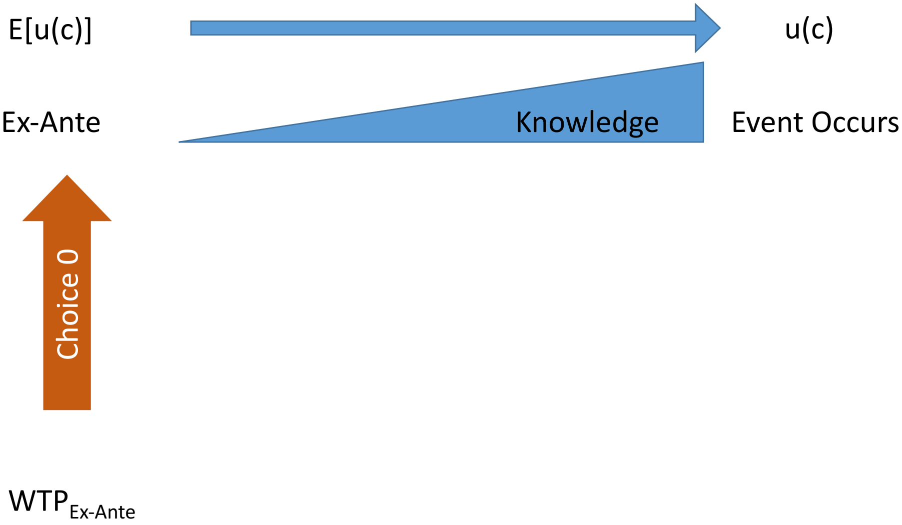


# Market Surplus is Unstable Measure of Welfare



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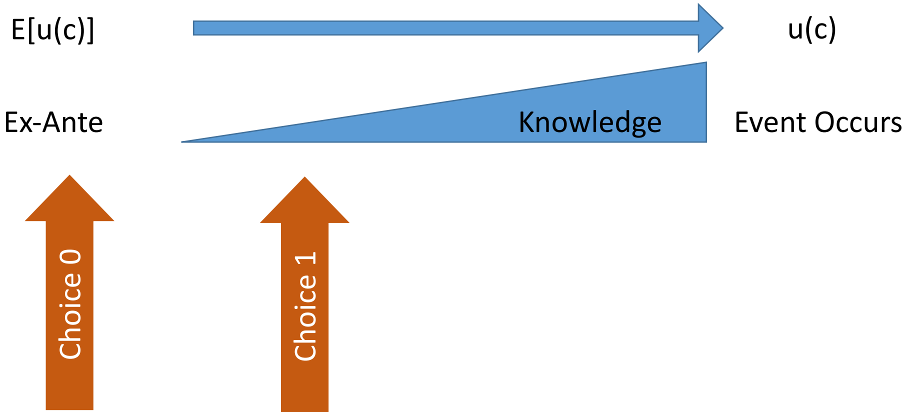
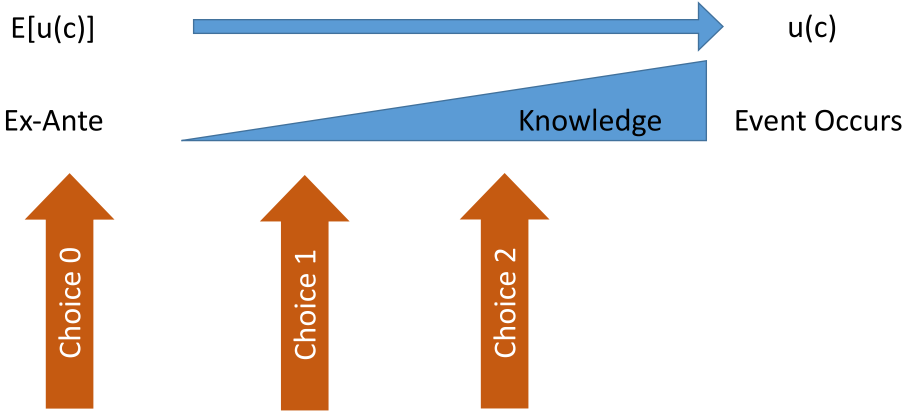


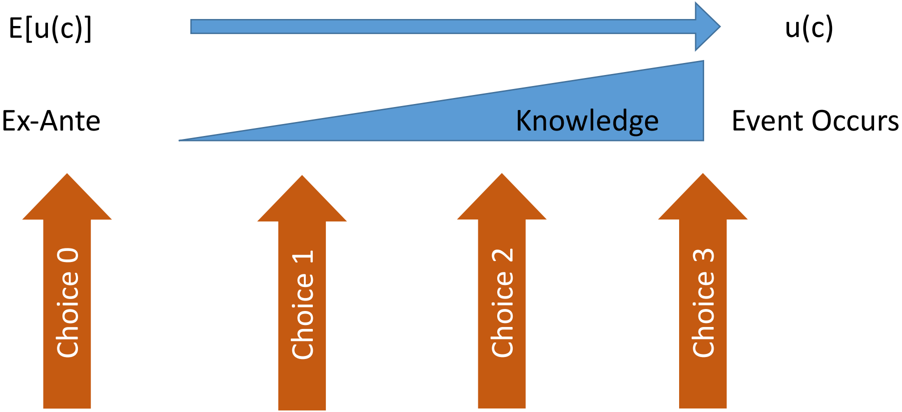

$$WTP_{Ex\text{-}Ante} \geq E[WTP_1]$$

# Market Surplus is Unstable Measure of Welfare



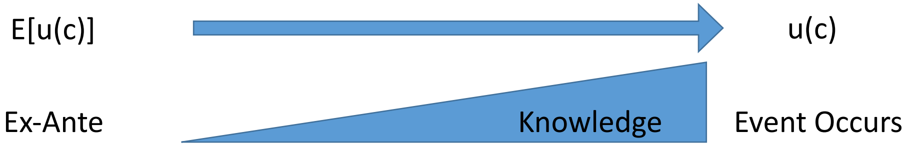

$$WTP_{Ex\text{-}Ante} \geq E[WTP_1] \geq E[WTP_2]$$

# Market Surplus is Unstable Measure of Welfare




$WTP_{Ex\text{-}Ante} \geq E[WTP_1] \geq E[WTP_2] \geq E[WTP_3] = Cost$

# Measuring Ex-Ante Welfare in Insurance Markets

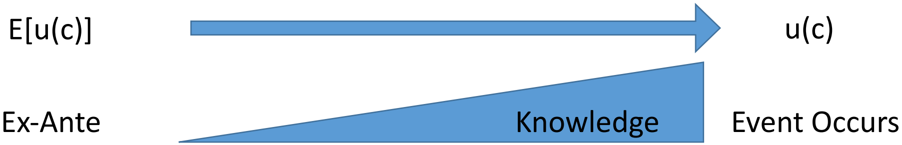



**Problem:** Revealed preference does not deliver a stable welfare metric corresponding to expected utility

- Depends on amount of information that happens to be revealed when insurance choices are made

- Same insurance policies (e.g. value of a mandate) may have different welfare properties simply because of when the econometrician chooses to measure WTP!

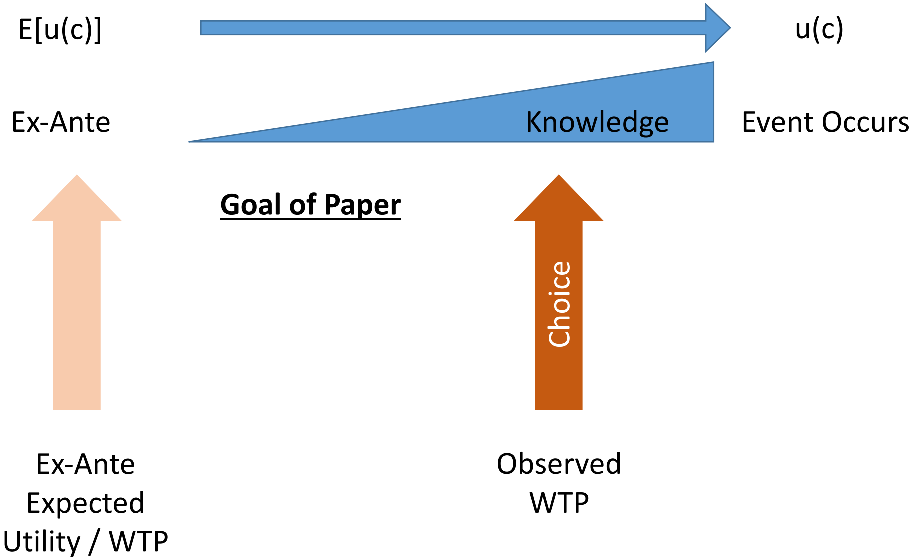
# Measuring Ex-Ante Welfare in Insurance Markets




**Goal of Paper:** Evaluate policies in markets where information has been revealed when measuring WTP (i.e. adverse selection)

- Use stable welfare criteria corresponding to ex-ante expected utility
  - Condition on observables (e.g. income) to isolate redistribution

# Timeline of Information Revelation and Insurance Purchase



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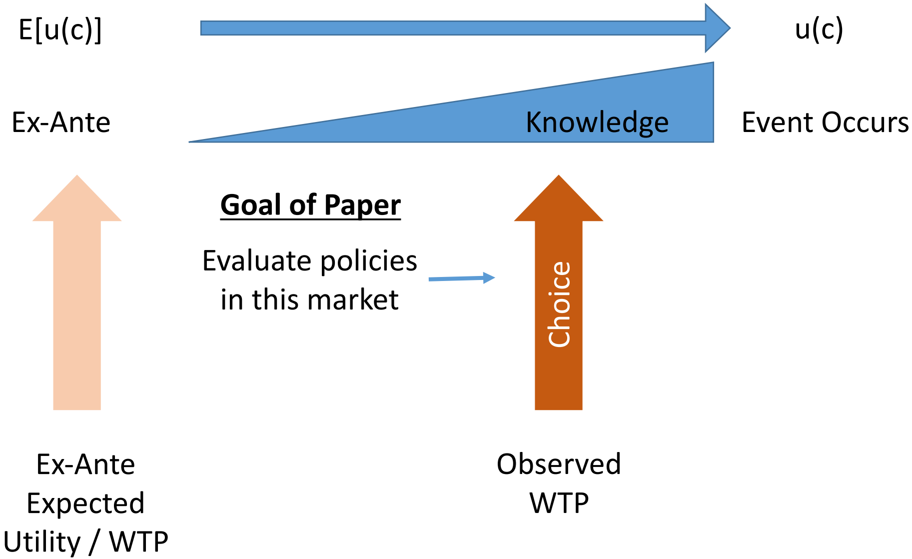

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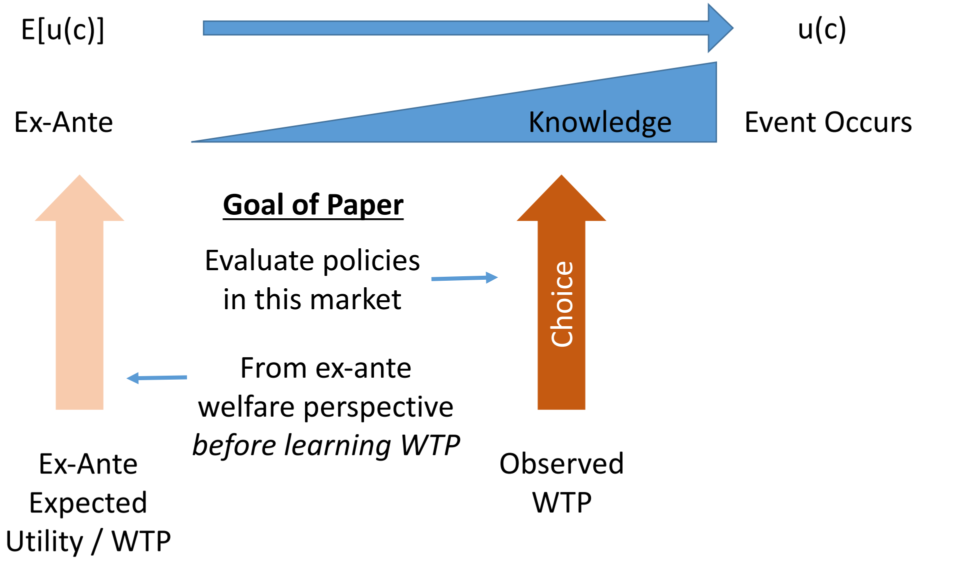
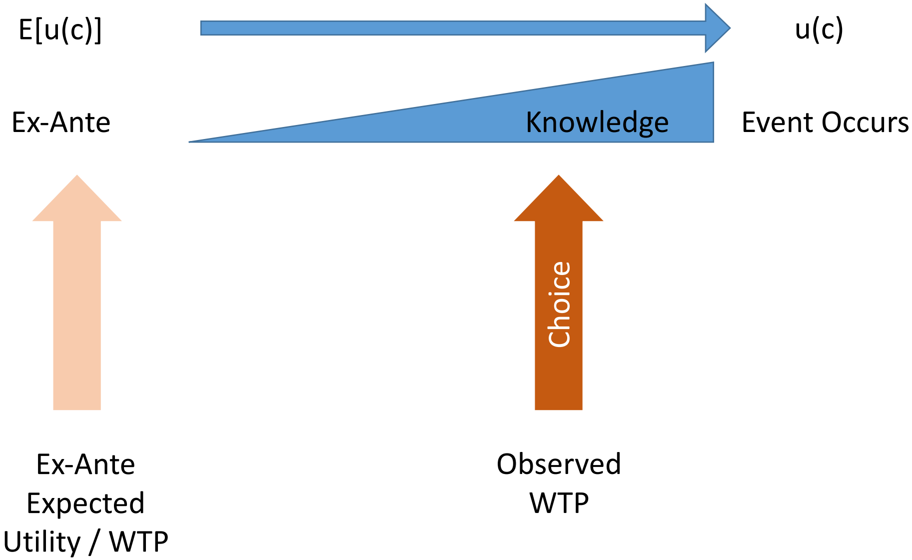


# Approach: Combine Market Surplus with Sufficient Statistics



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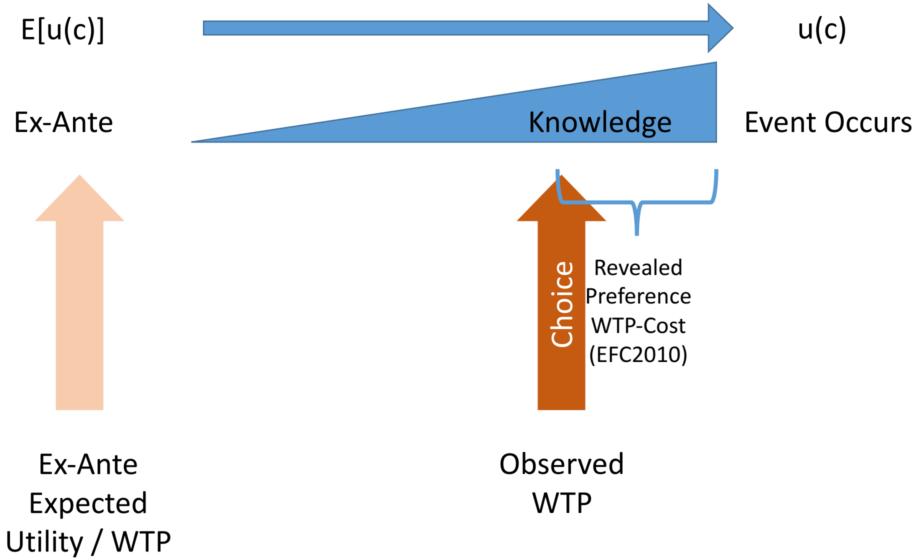

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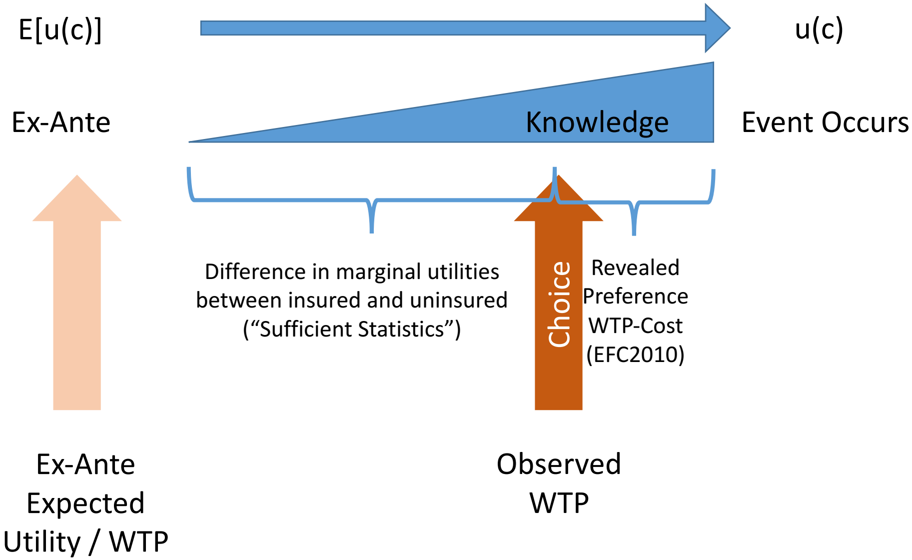

