Measuring Ex-Ante Welfare in Insurance Markets

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Revealed Preference in Insurance Markets

- How should we measure the welfare impacts of subsidies and mandates in insurance markets?

- Revealed preference theory is often used as a foundation for welfare analysis of many government policies

- Recent applications use exogenous price variation in insurance markets to measure WTP and the cost of insurance
(Einav, Finkelstein, and Cullen (2010); Hackmann, Kolstad, and Kowalski (2015); Finkelstein, Hendren, and Shepard (2017); …)

- Comparing WTP to cost provides a measure of DWL/market surplus of subsidies and mandates
  - If cost exceeds WTP, subsidies impose DWL

DWL/Market Surplus Can Be Misleading…

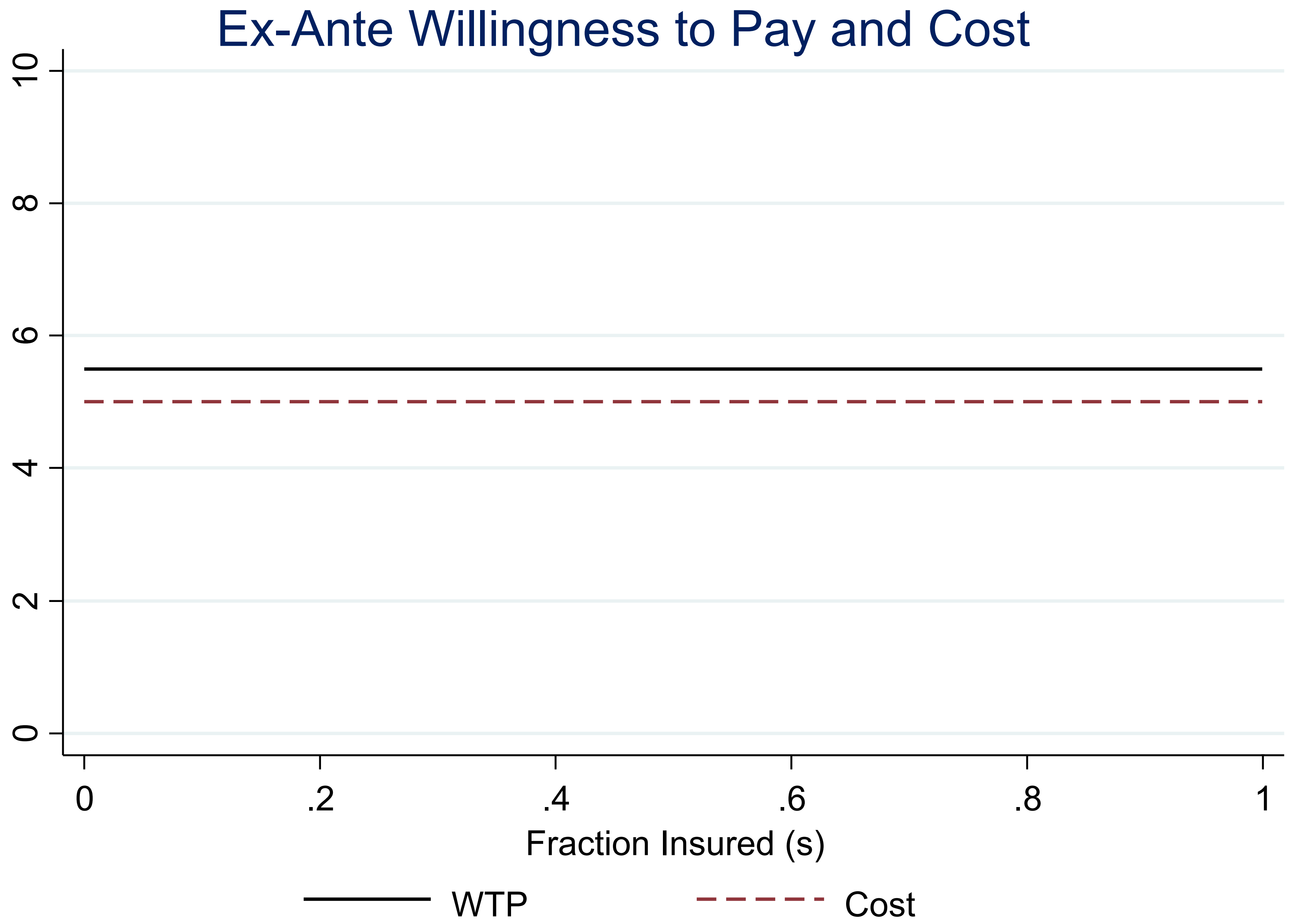
- Information evolves over time, and people may have knowledge about risk when measuring demand
  - LTC, Disability, Life insurance (Hendren, 2013)
  - Dental Insurance (Cabral, 2017)
  - Unemployment insurance (Hendren, 2016)
  - Health insurance (Cardon and Hendel, 2001; Handel, 2013; Handel, Hendel, and Whinston, 2015)