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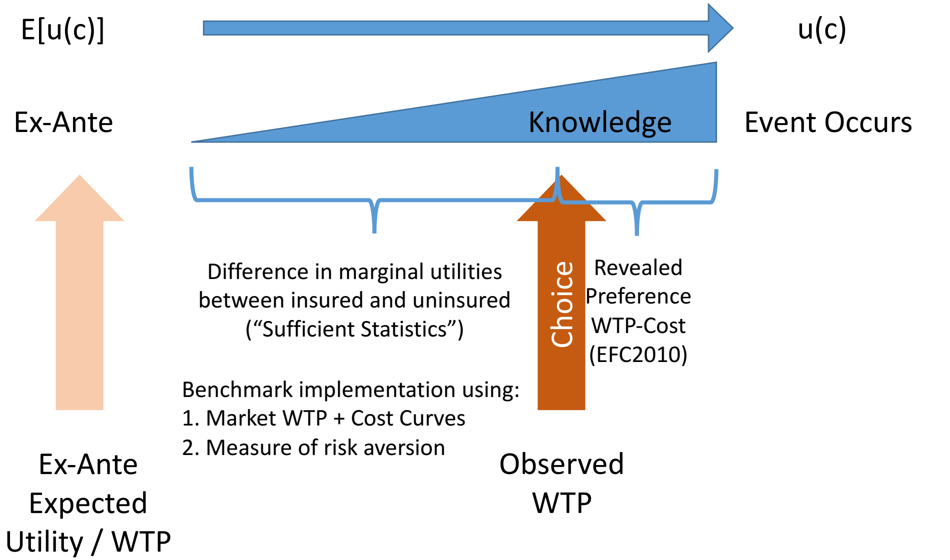

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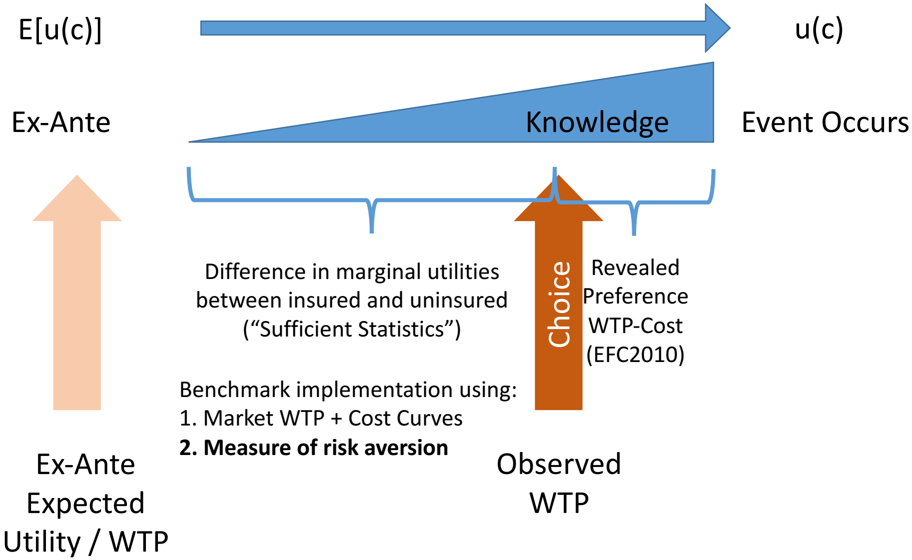


# Motivating Example

- Observed demand does not capture the value of insurance against learning about your risk prior to demand measurement
  - Adverse selection implies a divergence between DWL and Ex-Ante Welfare

# Motivating Example

- Observed demand does not capture the value of insurance against learning about your risk prior to demand measurement
  - Adverse selection implies a divergence between DWL and Ex-Ante Welfare
- Hendren (2017) derives an "ex-ante" demand curve to facilitate welfare analysis from behind the veil of ignorance
  - Combine Einav, Finkelstein, and Cullen (2010) with Baily-Chetty

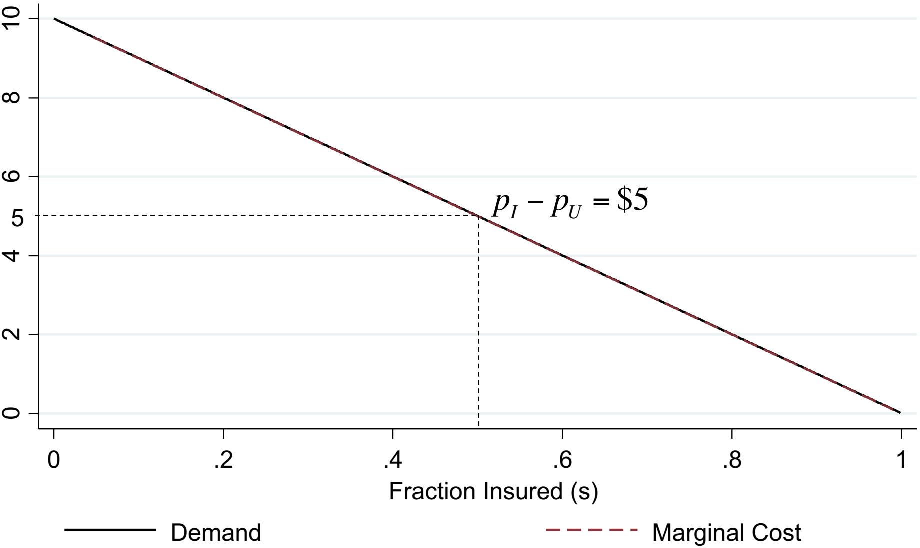
# Deriving the Ex-Ante Demand Curve

- Return to example in which D(s)=m(s)

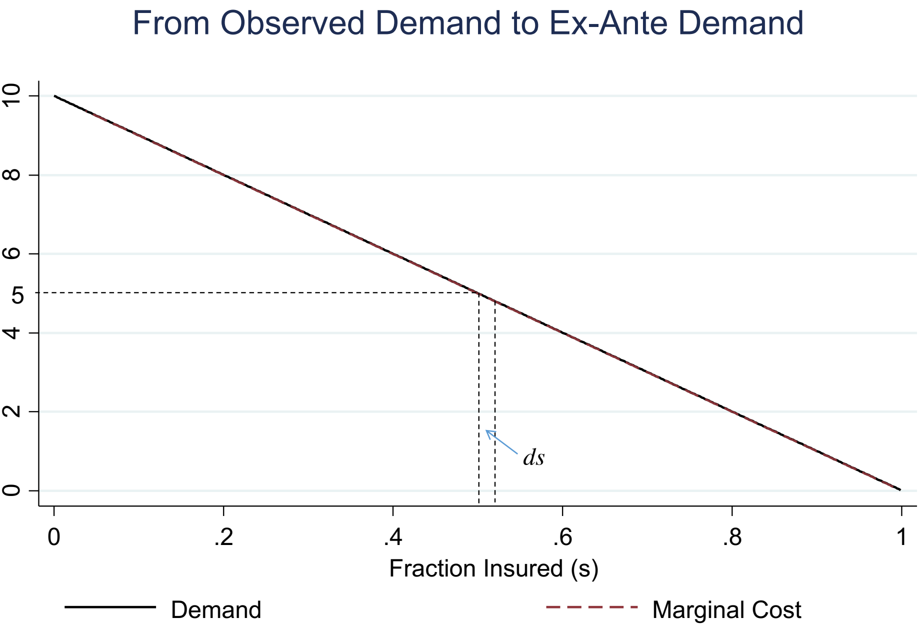
- Suppose $s = 50\%$ of the population has insurance

- Obtained by setting prices subject to a resource constraint:
  - Price of insurance, $p_I$
  - Price/penalty of being uninsured, $p_U$
  - Set so that $sp_I + (1-s)p_U = sAC(s)$

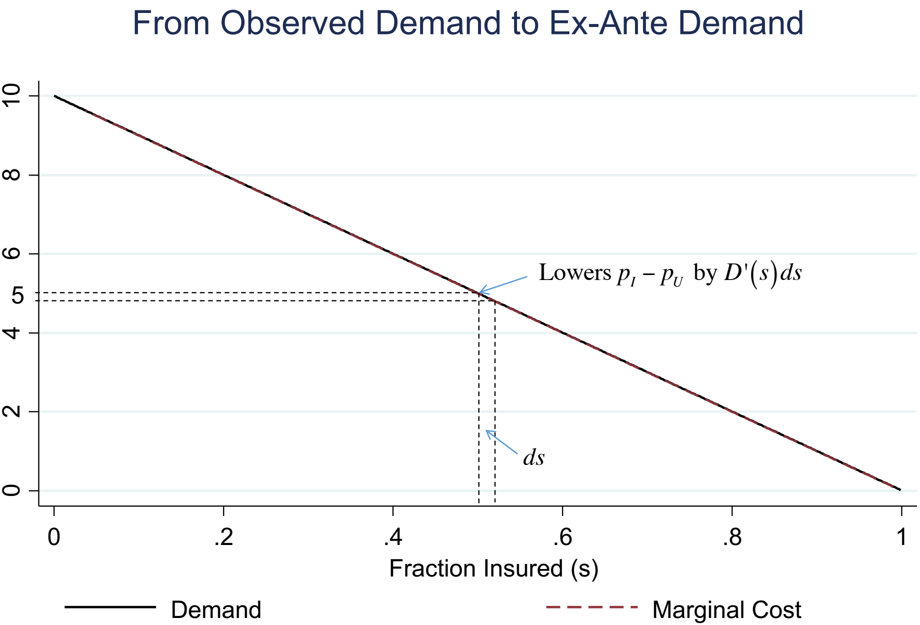
# From Observed Demand to Ex-Ante Demand




Price Calculation

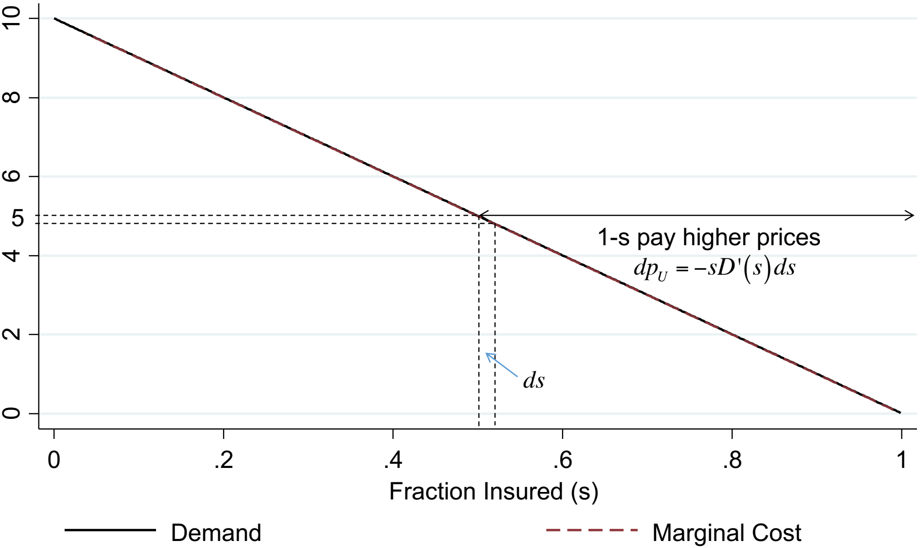


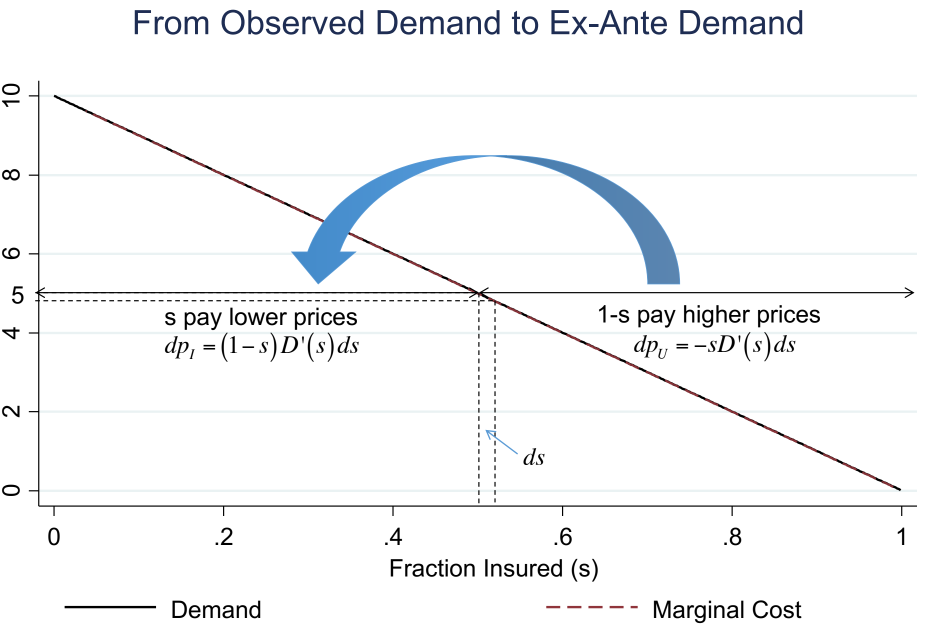
From Observed Demand to Ex-Ante Demand
10
8
6
5
4
2
0
ds
0
.2
.4
.6
.8
1
Fraction Insured (s)
Demand
Marginal Cost



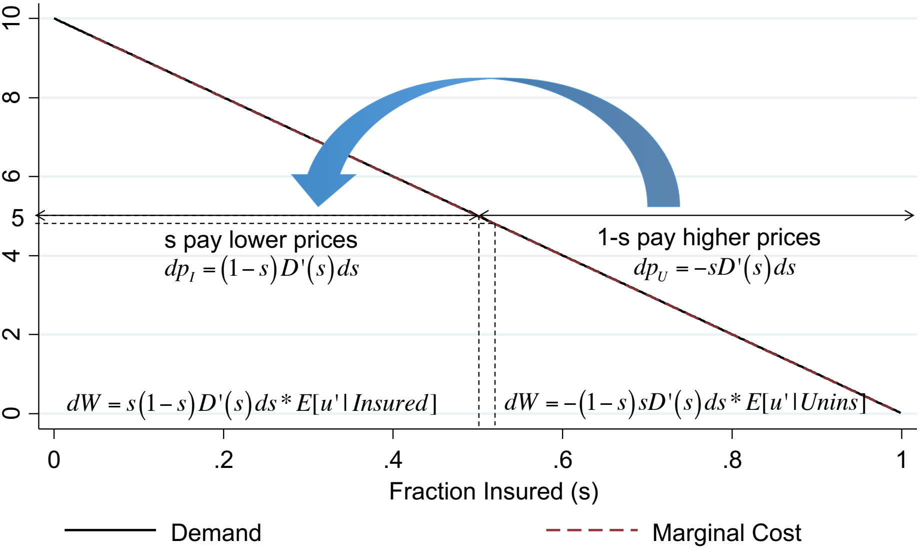
From Observed Demand to Ex-Ante Demand
10
8
6
5
4
2
0
0
.2
.4
.6
.8
1
Fraction Insured (s)
Lowers $p_I - p_U$ by $D'(s)ds$
$ds$
Demand
Marginal Cost

# From Observed Demand to Ex-Ante Demand

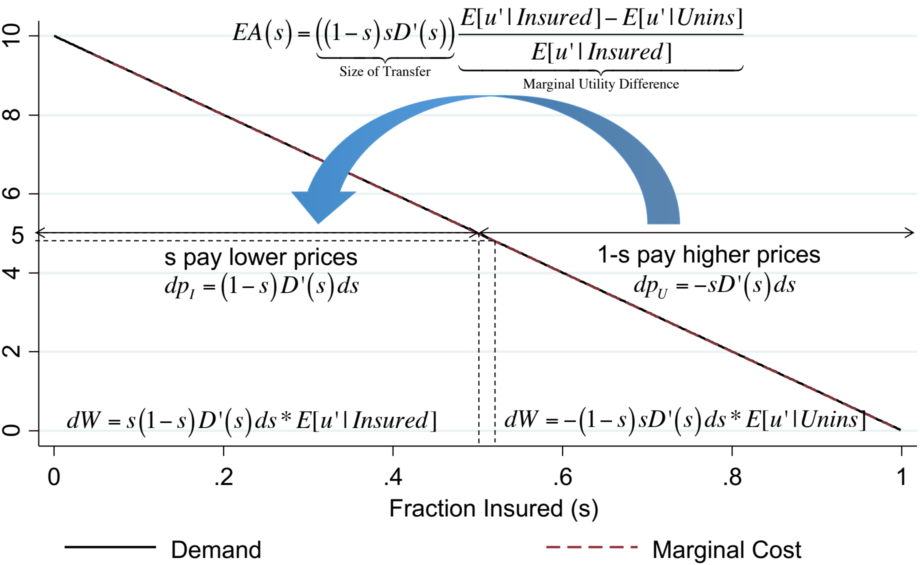



From Observed Demand to Ex-Ante Demand
10
8
6
5
4
2
0
s pay lower prices
$dp_I = (1-s)D'(s)ds$
1-s pay higher prices
$dp_U = -sD'(s)ds$
ds
0
.2
.4
.6
.8
1
Fraction Insured (s)
Demand
Marginal Cost