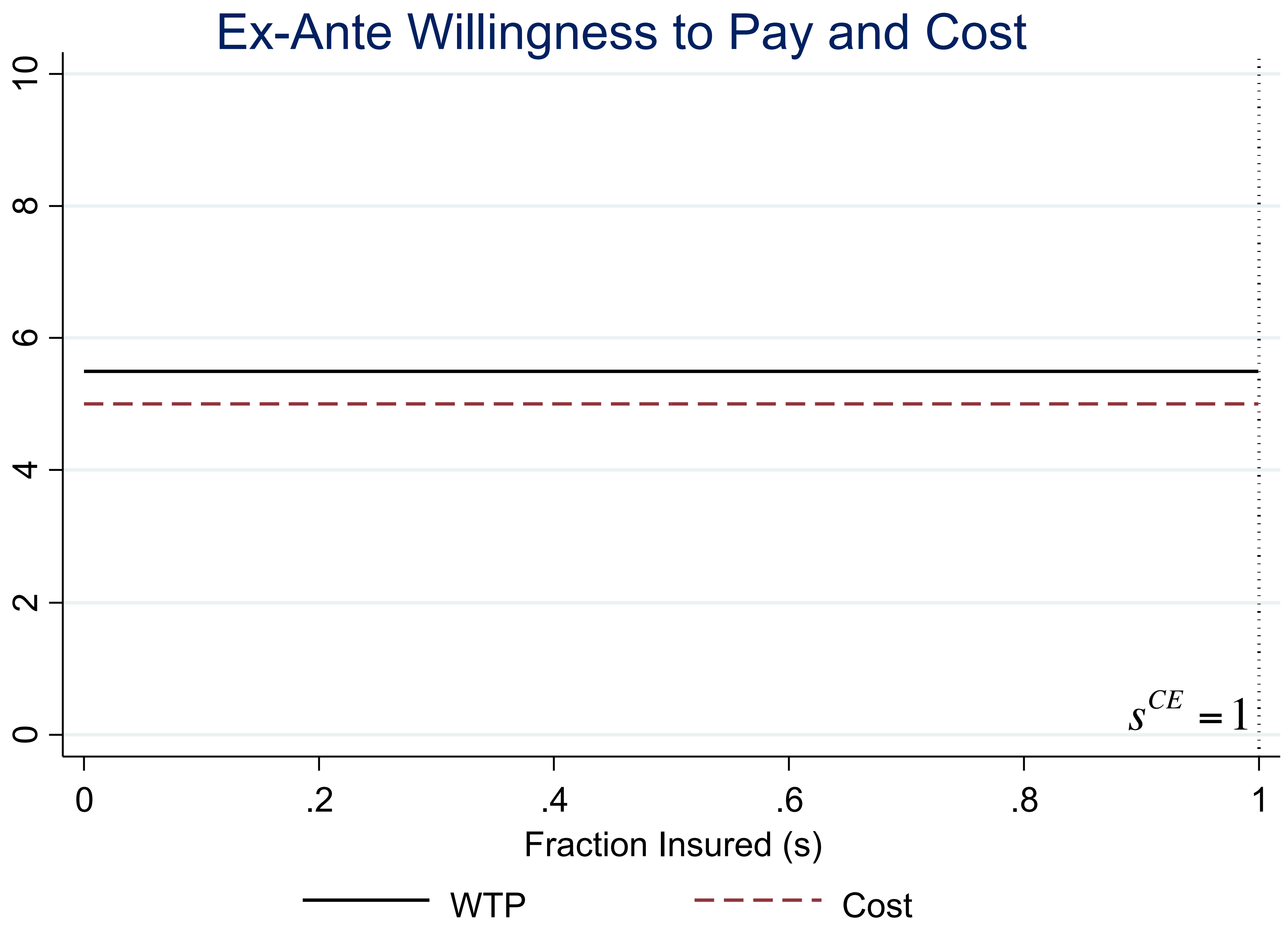
- Well-known that this can generate adverse selection, but less appreciated that textbook notions of market surplus do not measure canonical notions of expected utility