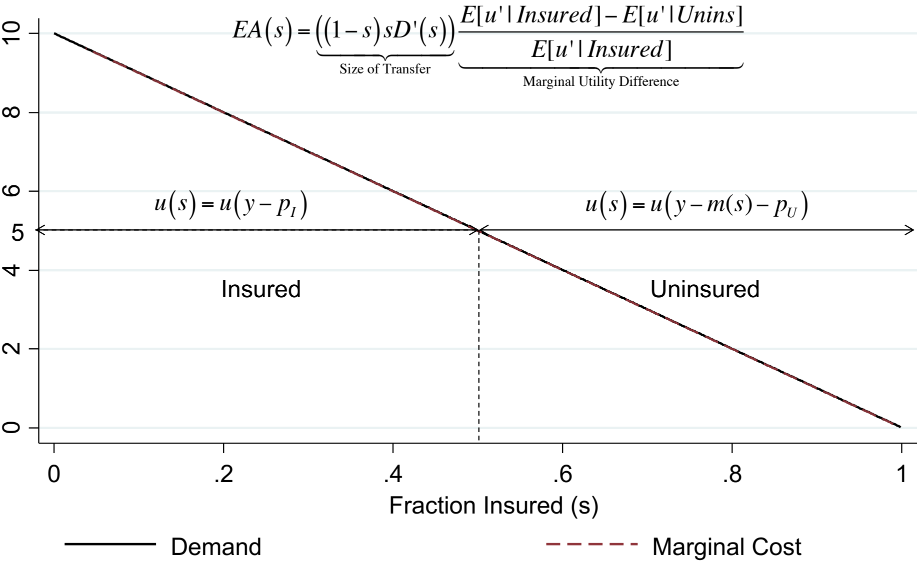
## From Observed Demand to Ex-Ante Demand



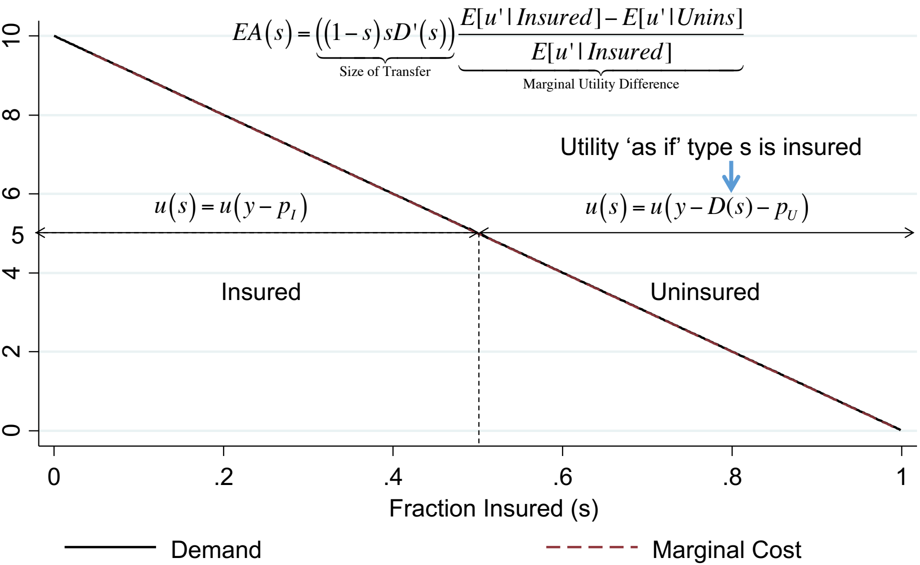
# From Observed Demand to Ex-Ante Demand



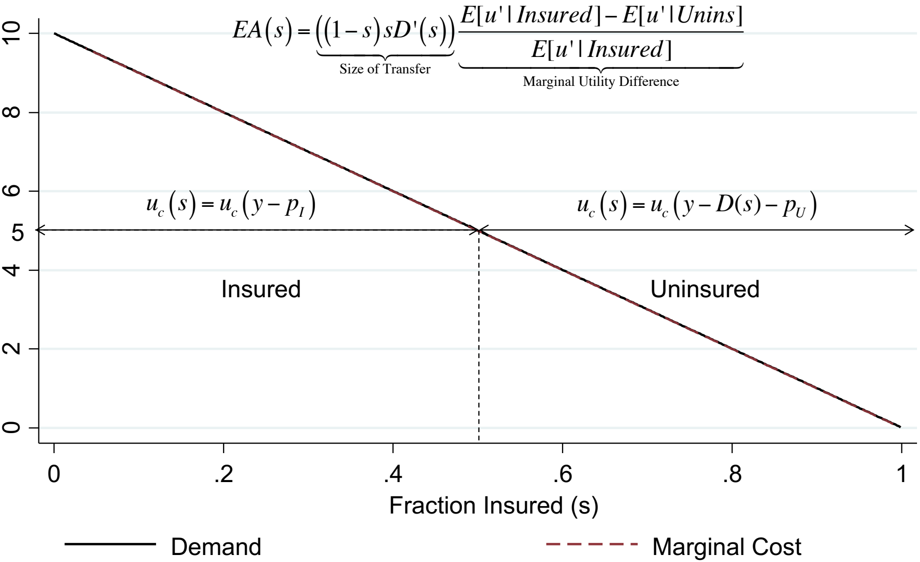
# From Observed Demand to Ex-Ante Demand



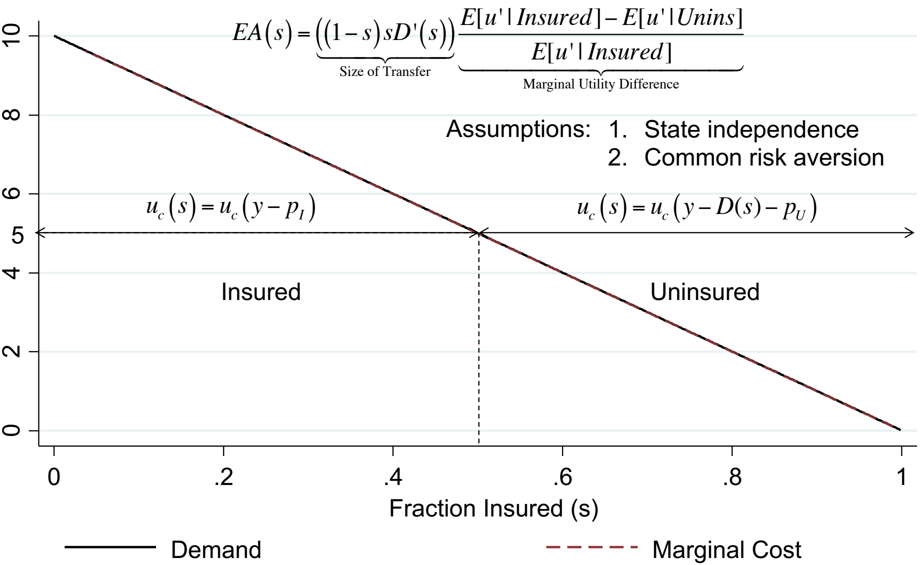
# From Observed Demand to Ex-Ante Demand

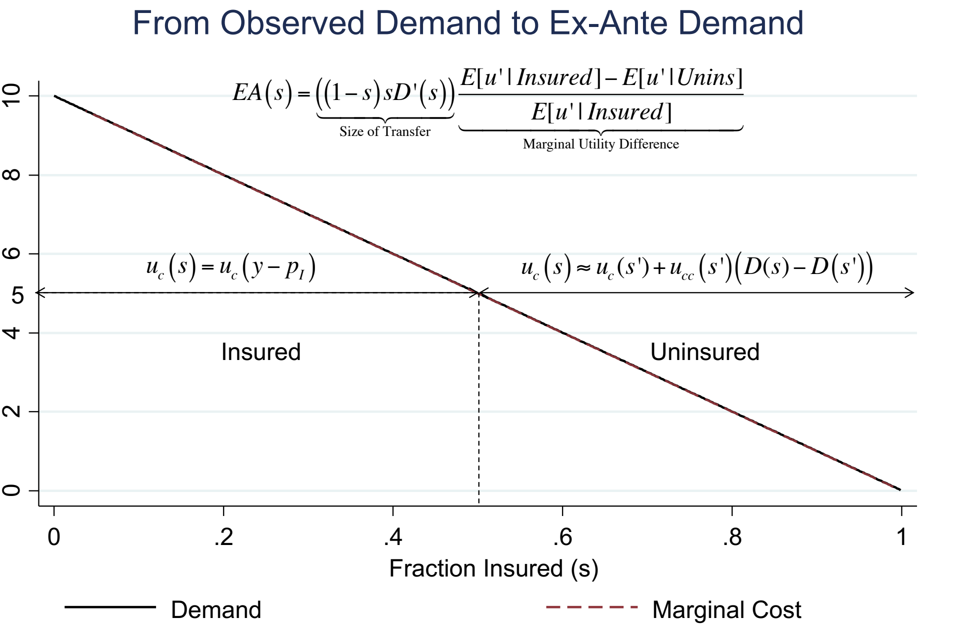


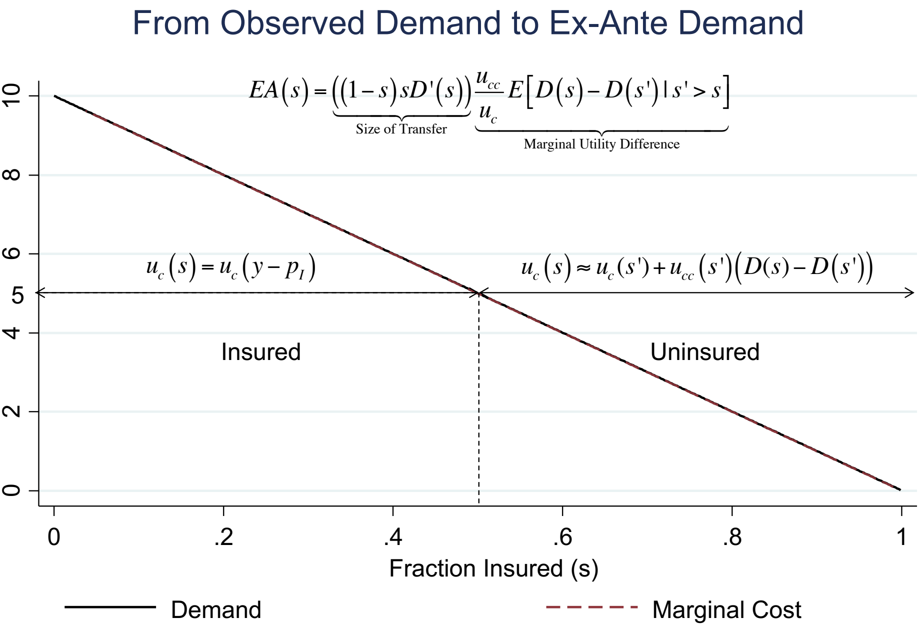
# From Observed Demand to Ex-Ante Demand



## From Observed Demand to Ex-Ante Demand

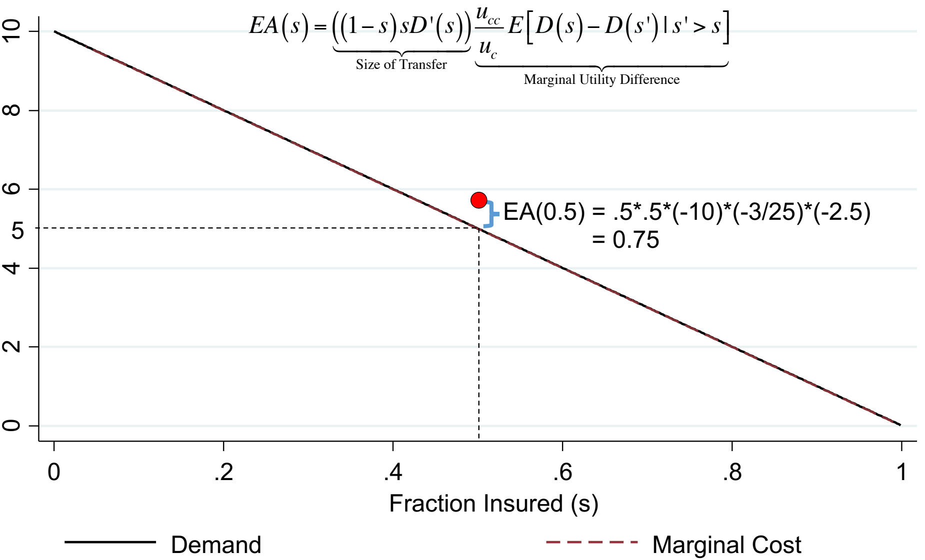



From Observed Demand to Ex-Ante Demand
$EA(s) = \underbrace{((1-s)sD'(s))}_{\text{Size of Transfer}} \underbrace{\frac{E[u' | Insured] - E[u' | Unins]}{E[u' | Insured]}}_{\text{Marginal Utility Difference}}$
$u_c(s) = u_c(y - p_I)$
$u_c(s) \approx u_c(s') + u_{cc}(s')(D(s) - D(s'))$
Insured
Uninsured
10
8
6
5
4
2
0
0
.2
.4
.6
.8
1
Fraction Insured (s)
Demand
Marginal Cost

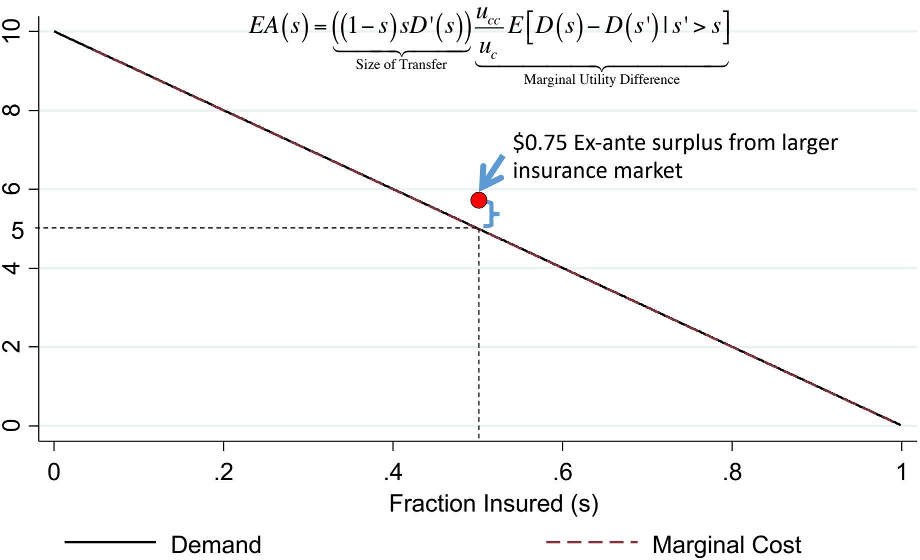


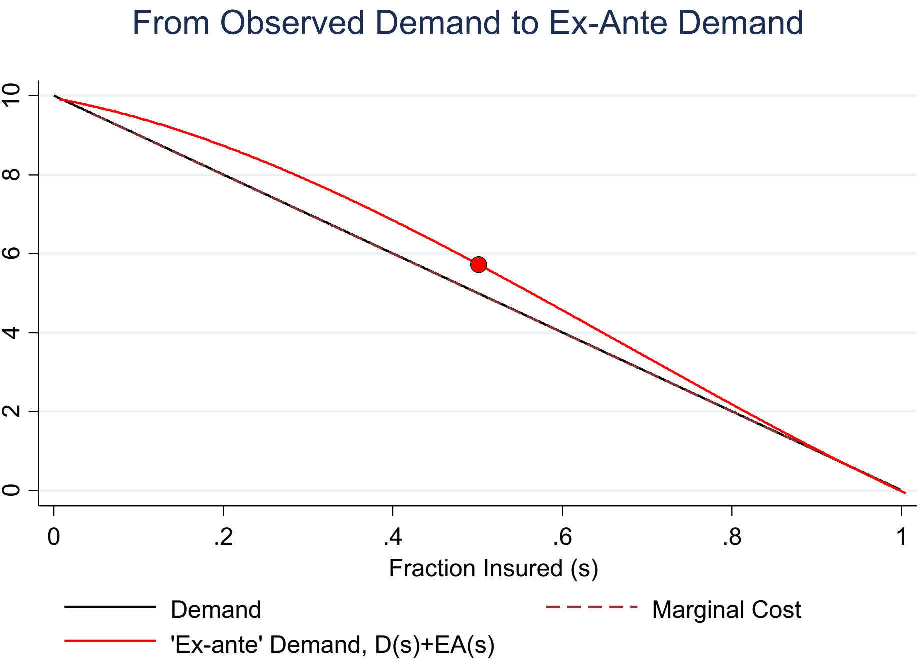
From Observed Demand to Ex-Ante Demand
$EA(s) = ((1-s)sD'(s)) \frac{u_{cc}}{u_c} E[D(s) - D(s') \mid s' > s]$
Size of Transfer
Marginal Utility Difference
$u_c(s) = u_c(y - p_I)$
$u_c(s) \approx u_c(s') + u_{cc}(s')(D(s) - D(s'))$
Insured
Uninsured
0
2
4
5
6
8
10
0
.2
.4
.6
.8
1
Fraction Insured (s)
Demand
Marginal Cost

# From Observed Demand to Ex-Ante Demand

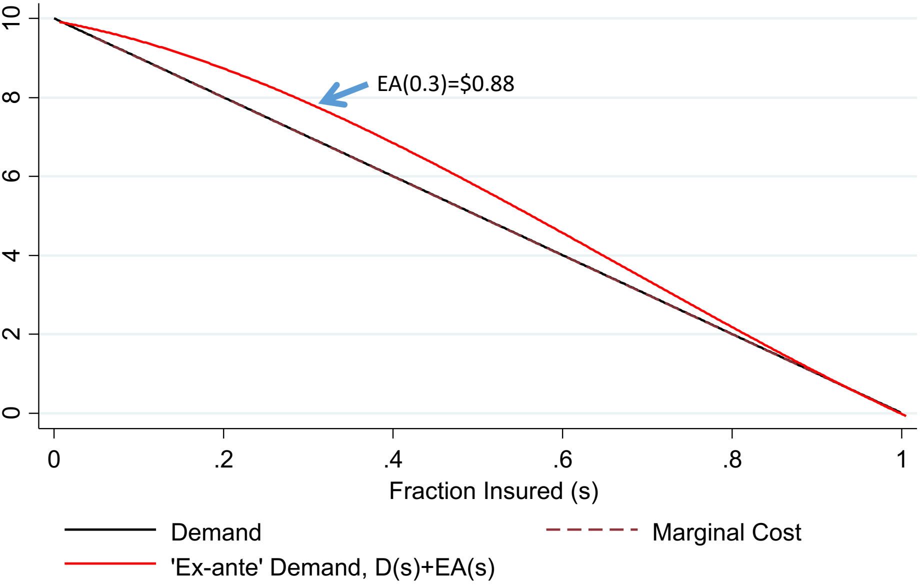


# From Observed Demand to Ex-Ante Demand

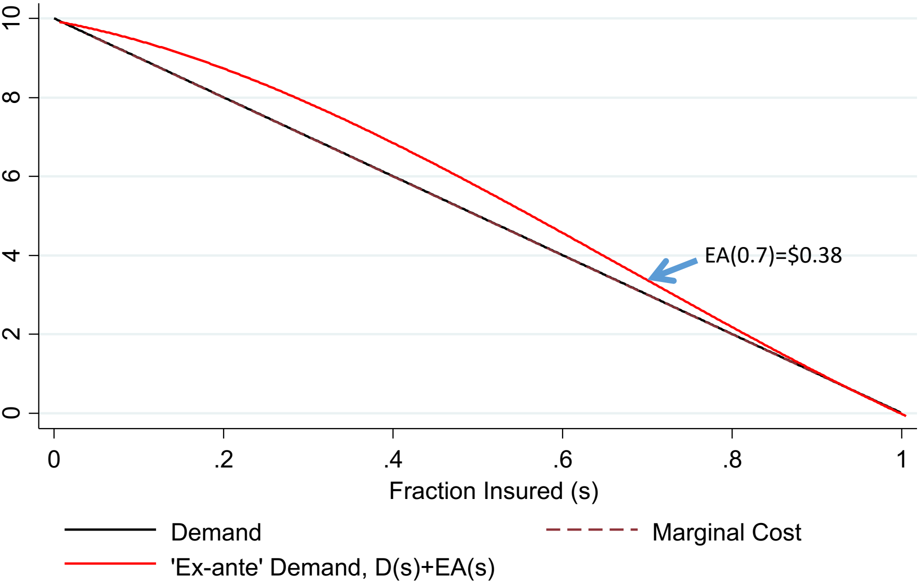


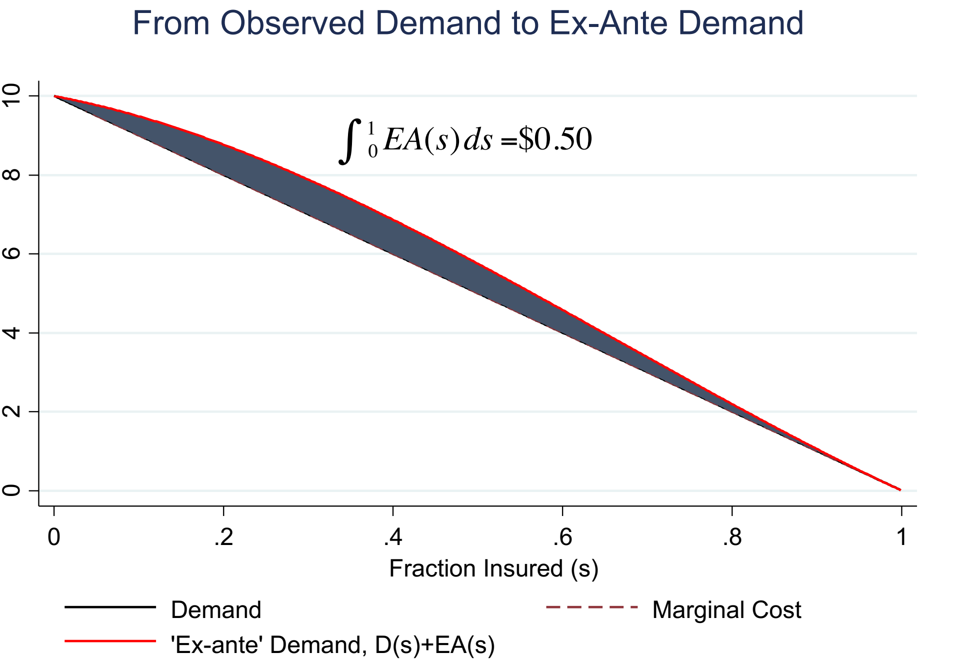

From Observed Demand to Ex-Ante Demand
0
2
4
6
8
10
0
.2
.4
.6
.8
1
Fraction Insured (s)
Demand
Marginal Cost
'Ex-ante' Demand, D(s)+EA(s)

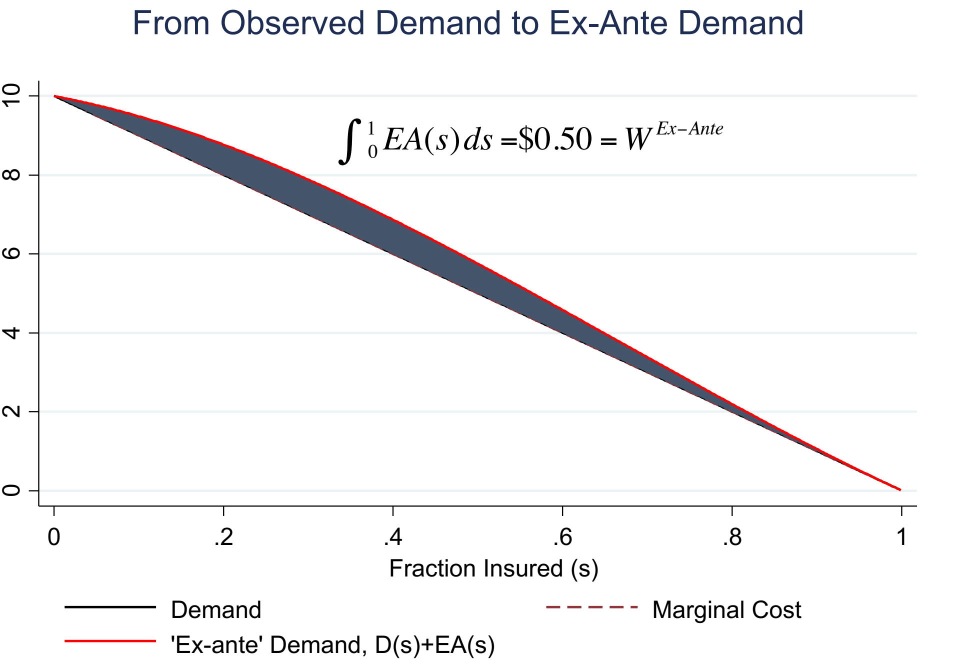
# From Observed Demand to Ex-Ante Demand



# From Observed Demand to Ex-Ante Demand




From Observed Demand to Ex-Ante Demand
$\int_0^1 EA(s)\,ds = \$0.50$
10
8
6
4
2
0
0
.2
.4
.6
.8
1
Fraction Insured (s)
Demand
Marginal Cost
'Ex-ante' Demand, D(s)+EA(s)


From Observed Demand to Ex-Ante Demand
$\int_0^1 EA(s)\,ds = \$0.50 = W^{Ex-Ante}$
10
8
6
4
2
0
0
.2
.4
.6
.8
1
Fraction Insured (s)
Demand
Marginal Cost
'Ex-ante' Demand, D(s)+EA(s)

# DWL versus Ex-Ante WTP

- Ex-ante demand curve facilitates ex-ante/utilitarian welfare analysis
  - Even though demand is measured after information is revealed

- Ex-ante (ex-post utilitarian) surplus can lead to different conclusions about the value of insurance
  - Ex-ante efficient to have full insurance
  - No value to insurance market after info is revealed
    - (Strictly positive DWL if there was moral hazard)

# General Model with Moral Hazard

- Ex-ante/Utilitarian welfare when fraction s has insurance

$$W(s) = E\left[u(c(s;\theta), m(s;\theta);\theta)\right]$$

- Ex-ante WTP for larger insurance market:

$$\frac{W'(s)}{E[u' | Insured]} = \underbrace{D(s) - MC(s)}_{\text{Ex-Post Surplus}} + EA(s)$$

where

$$EA(s) = (1-s)s \frac{-\partial D}{\partial s} \frac{E[u'(s)|Insured] - E[u'(s)|Uninsured]}{E[u'(s)]}$$

# Implementation

- Use common assumptions to approximate difference in marginal utilities between insured and uninsured
  - State independence: $u_c$ only depends on c
  - Income doesn't vary with s
  - Common risk aversion (Andrews and Miller, 2013)
- Implies:

$$EA(s) = (1 - \text{s})\text{s}\frac{-\partial D}{\partial s}\frac{u_{cc}}{u_c}E[D(s) - D(s')|s' > s]$$

- Ex-ante component increasing with the square of demand/cost
  - $D(s) \rightarrow aD(s)$ implies $EA(s) \rightarrow a^2 EA(s)$

# Risk Aversion

- Measuring ex-ante demand requires risk aversion

- Can be assumed externally
  - CRRA = 3
  - CARA = $5x10^{-4}$

- Or can be estimated internally

$$\frac{-u_{cc}}{u_c} \approx 2 \frac{\text{Markup}}{\text{Variance Reduction}} \approx 2 \frac{D(s) - MC(s)}{\text{var}(m^U) - \text{var}(x^I)}$$

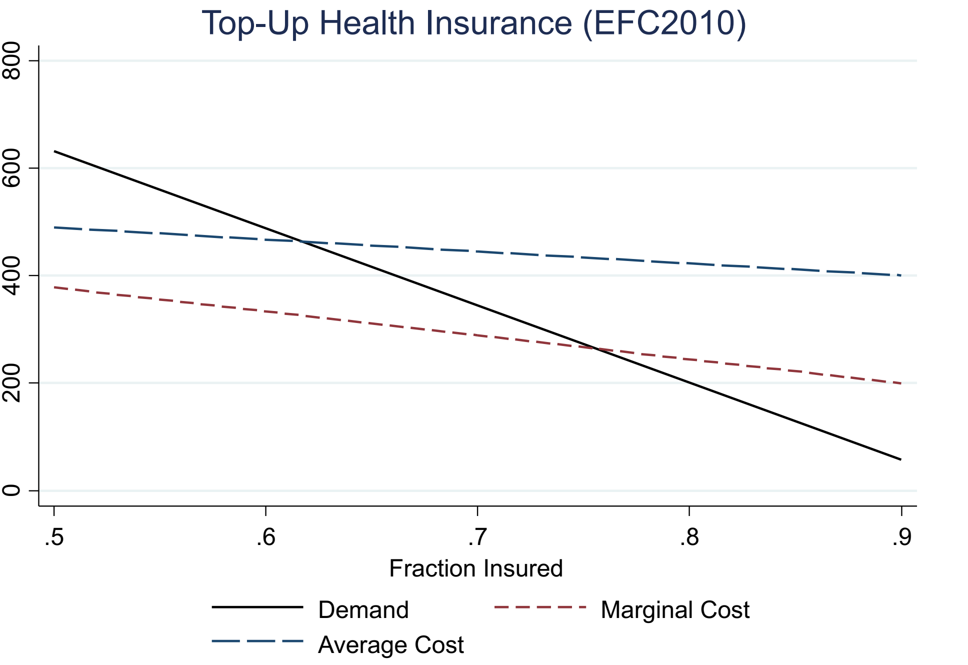
- WTP for insurance against remaining risk reveals can proxy for WTP for insurance against realized risk

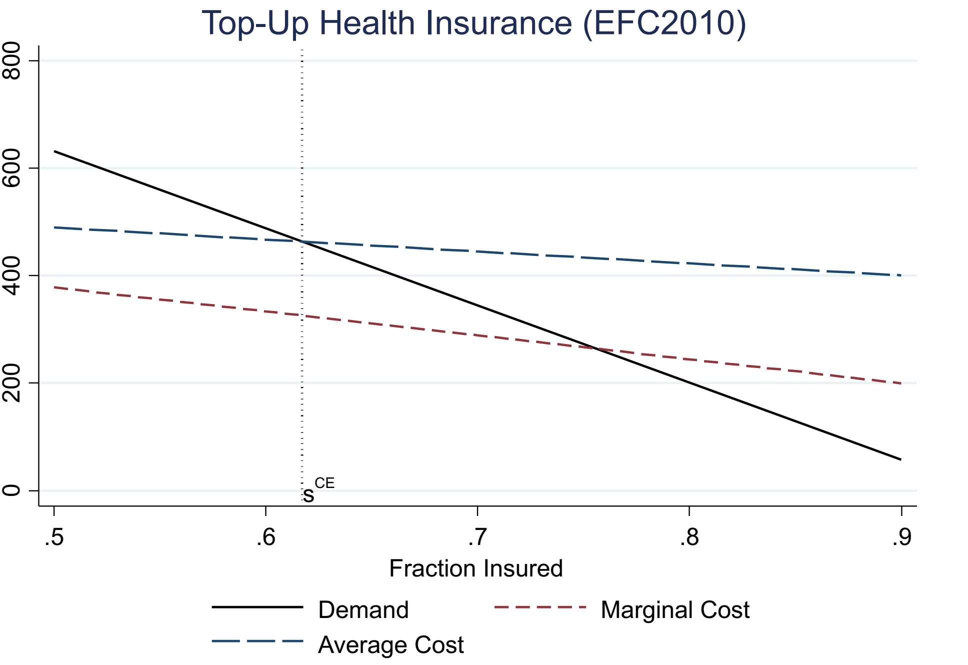
# Illustration to Einav, Finkelstein, and Cullen (2010)

1. Top-up market for more generous PPO coverage in Alcoa
   - Demand and Cost Curves from Einav, Finkelstein, and Cullen (2010)
   - Average annual cost: $500

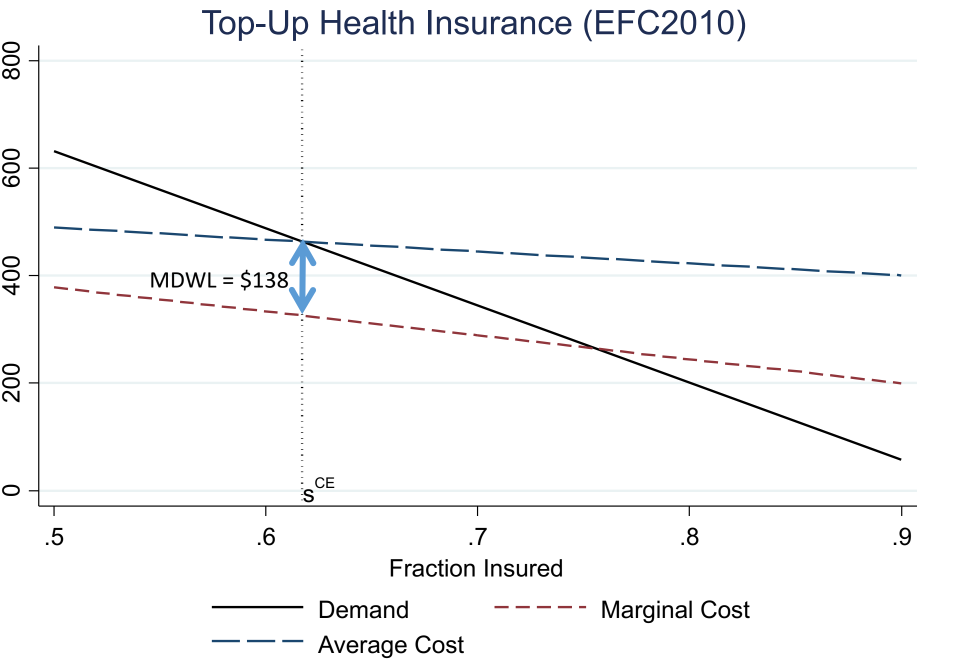
2. "Medium risk"
   - 4x Demand and Cost curves from Einav, Finkelstein, and Cullen (2010)
   - Average annual cost: $2,000