- Depends on when choices happen to be measured (Hirshleifer, 1971)

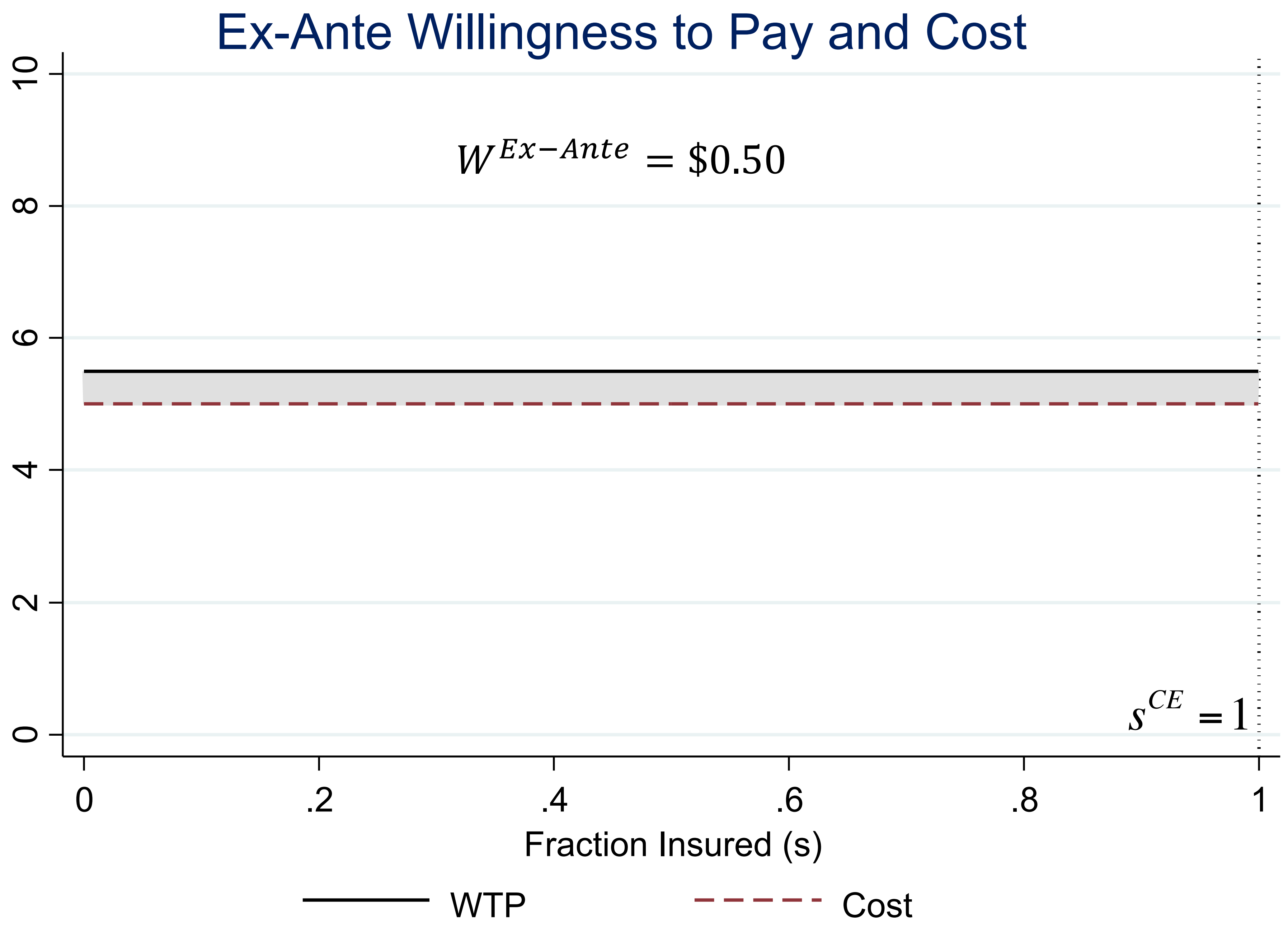
Motivating Example

- Individuals have \$30
- 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 $[20,30]$
- Suppose we observe exogenous price variation for insurance
  - What would be the WTP and cost curves?