3. "Large Risk": Conservative approx. to insured vs. uninsured
   - 8x Demand and Cost curves from Einav, Finkelstein, and Cullen (2010)
   - Average annual cost: $4,000
   - Smaller than $5,922 (full vs. no insurance) or $5,270 in MA (Hackman, Kolstad, Kowalski, 2015)

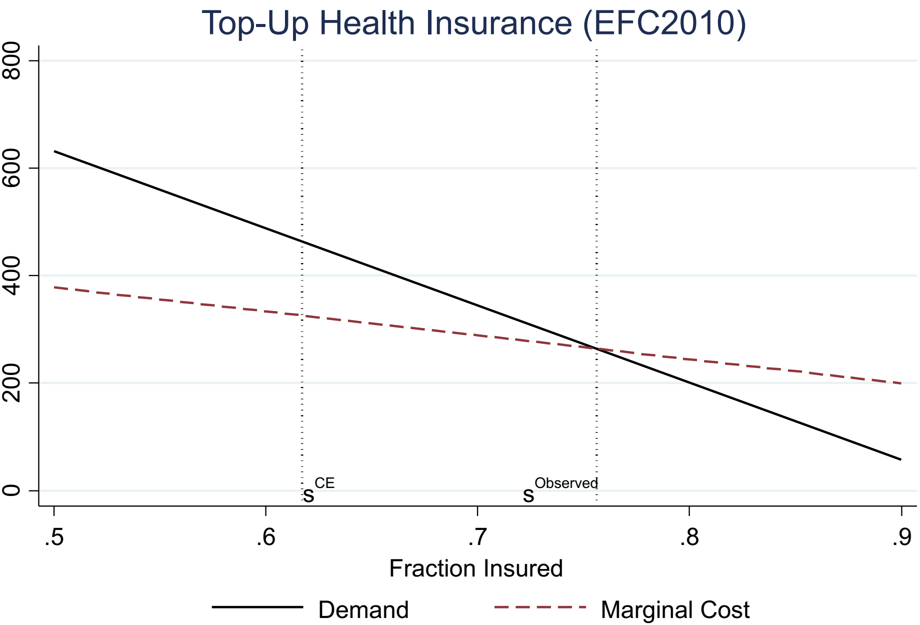

Top-Up Health Insurance (EFC2010)
0
200
400
600
800
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost
Average Cost

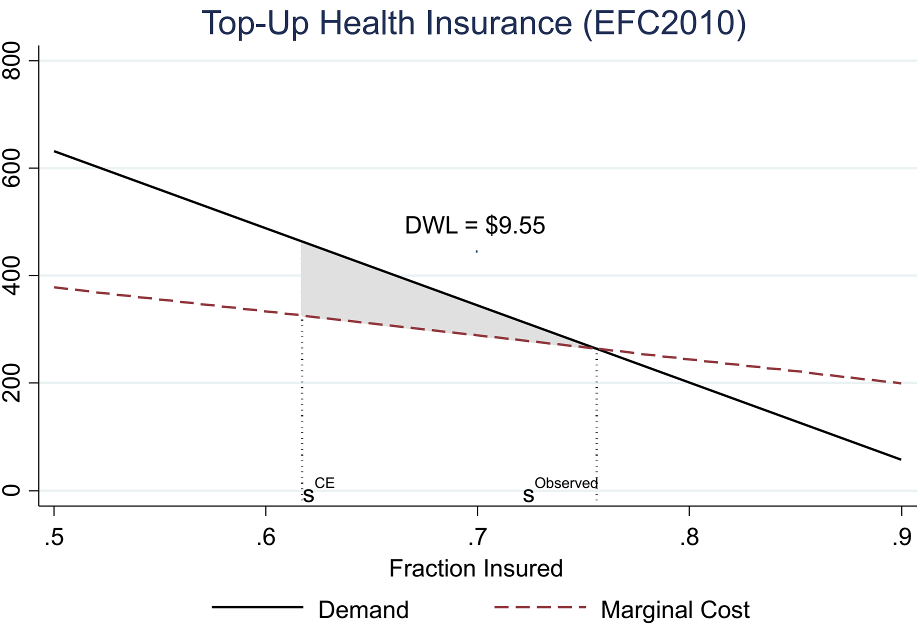


Top-Up Health Insurance (EFC2010)
800
600
400
200
0
s^CE
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost
Average Cost

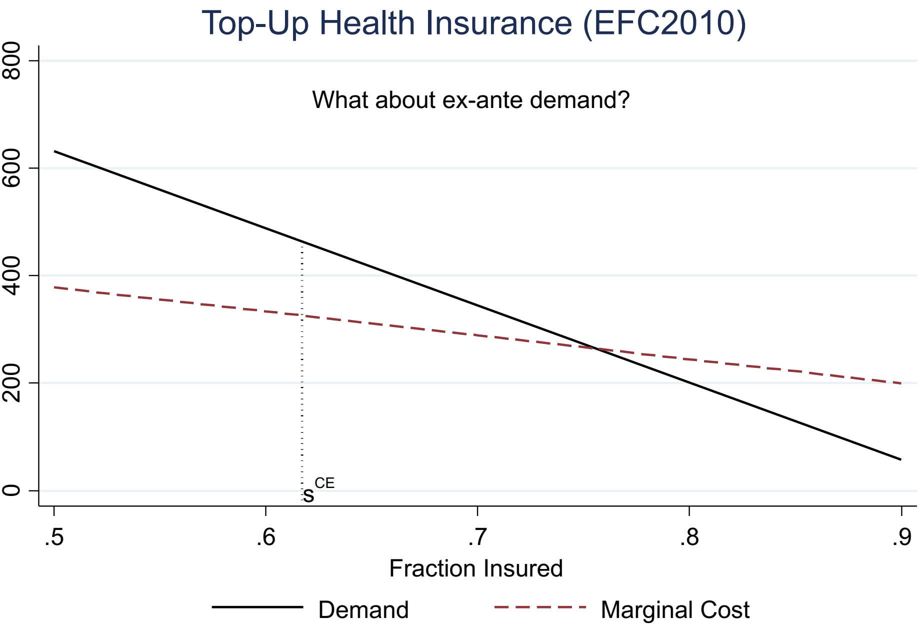


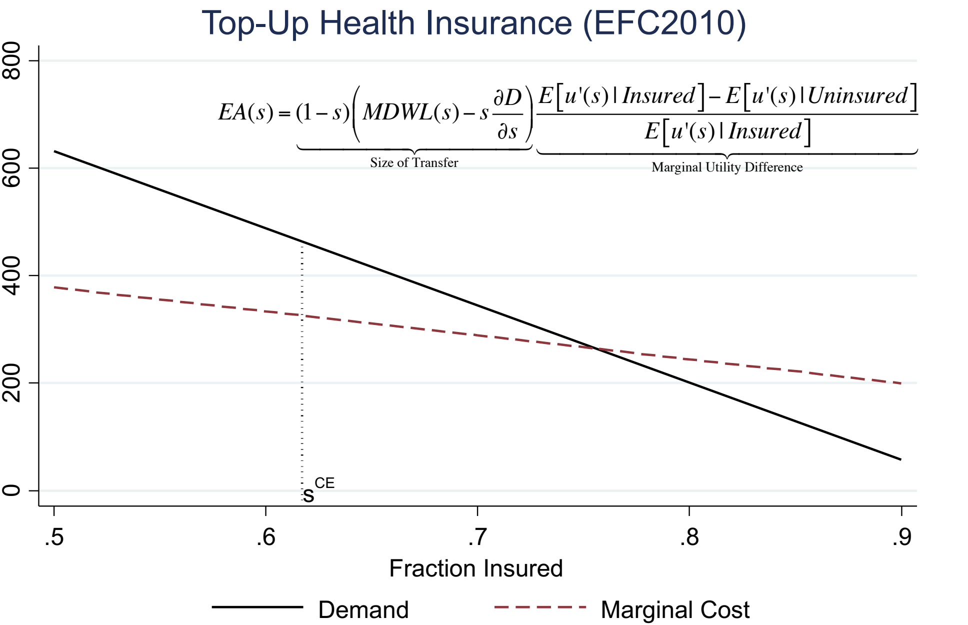
Top-Up Health Insurance (EFC2010)
800
600
400
200
0
MDWL = $138
s^CE
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost
Average Cost


Top-Up Health Insurance (EFC2010)
800
600
400
200
0
s^CE
s^Observed
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost

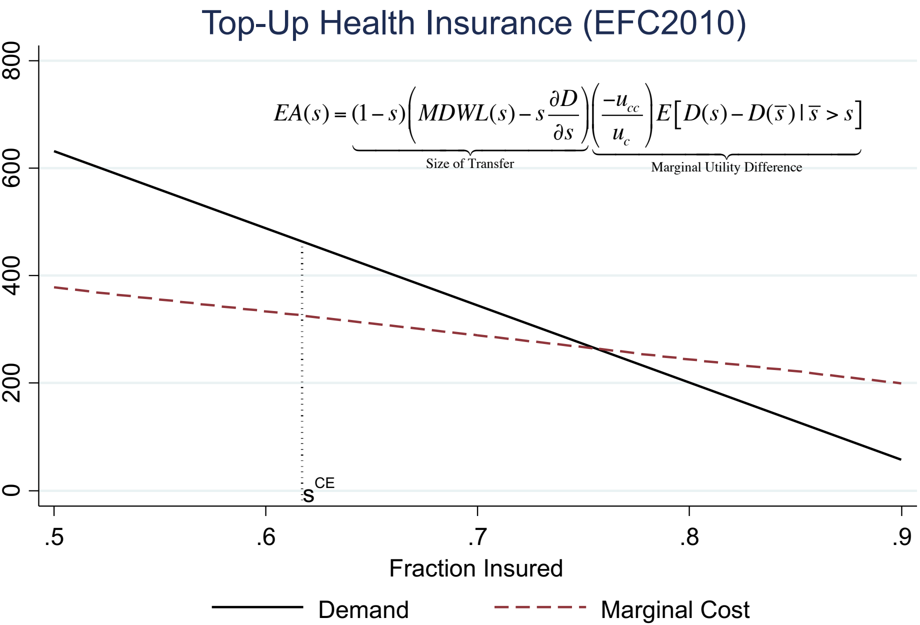


Top-Up Health Insurance (EFC2010)
800
600
400
200
0
DWL = $9.55
s^CE
s^Observed
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost

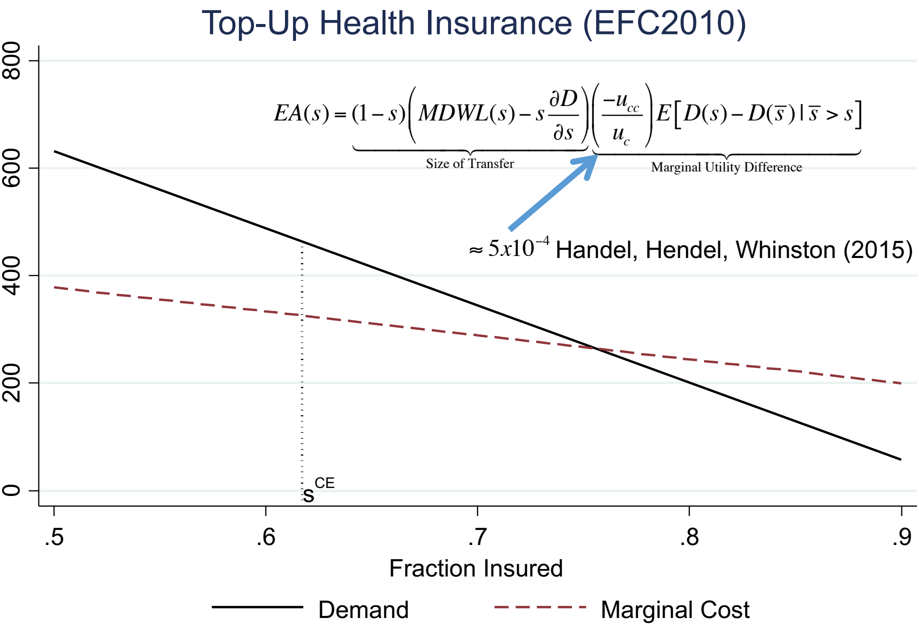

Top-Up Health Insurance (EFC2010)
What about ex-ante demand?
800
600
400
200
0
s^CE
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost



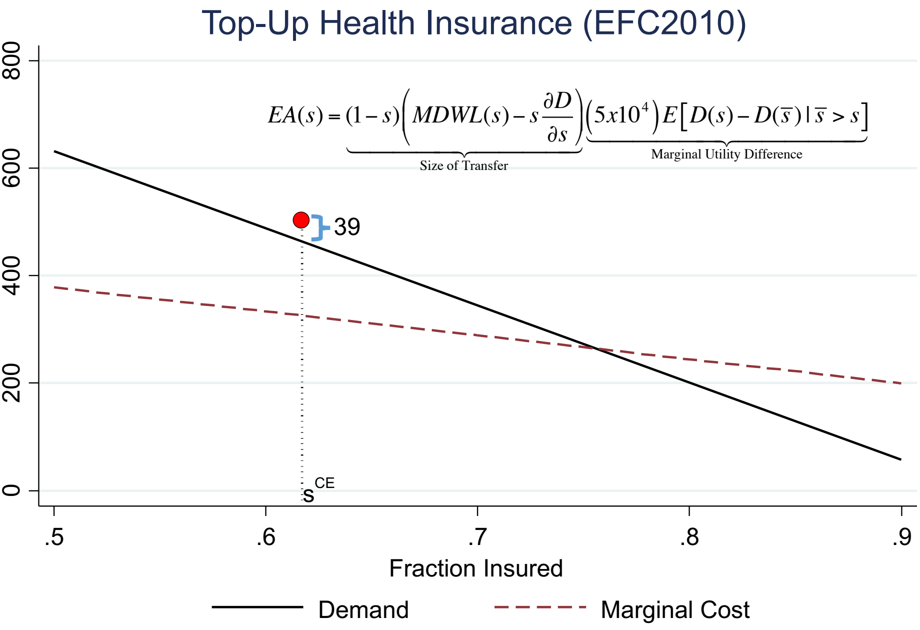
Top-Up Health Insurance (EFC2010)
$EA(s) = (1-s)\left(MDWL(s) - s\frac{\partial D}{\partial s}\right)\frac{E[u'(s)|Insured] - E[u'(s)|Uninsured]}{E[u'(s)|Insured]}$
Size of Transfer
Marginal Utility Difference
$s^{CE}$
0
200
400
600
800
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost

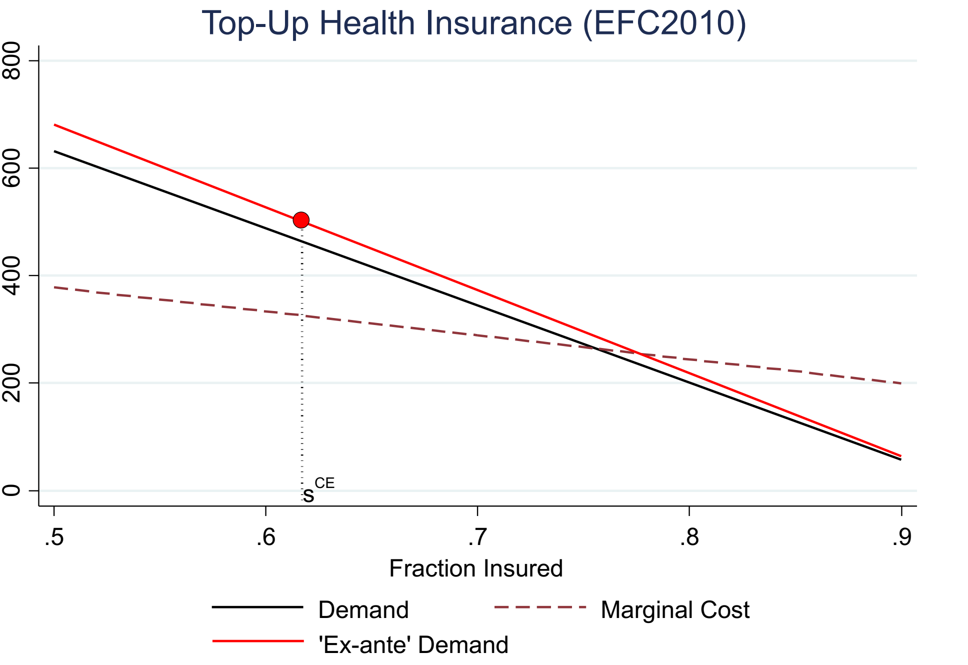


Top-Up Health Insurance (EFC2010)
$EA(s) = (1-s)\left(MDWL(s) - s\frac{\partial D}{\partial s}\right)\left(\frac{-u_{cc}}{u_c}\right)E\left[D(s) - D(\bar{s}) \mid \bar{s} > s\right]$
Size of Transfer
Marginal Utility Difference
800
600
400
200
0
$s^{CE}$
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost

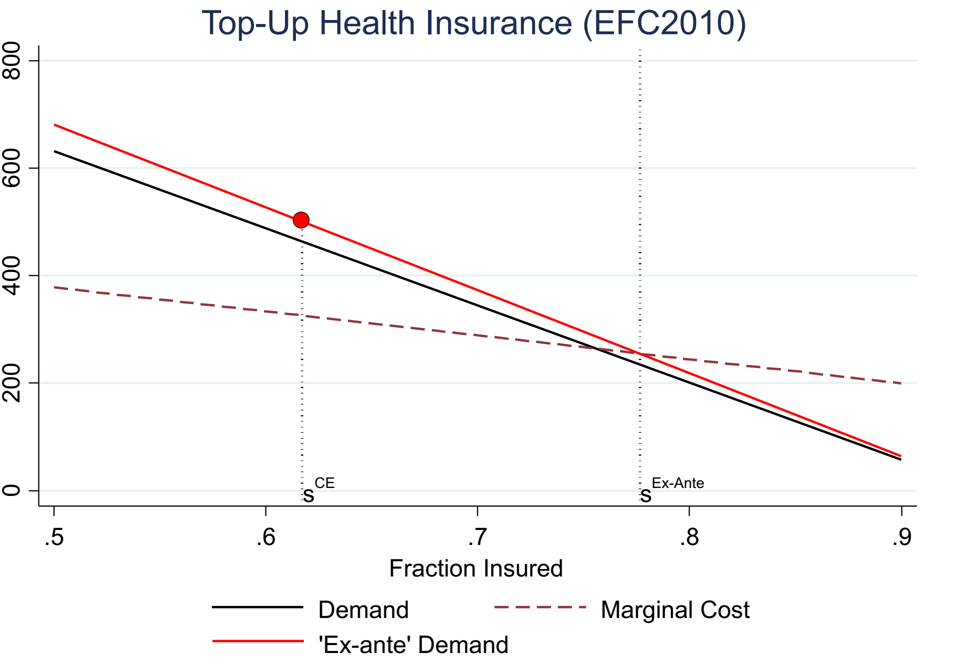


Top-Up Health Insurance (EFC2010)
$EA(s) = (1-s)\left(MDWL(s) - s\frac{\partial D}{\partial s}\right)\left(\frac{-u_{cc}}{u_c}\right)E\left[D(s) - D(\bar{s}) \mid \bar{s} > s\right]$
Size of Transfer
Marginal Utility Difference
$\approx 5x10^{-4}$ Handel, Hendel, Whinston (2015)
800
600
400
200
0
$s^{CE}$
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost


Top-Up Health Insurance (EFC2010)
$EA(s) = (1-s)\left(MDWL(s) - s\frac{\partial D}{\partial s}\right)\left(5x10^4\right)E\left[D(s) - D(\bar{s}) \mid \bar{s} > s\right]$
Size of Transfer
Marginal Utility Difference
39
$s^{CE}$
0
200
400
600
800
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost



Top-Up Health Insurance (EFC2010)
800
600
400
200
0
s^CE
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost
'Ex-ante' Demand



Top-Up Health Insurance (EFC2010)
0
200
400
600
800
.5
.6
.7
.8
.9
Fraction Insured
s^CE
s^Ex-Ante
Demand
Marginal Cost
'Ex-ante' Demand

# Ex-Ante Optimal Insurance Markets Generate DWL

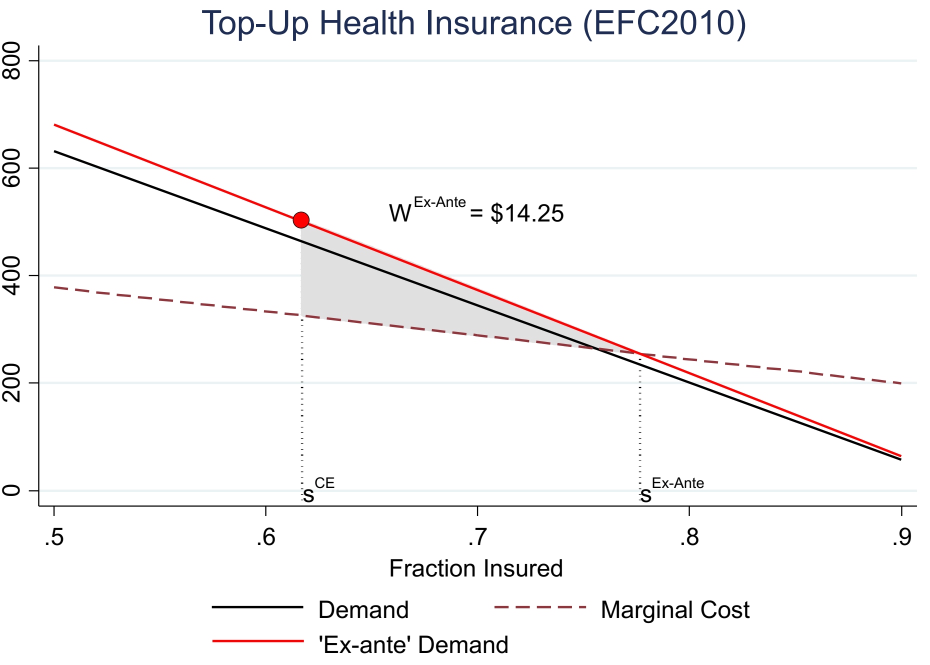
- Ex-ante optimal size of the insurance market solves:

$$\frac{W'(s^{Ex-Ante})}{E\left[u' \mid Insured\right]} = \underbrace{D(s^{Ex-Ante}) - MC(s^{Ex-Ante})}_{\text{Ex-Post Surplus}} + EA(s^{Ex-Ante}) = 0$$

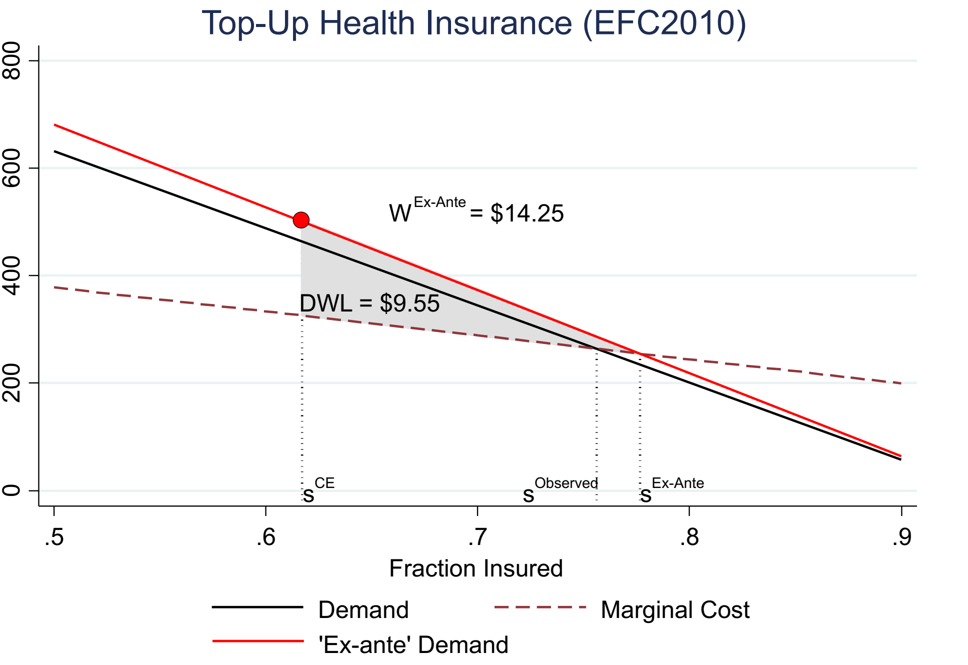
- Yields a "Baily-Chetty" condition:

$$EA(s^{Ex-Ante}) = MDWL(s^{Ex-Ante})$$

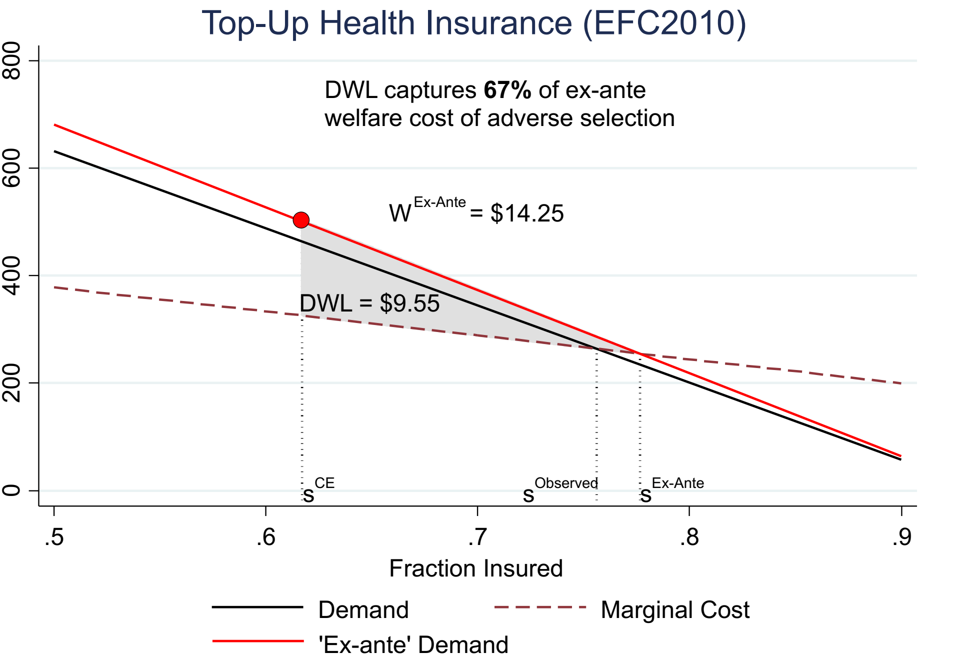
- **Corollary:** The ex-ante optimal allocation generally involves (ex-post) deadweight loss
  - Easy to show that MDWL(s)=0 implies EA(s)>0 whenever marginal utilities are higher for the insured than uninsured
  - MDWL is a cost we're willing to accept for ex-ante insurance



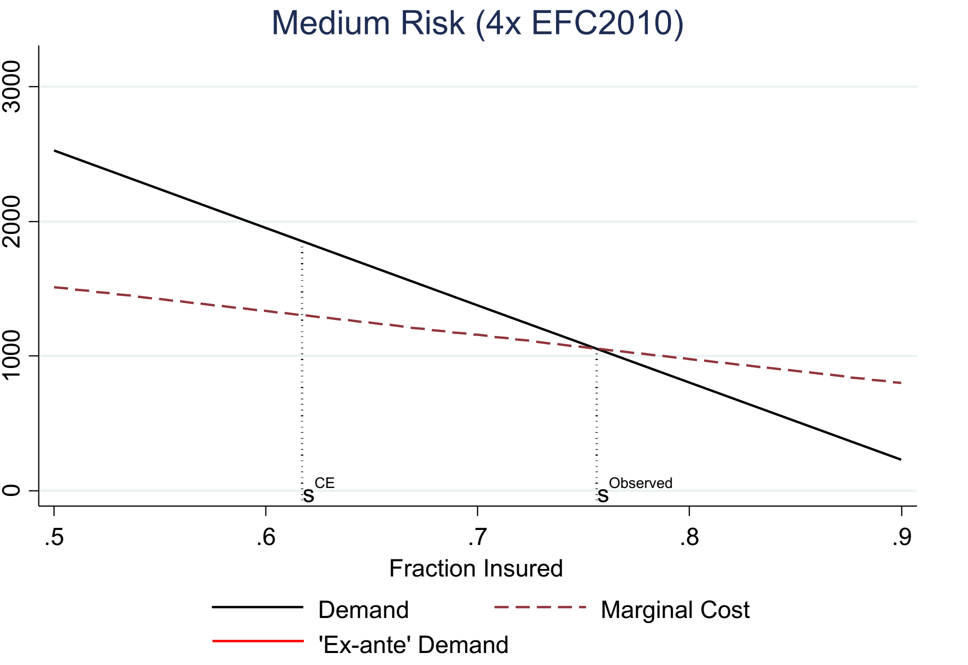
Top-Up Health Insurance (EFC2010)
800
600
400
200
0
W^Ex-Ante = $14.25
s^CE
s^Ex-Ante
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost
'Ex-ante' Demand



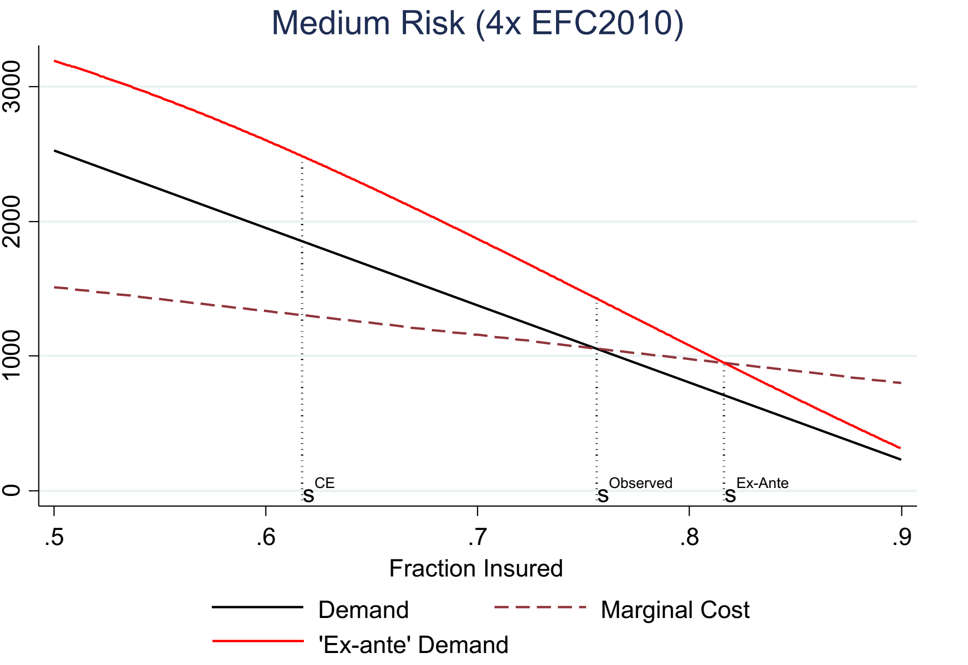
Top-Up Health Insurance (EFC2010)
800
600
400
200
0
W^Ex-Ante = $14.25
DWL = $9.55
s^CE
s^Observed
s^Ex-Ante
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost
'Ex-ante' Demand



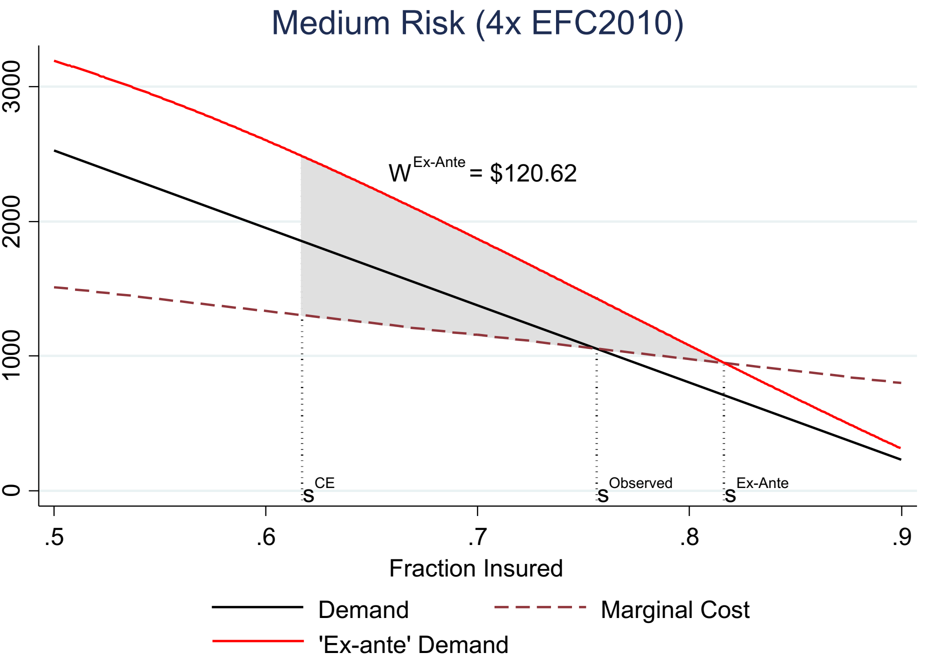
Top-Up Health Insurance (EFC2010)
DWL captures 67% of ex-ante welfare cost of adverse selection
W Ex-Ante = $14.25
DWL = $9.55
s CE
s Observed
s Ex-Ante
0
200
400
600
800
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost
'Ex-ante' Demand



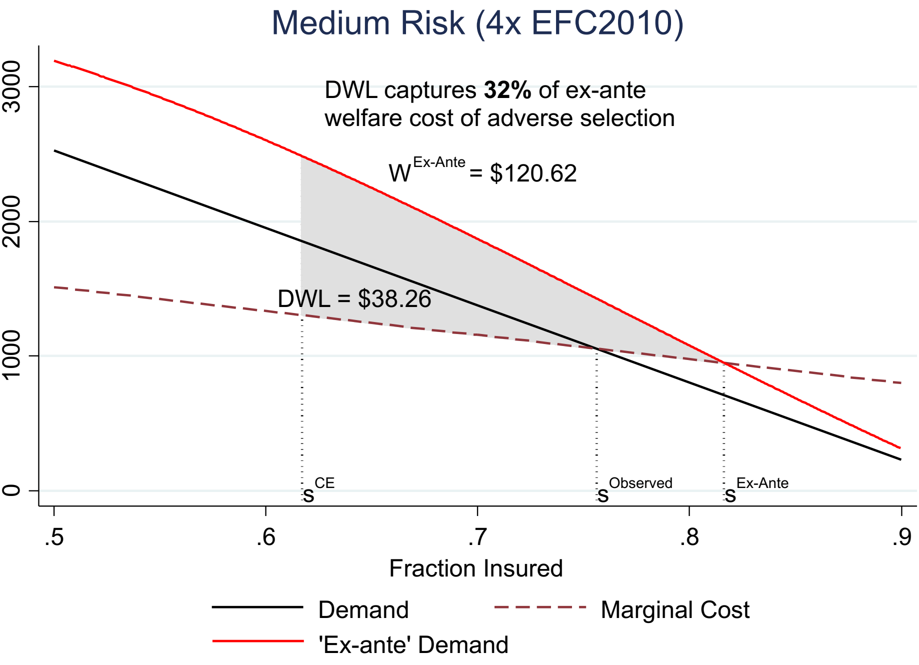
Medium Risk (4x EFC2010)
3000
2000
1000
0
s^CE
s^Observed
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost
'Ex-ante' Demand



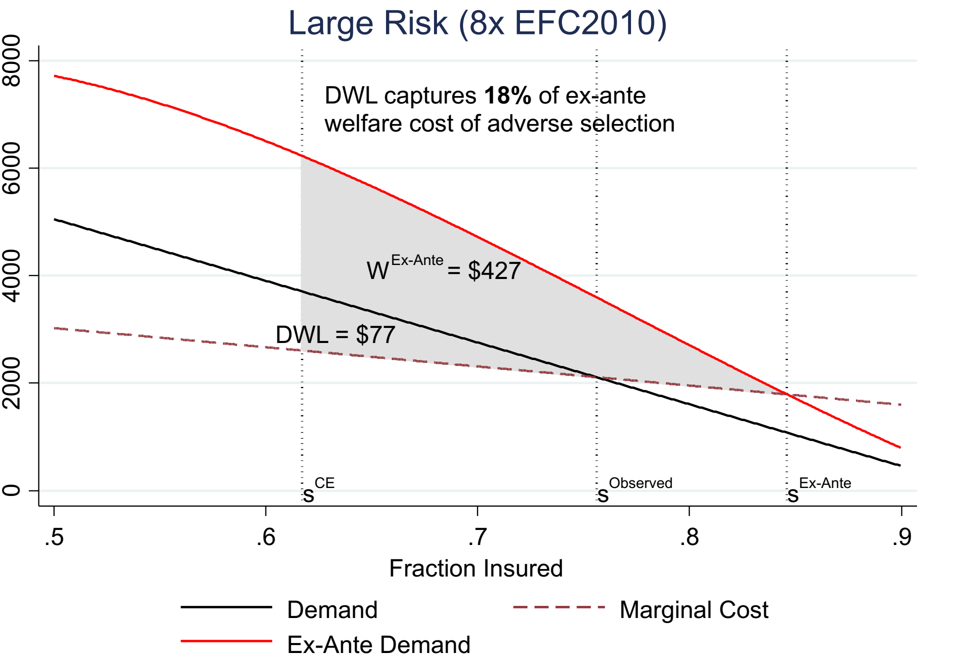
Medium Risk (4x EFC2010)
3000
2000
1000
0
s^CE
s^Observed
s^Ex-Ante
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost
'Ex-ante' Demand



Medium Risk (4x EFC2010)
W^Ex-Ante = $120.62
3000
2000
1000
0
s^CE
s^Observed
s^Ex-Ante
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost
'Ex-ante' Demand



Medium Risk (4x EFC2010)
DWL captures **32%** of ex-ante welfare cost of adverse selection
W^Ex-Ante = $120.62
DWL = $38.26
3000
2000
1000
0
s^CE
s^Observed
s^Ex-Ante
.5
.6
.7
.8
.9
Fraction Insured
Demand
Marginal Cost
'Ex-ante' Demand

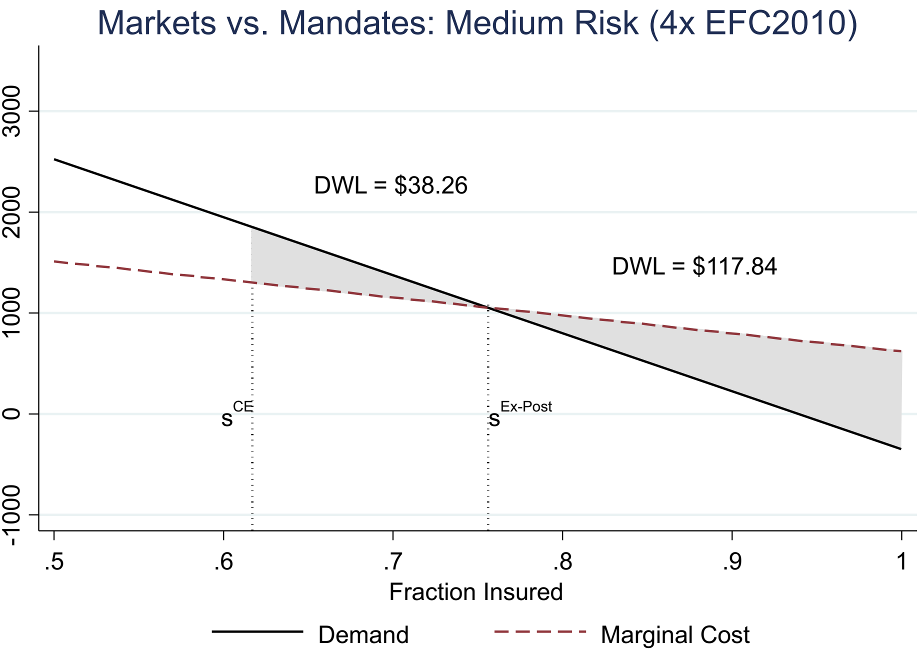

Large Risk (8x EFC2010)
DWL captures 18% of ex-ante welfare cost of adverse selection
W^Ex-Ante = $427
DWL = $77
8000
6000
4000
2000
0
s^CE
s^Observed
s^Ex-Ante
.5
.6
.7
.8
.9
Fraction Insured
Demand
Ex-Ante Demand
Marginal Cost

# Ex-ante Insurance Value Increasing in Premium

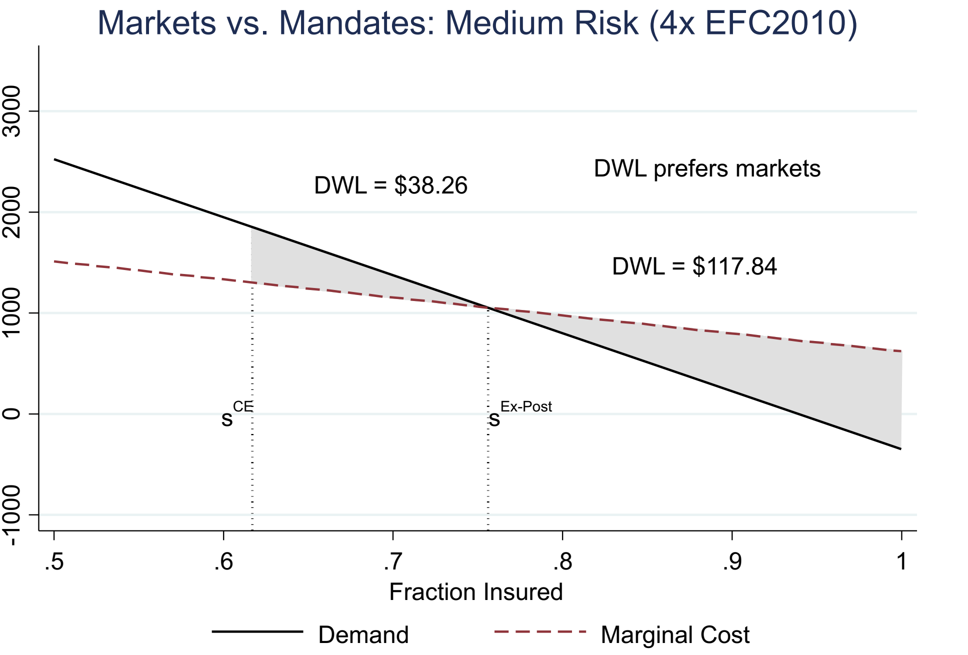
- Divergence between Observed and Ex-ante value of insurance is increasing in the size/importance of the risk
  - DWL captures 67% of the ex-ante welfare cost of adverse selection for baseline specification in Einav, Finkelstein, and Cullen (2010)
  - Only 18% if risks are 8x as large
- More important for risks where the premiums are a significant share of people's incomes
  - Health, life, disability, unemployment insurance
  - Less important for iPhone insurance…

# Competitive Markets vs. Mandates

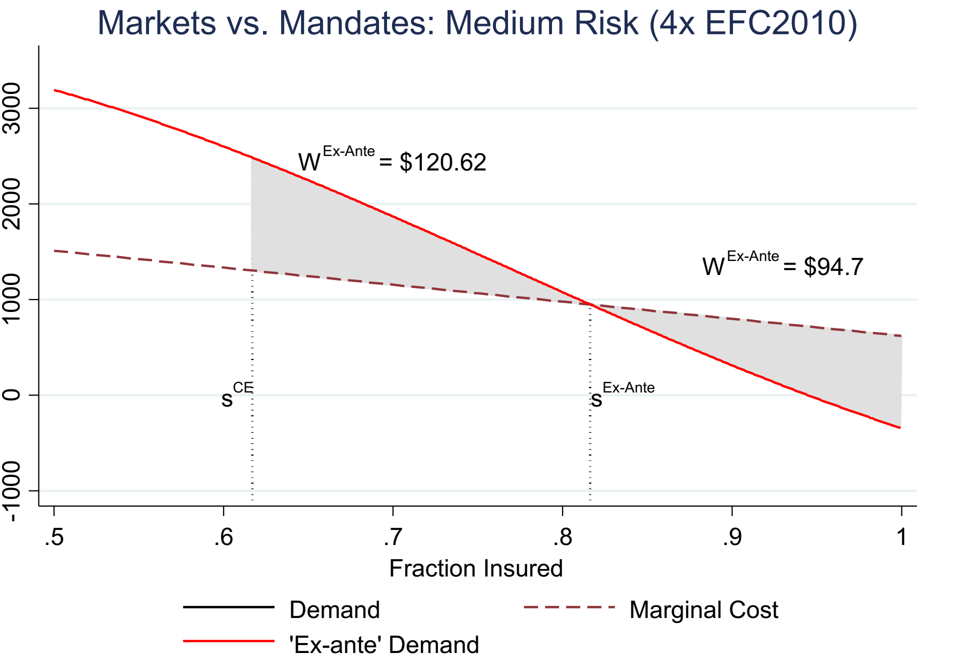
- Are competitive markets better or worse than govt mandates?
  - Competitive markets suffer adverse selection
  - Mandates may require some to buy insurance that don’t want it

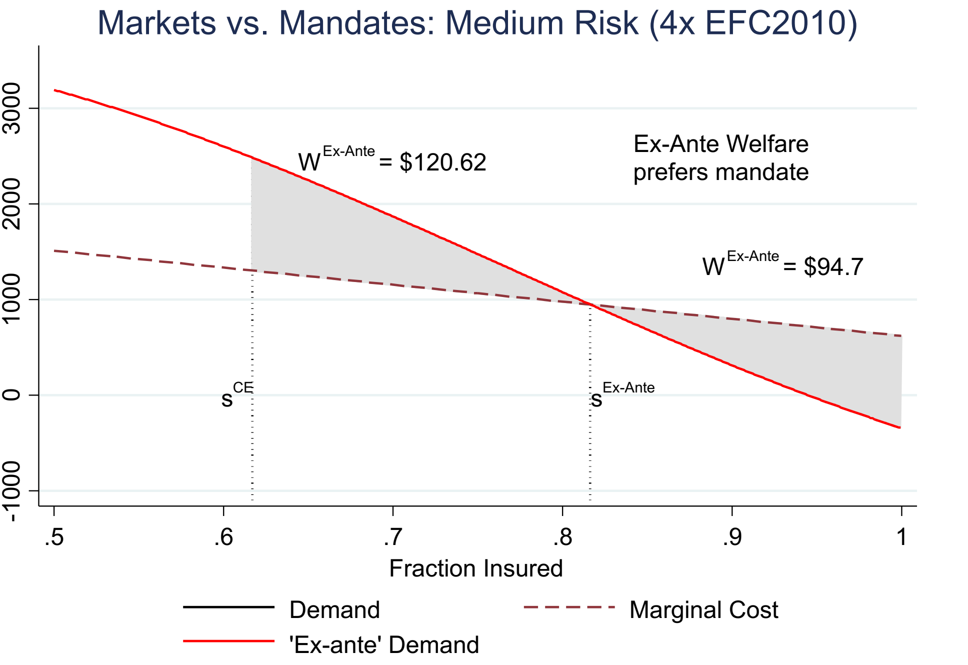


Markets vs. Mandates: Medium Risk (4x EFC2010)
3000
2000
1000
0
-1000
DWL = $38.26
DWL = $117.84
s^CE
s^Ex-Post
.5
.6
.7
.8
.9
1
Fraction Insured
Demand
Marginal Cost



Markets vs. Mandates: Medium Risk (4x EFC2010)
DWL prefers markets
DWL = $38.26
DWL = $117.84
s^CE
s^Ex-Post
3000
2000
1000
0
-1000
.5
.6
.7
.8
.9
1
Fraction Insured
Demand
Marginal Cost


Markets vs. Mandates: Medium Risk (4x EFC2010)
-1000
0
1000
2000
3000
$W^{Ex\text{-}Ante}$ = $120.62
$W^{Ex\text{-}Ante}$ = $94.7
$s^{CE}$
$s^{Ex\text{-}Ante}$
.5
.6
.7
.8
.9
1
Fraction Insured
Demand
Marginal Cost
'Ex-ante' Demand



Markets vs. Mandates: Medium Risk (4x EFC2010)
W^Ex-Ante = $120.62
Ex-Ante Welfare prefers mandate
W^Ex-Ante = $94.7
s^CE
s^Ex-Ante
-1000
0
1000
2000
3000
.5
.6
.7
.8
.9
1
Fraction Insured
Demand
Marginal Cost
'Ex-ante' Demand

# DWL vs. Ex-Ante Welfare Lead to Different Conclusions

- For the medium and large risk specifications, ex-ante and ex-post (DWL) welfare measures generate different conclusions
- DWL perspective prefers markets
- Ex-ante/utilitarian perspective prefers mandates

# Key Lessons

- Insurance insures against the realization of risk
  - Adverse selection implies a divergence between DWL and Ex-ante welfare
- Exploit Baily-Chetty logic to create ex-ante demand curve
  - Conduct utilitarian/ex-ante welfare analysis
- DWL and Ex-ante welfare can differ in conclusions about:
  - Optimal size of insurance market
  - Welfare cost of adverse selection
  - Competitive markets vs. mandates
  - Difference between DWL and Ex-ante welfare increasing in size of risk

# Reclassification Risk

- Suppose there are $T$ periods
  - No discounting for simplicity
- Each period, medical spending shock $m_t$ is realized
  - Shocks can be persistent: future $m_{t+1}$ correlated with $m_t$
  - No choice in $m_t$ (can be extended)
- Ex-Ante (time 0) budget constraint

$$E\left[\sum_t c_t\right] = E\left[\sum_t y\right] - E\left[\sum_t m_t\right]$$

  - Equivalent to selling claims to $y_t$ and buying insurance in competitive ex-ante market to cover cost, $m_t$ (price in the market equals probability)
- Utility given by

$$E\left[\sum_t u\left(c_t\right)\right]$$

# Reclassification Risk

- Ex-ante optimal allocation, $\{c_t\}$, solves

$$u'(c_t) = \lambda \quad \forall t$$

  where $\lambda$ is the lagrange multiplier on the budget constraint
- Individuals are fully insured
  - State independent utility implies $c_t = \bar{c} = E\left[\sum_t y\right] - E\left[\sum_t m_t\right]$

# Implementing the Optimal Allocation

- Are ex-ante contingent claims time-consistent?
  - No. Suppose you get a positive health shock – might want to withdraw and consume future endowment
    - Requires commitment to sell future income stream to cover health costs
    - But healthy people might want to leave!
- Cochrane (1996): Can implement with 1-period contracts
- Each period $t$ buy insurance that pays $t_t(m_{t+1})$ if $m_{t+1}$ occurs in period $t+1$ at price $q_t(m_{t+1}|m_t) = \Pr\{m_{t+1}|m_t\}$

$$c_t(m_t) + m_t + \sum_{m_{t+1}|m_t} t_t(m_{t+1})\, q_t(m_{t+1}|m_t) = y + t_{t-1}(m_t)$$

- Lagrange multiplier $\lambda_t(m_t)$ = marginal utility of consumption if $m_t$ is realized

# Time Consistent Allocation

- Consider period $t$ optimization after $m_t$ has been realized
- Can collapse period $t' > t$ budget constraints (recursively substitute out $t_t\left(m_{t+1}\right)$)

$$c_t + m_t = y - E\left[\sum_{t'>t} m_{t'} | m_t\right]$$

or

$$c_t = y - E\left[\sum_{t'\geq t} m_{t'} | m_t\right]$$

# Time Consistent Allocation

- The maximization becomes

$$\max E\left[\sum_{t'\geq t} u\left(c_t\right)|m_t\right]$$

subject to

$$c_t = y - E\left[\sum_{t'\geq t} m_{t'}|m_t\right]$$

- Claim: can equate marginal utilities across all states/time periods:

$$u'\left(c_{t'}\right) = \lambda\left(m_t\right)$$

for all $t' \geq t$

- WLOG, extend back to $t = 0$ and we can implement the first best!