Ex-Ante Willingness to Pay and Cost
0
2
4
6
8
10
0
.2
.4
.6
.8
1
Fraction Insured (s)
WTP
Cost



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

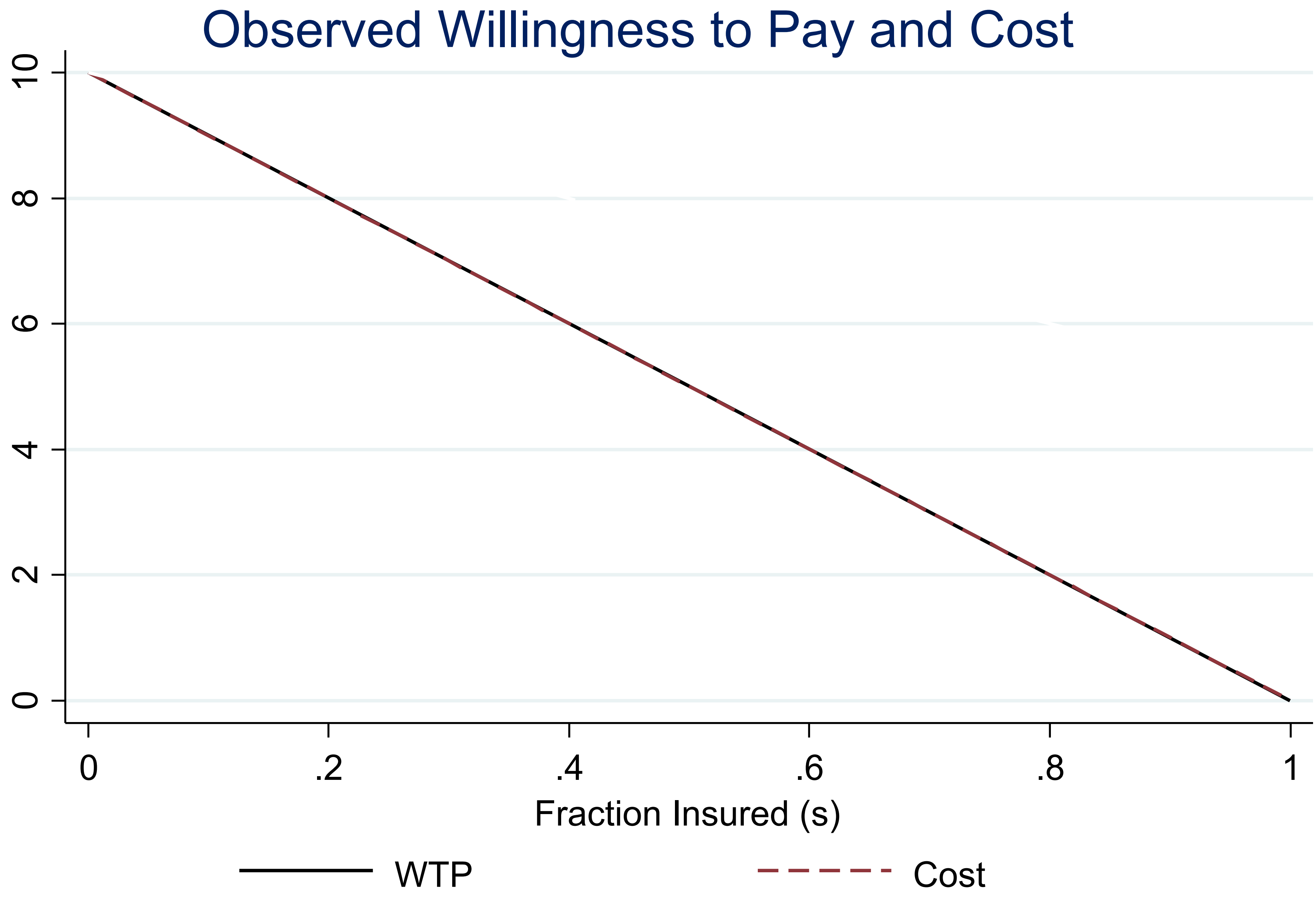

Ex-Ante Willingness to Pay and Cost
$W^{Ex-Ante} = \$0.50$
$s^{CE} = 1$
0
2
4
6
8
10
0
.2
.4
.6
.8
1
Fraction Insured (s)
WTP
Cost