# Insurance Product

- What do the insurance products look like that implement the first best?
- Each period:

$$\bar{c} + m_t + \sum_{m_{t+1}} t_t\left(m_{t+1}\right) q_t\left(m_{t+1} | m_t\right) = y + t_{t-1}\left(m_t\right)$$

or

$$\bar{c} + m_t + E\left[t_t\left(m_{t+1}\right) | m_t\right] = y + t_{t-1}\left(m_t\right)$$

or

$$t_{t-1}\left(m_t\right) = \underbrace{m_t + \bar{c} - y}_{\text{Net Deficit}} + \underbrace{E\left[t_t\left(m_{t+1}\right) | m_t\right]}_{\text{Future Insurance Cost}}$$

- Payments, $t_{t-1}\left(m_t\right)$, are increasing in $m_t$ for **two** reasons:
  - Medical shock, $m_t$
  - Impact of $m_t$ on future insurance costs, $E\left[t_t\left(m_{t+1}\right) | m_t\right]$
    - "Reclassification Risk"

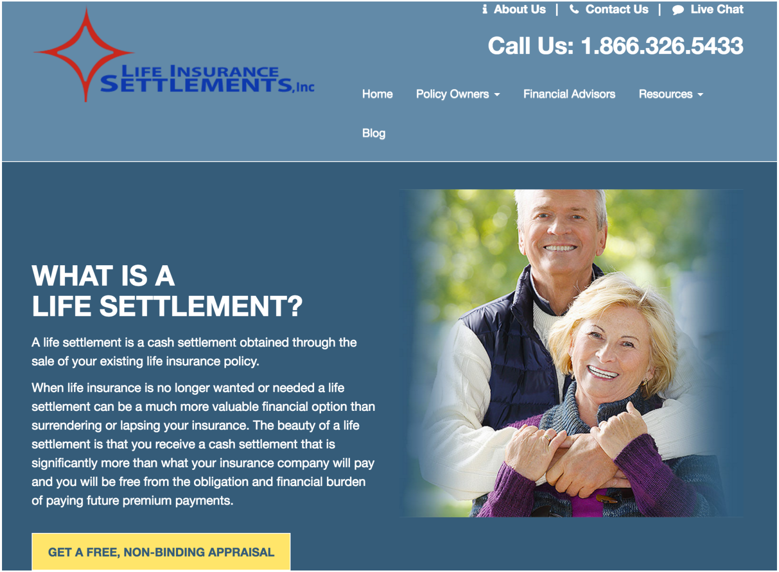
# Reclassification Risk: Commitment

- But, we don't see markets for "reclassification risk" insurance
  - Why?
- Private information about future realizations of $m_t$
  - Akerlof unraveling?
  - No evidence of this, but could be true...
- Lack of 1-period commitment (Hendel and Lizzeri, 2003)
  - Good realizations of $m_t$ may induce people to "run" from the contract
    - Can implement with zero profits in each period, but requires $t_t\left(m_{t+1}\right) < 0$ for some realizations of $m_{t+1}$
    - Incentive to leave the contract and not pay!

# Front-Loading

- Solution: Front-load the contract!
  - Pay the insurer lump sum upfront
  - Can sustain $t_t(m_{t+1}) \geq 0$ in all future periods so that consumers never wish to leave the contract
  - Hendel and Lizzeri (2003) argue this explains why life insurance contracts are front-loaded
- Many reasons to want to front-load insurance contracts
  - Prevents ex-post healthy people from leaving the risk pool
- But, if front-loading helps increase commitment, should people be allowed to re-sell their insurance contracts?
  - "Life settlement" market (Fang and Kung, 2010)

# Life Settlement Market



# Secondary Markets: Fang and Kung (2010)

- Should people be allowed to re-sell their insurance contracts?
  - "Life settlement" market
- Downside: Prevents commitment
- Upside: Increases flexibility / choice
  - But choice not necessarily welfare improving with asymmetric information
- In general, if first period insurance contracts were optimal but required commitment, then re-trading in life settlement markets ex-post will reduce welfare

# Reclassification Risk

- In practice, most health insurance contracts do not look like optimal contracts in Cochrane (1996)
    - Repeated static contracts
    - Perhaps because of both commitment and private information problems?
- Opens up important questions in optimal insurance designs
    - Community rating versus adverse selection
- Handel, Hendel, and Whinston (2015, ECMA): Equilibria in Health Exchanges: Adverse Selection versus Reclassification Risk

# Handel, Hendel, and Whinston (ECMA, 2015)

- Simulate model of health insurance with repeated static insurance contracts
  - Community rating: everyone pays same price
  - Risk-based pricing: prices of insurance is risk-rated
- Community rating generates adverse selection within periods
  - Healthy people don't buy insurance
    - Wait until they're sick to buy
  - Leads prices for insurance to be too high
- Risk-based pricing generates risk against the realization of health conditions
  - Expose to reclassification risk: higher price of insurance if sick
- Results: community rating generates signfiicant adverse selection but 5x higher welfare than risk-based pricing
  - Reduces reclassification risk!

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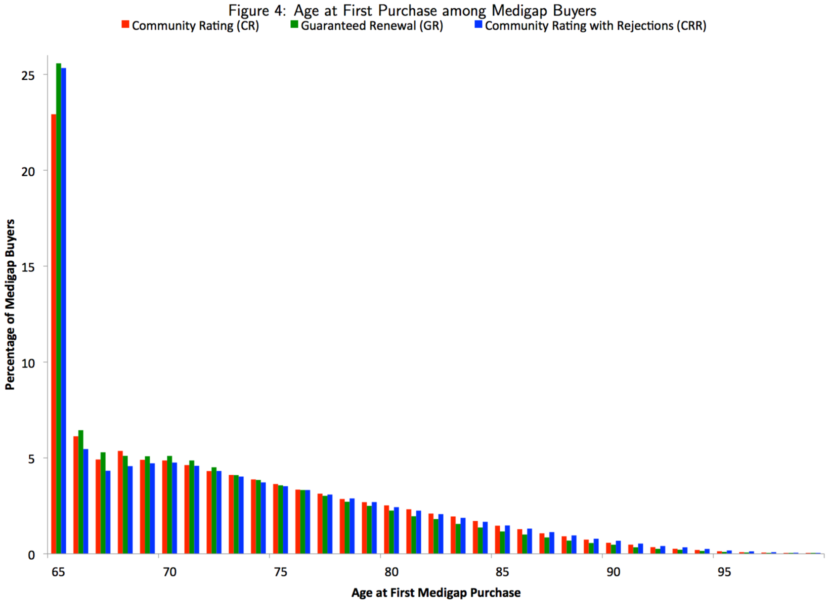
# Curto (2016)

- Curto (2016): "Pricing Regulations in Individual Health Insurance: Evidence from Medigap"
- Studies Medigap Market
  - Medicare pays 80% of bills; coinsurance of 20%
  - Medigap reduces this 20% (several standardized/regulated policies available)
- Two regulatory regimes that vary by states:
  - Community rating for all ages
  - Open enrollment period (6-months) at age 65
    - Followed by ability of insurers to underwrite post age 65
    - But, if purchased at age 65, policy is guaranteed renewable

# Curto (2016)

- Incentives under community rating?
  - Wait until sick to buy Medigap...
- Curto (2016) provides evidence for this strategic behavior
- Empirical strategies:
  - Compare take-up across states with different policies
  - Robustness: explore differences only along border discontinuities

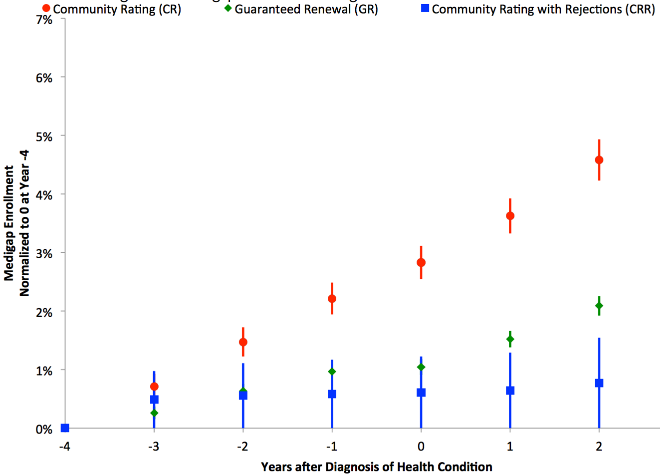
# Curto (2016)




Notes: This figure shows a histogram of age at first Medigap purchase among Medigap buyers. The sample is restricted to individuals living in Community

# Curto (2016)

Figure 12: Medigap Enrollment during Onset of Chronic Health Condition




Notes: This figure shows estimates of Medigap enrollment for each of the years prior to and after the onset of a chronic health condition. The chronic health conditions examined are severe cancers including those of the lung and upper digestive tract. The sample is all aged Medicare beneficiaries ever diagnosed with this health condition between 2006 and 2010. Year 0 is defined as the first year the health condition was diagnosed. Estimated coefficients are obtained from a regression of Medigap coverage on yearly indicators and individual fixed effects. The bars show 95 percent confidence intervals.

# Market Power and Provider Networks

- Considerable evidence of lack of competition in several dimensions:
    - Health insurers
    - Health providers
- Additional reason for insurance: bargaining power with providers
- Generates role of provider networks
    - Ability to go to some but not all hospitals

# Shepard (2016)

- Shepard (2016), "Hospital Network Competition and Adverse Selection: Evidence from the Massachusetts Health Insurance Exchange"
- Star hospitals (e.g. MGH) attract sicker patients (adverse selection) and also cause an increases in costs (moral hazard)
- But, people have strong demand for them!
  - Adverse selection can lead to inefficiently low coverage of star hospitals
  - But, adverse selection can reduce market power effects
    - higher prices -> higher costs -> less incentive to raise prices and exploit market power
- [Aside: Thanks to Mark Shepard for sharing his presentation slides!]

# High-Price Star Hospitals: Partners Healthcare

- **Price**: Estimated with model of average amount paid per admission, adjusted for patient severity → *Details*

Star Hospitals
**Partners Healthcare**

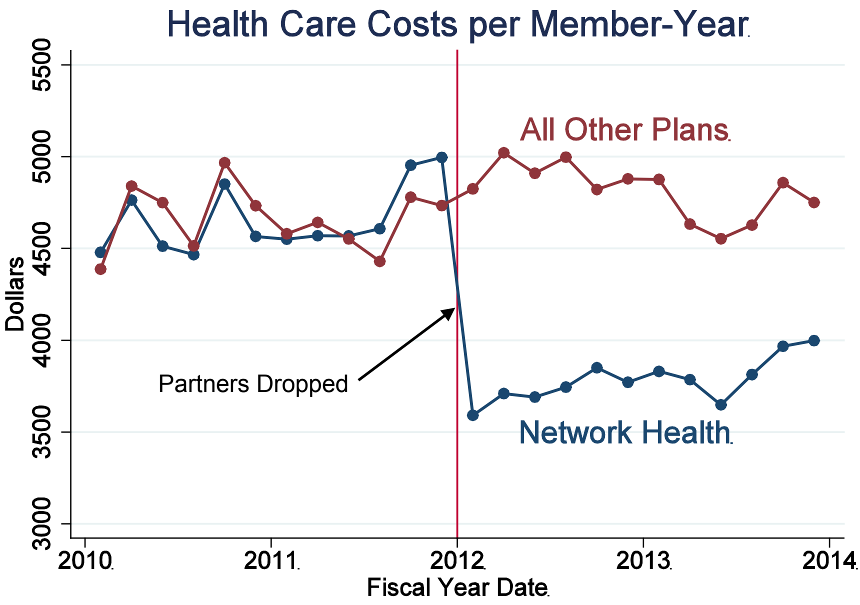
| | Hospital | System | Average Values | |
|---|---|---|---|---|
| | | | Price | Severity |
| 1 | Brigham & Women's | Partners | $20,474 | 1.12 |
| 2 | Mass. General | Partners | $19,550 | 1.09 |
| 3 | Boston Med. Ctr. | BMC | $15,919 | 1.05 |
| 4 | Tufts Med. Ctr. | Tufts | $14,038 | 1.10 |
| 5 | UMass Med. Ctr. | UMass | $14,111 | 1.07 |
| 6 | Charlton Memorial | Southcoast | $14,210 | 1.03 |
| 7 | Baystate Med. Ctr. | Baystate | $12,223 | 1.11 |
| 8 | Lahey Clinic | Lahey | $11,742 | 1.13 |
| 9 | Beth Israel Deaconess | CareGroup | $11,787 | 1.08 |
| 10 | St. Vincent | Vanguard | $11,455 | 1.03 |
| | *All Other Hospitals* | --- | *$8,585* | *0.95* |

# Evidence from Network Changes

- **Additional evidence**: How do selection patterns, costs respond to change in network coverage of Partners?

- **Biggest change** : Large plan (Network Health) drops Partners (+ several other hospitals) in 2012

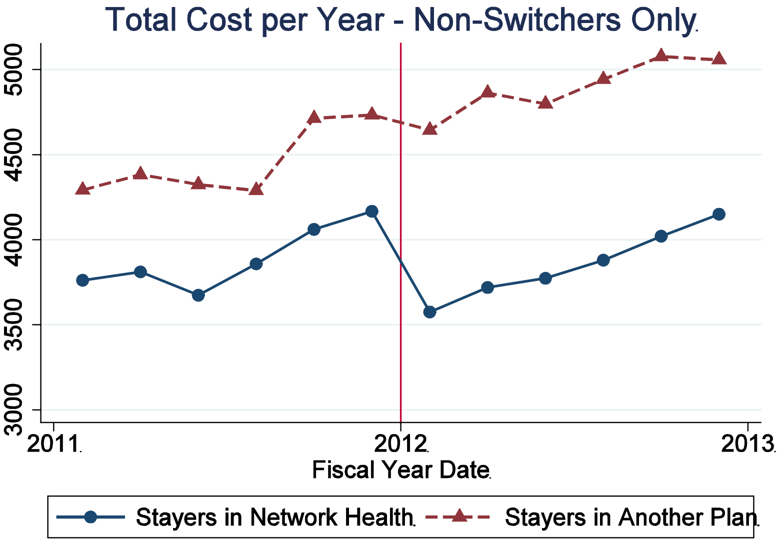
- How did network changes affect selection and costs?
  - **Selection**: Look at plan switching
  - **Cost changes (moral hazard)**: Analyze cost changes for non-switchers


Health Care Costs per Member-Year
Dollars
5500
5000
4500
4000
3500
3000
All Other Plans
Partners Dropped
Network Health
2010
2011
2012
2013
2014
Fiscal Year Date

# Shepard (2016): Main Results

- Costs to policy decrease after Network Health plan drops Partners
- Is this moral hazard or adverse selection?
  - Study costs on those who don't switch policies
  - Finds some reduction in costs
  - Indicates "moral hazard'

# Evidence of Overall Cost Reductions for Stayers




*Note: Points are group x time coeffs. from regression with individual fixed effects.*

# Shepard (2016): Main Results

- Paper sets up structural model to:
  - Study the welfare impact of covering a star hospital?
    - e.g. do too few or too many plans include MGH?
  - Studies counterfactual policies (e.g. increased risk adjustment)
    - Can prevent unraveling of coverage of star hospitals
    - But this doesn't increase welfare on net
- Main Lessons:
  - Adverse selection discourages covering star hospitals
    - Adverse selection may help explain rise in narrow network plans
  - Additional non-risk channel for thinking about adverse selection: selection on use of higher-cost option
    - Do people value this from an ex-ante perspective?

# Summary and Key Lessons

- Einav, Finkelstein and Cullen (2010) provide baseline framework for welfare analysis of insurance
- But, may not capture ex-ante welfare because information is realized over time (Hendren, 2017)
- Suggests may be willing to trade off adverse selection for insurance against reclassification risk (Handel, Hendel, and Whinston, 2015)
  - But first-best would be to have dynamic re-classification contracts that insure against higher premiums in the future (Cochrane, 1996)
  - Alternatively, can front-load insurance contracts and have dynamic commitment (Hendel and Lizzeri, 2003; Curto, 2016)
    - e.g. Life insurance, LTC insurance, disability insurance, health?
- Health insurance also provides access to providers
  - Additional adverse selection on preference for hospitals
  - Creates more complicated welfare/design questions