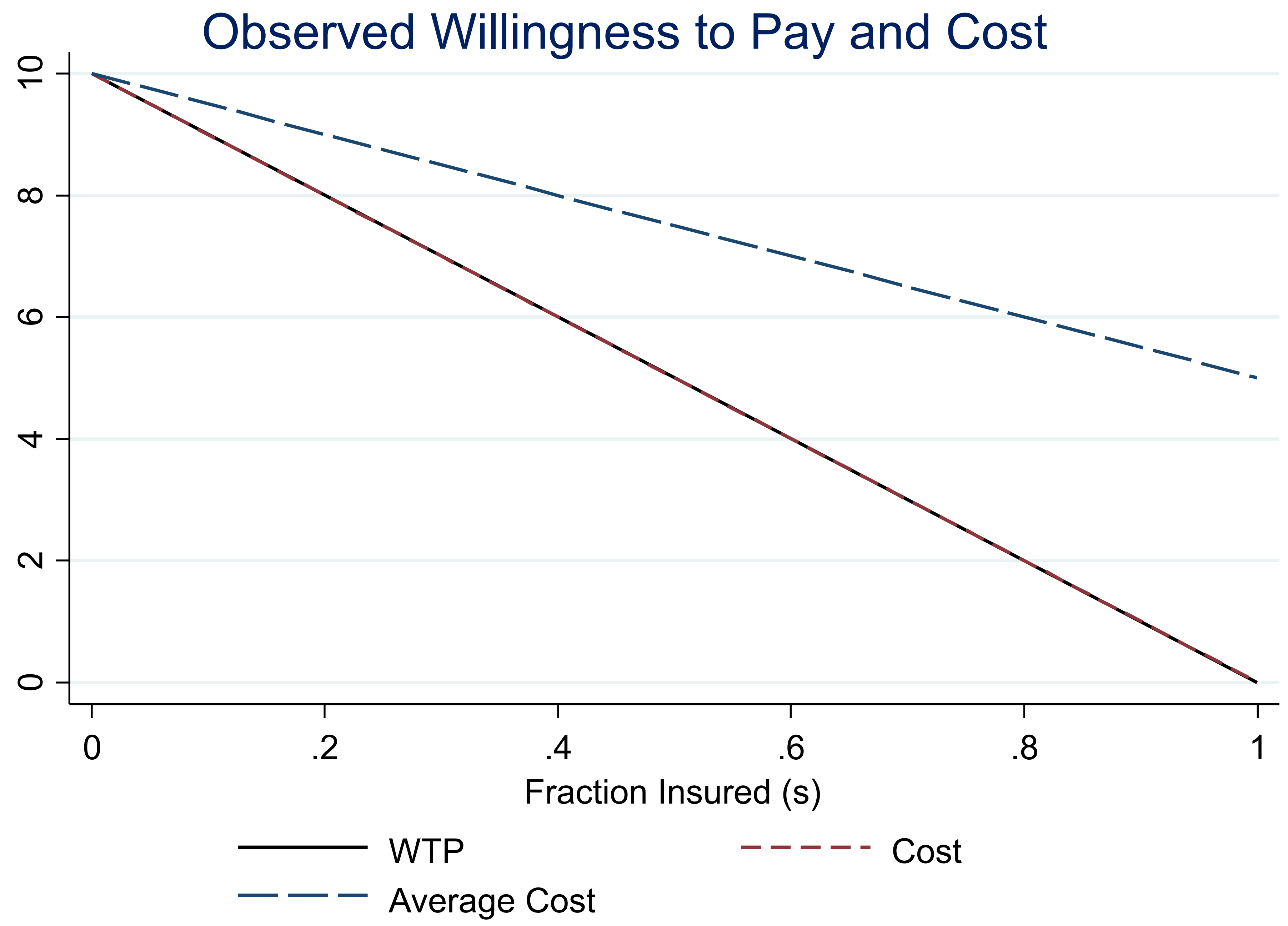
Motivating Example

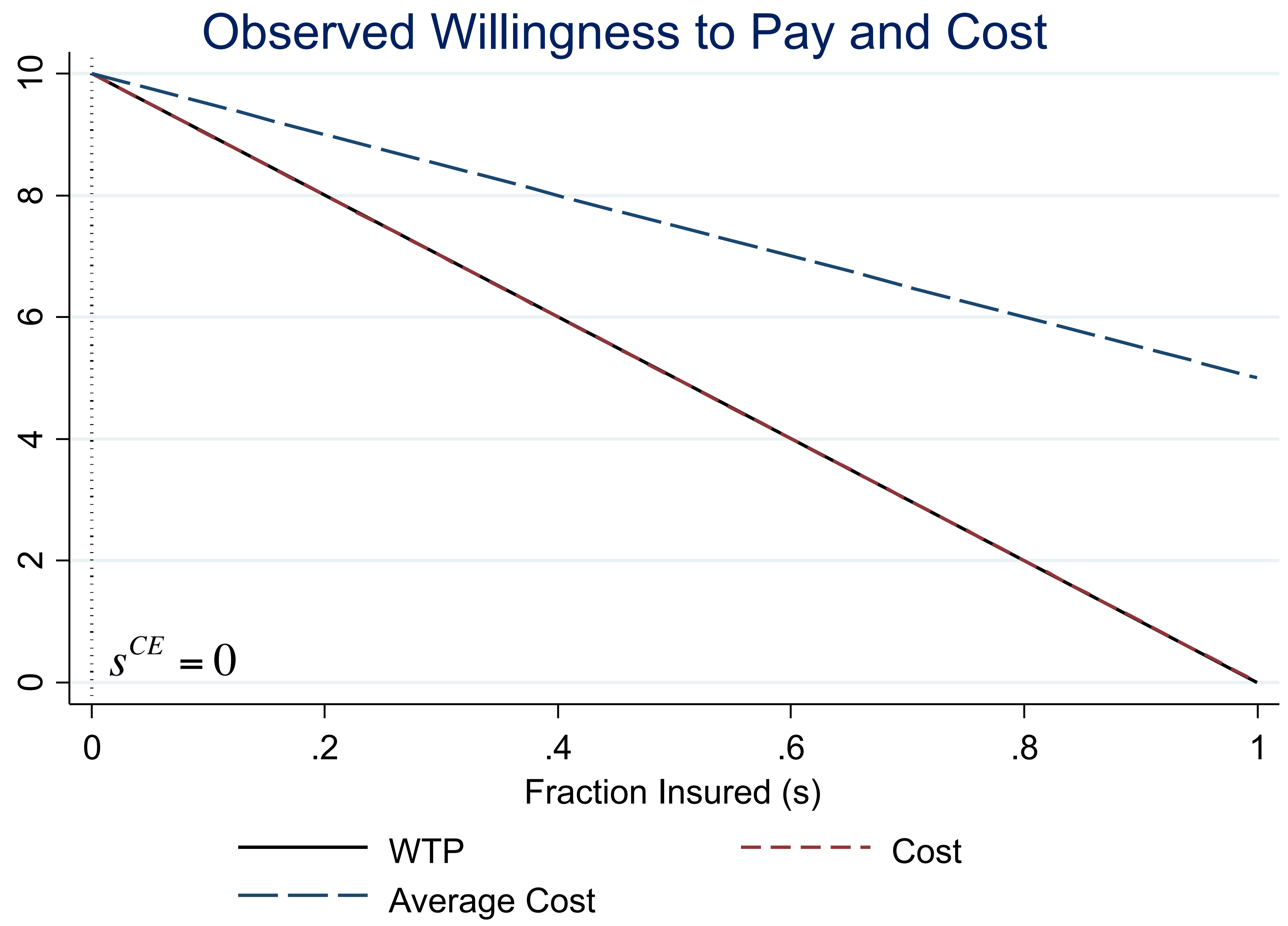
- What if people have information about their risk when we measure demand?

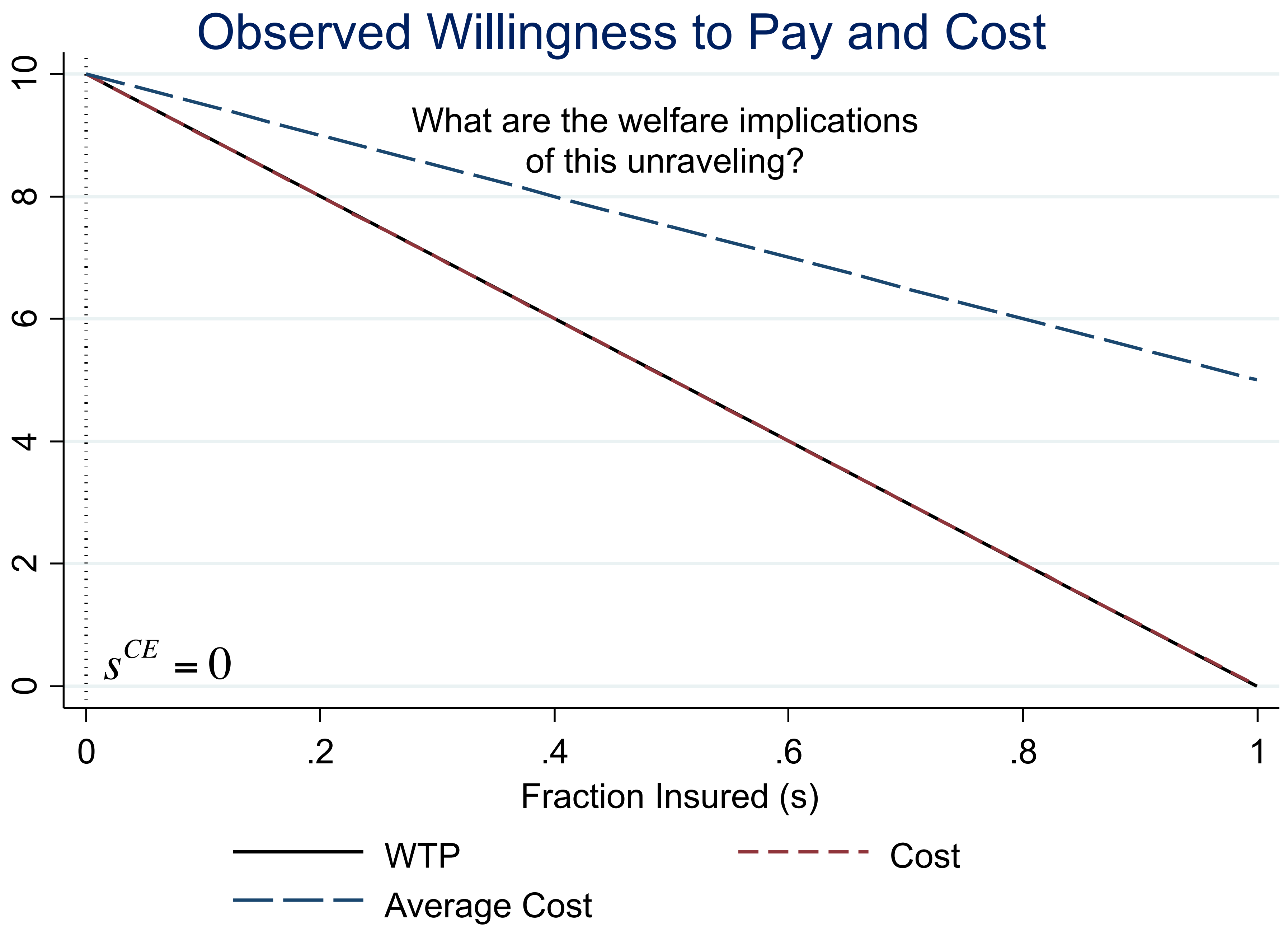
- Begin with extreme case: suppose individuals learn their loss

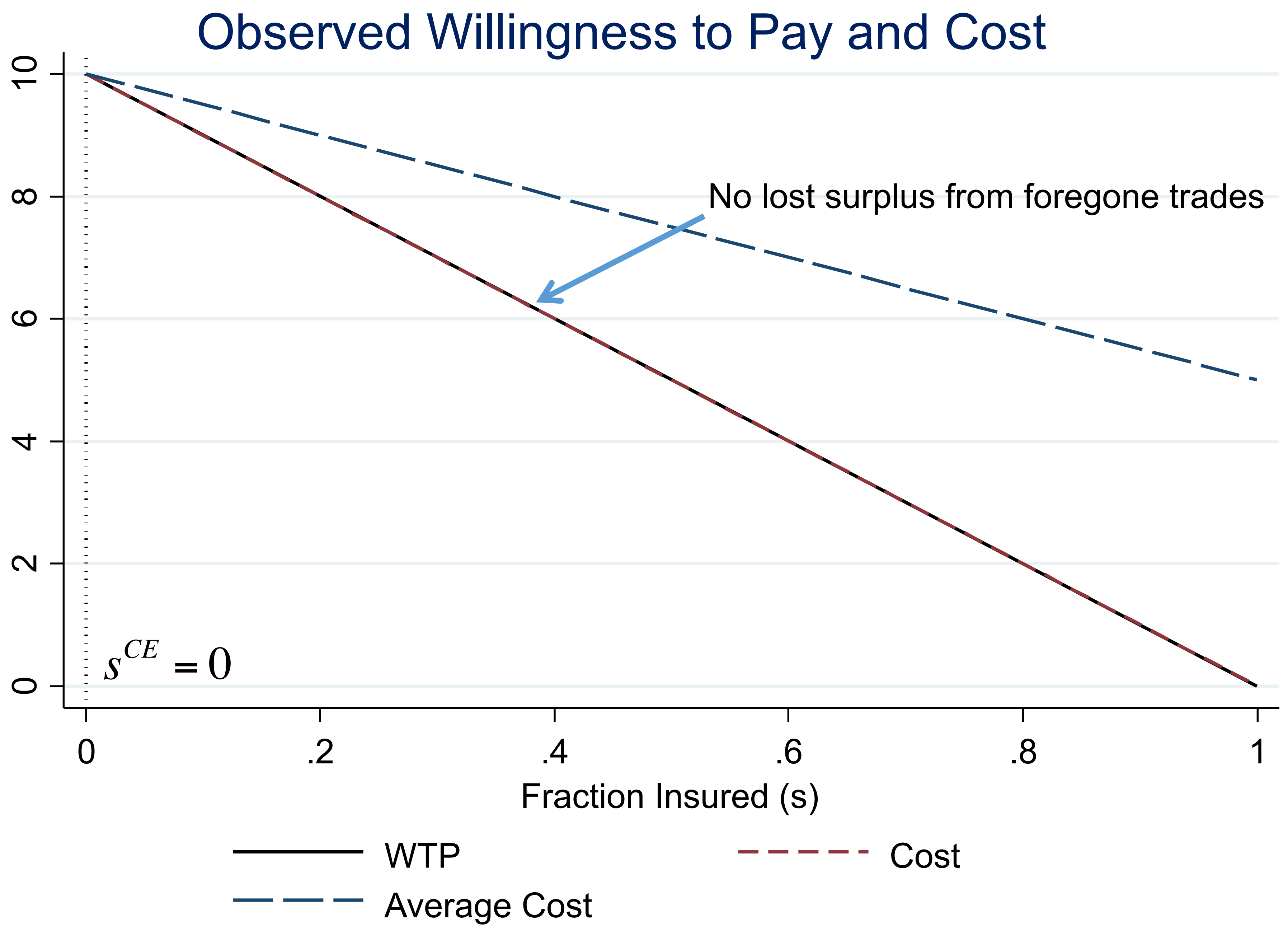
  – Willingness to pay (“demand”) equals cost, $D(s) = m(s)$


Observed Willingness to Pay and Cost
0
2
4
6
8
10
0
.2
.4
.6
.8
1
Fraction Insured (s)
WTP
Cost


Observed Willingness to Pay and Cost
0
2
4
6
8
10
0
.2
.4
.6
.8
1
Fraction Insured (s)
WTP
Cost
Average Cost


Observed Willingness to Pay and Cost
10
8
6
4
2
0
$s^{CE} = 0$
0
.2
.4
.6
.8
1
Fraction Insured (s)
WTP
Cost
Average Cost

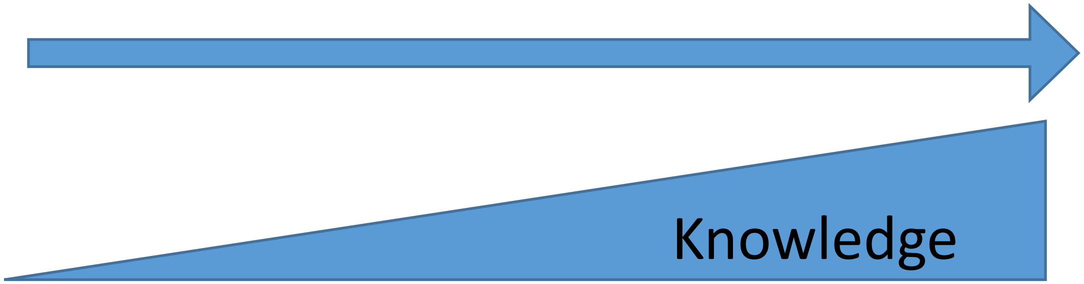

Observed Willingness to Pay and Cost
What are the welfare implications
of this unraveling?
$s^{CE} = 0$
0
2
4
6
8
10
0
.2
.4
.6
.8
1
Fraction Insured (s)
WTP
Cost
Average Cost



Observed Willingness to Pay and Cost
No lost surplus from foregone trades
$s^{CE} = 0$
0
2
4
6
8
10
0
.2
.4
.6
.8
1
Fraction Insured (s)
WTP
Cost
Average Cost

Timeline of Information Revelation and Insurance Purchase

Ex-Ante:
$E[u(c)]$
or
$E[u(c)|X]$



Event
Realized,
$u(c)$

Timeline of Information Revelation and Insurance Purchase

Ex-Ante:
$E[u(c)]$
or
$E[u(c)|X]$

Knowledge

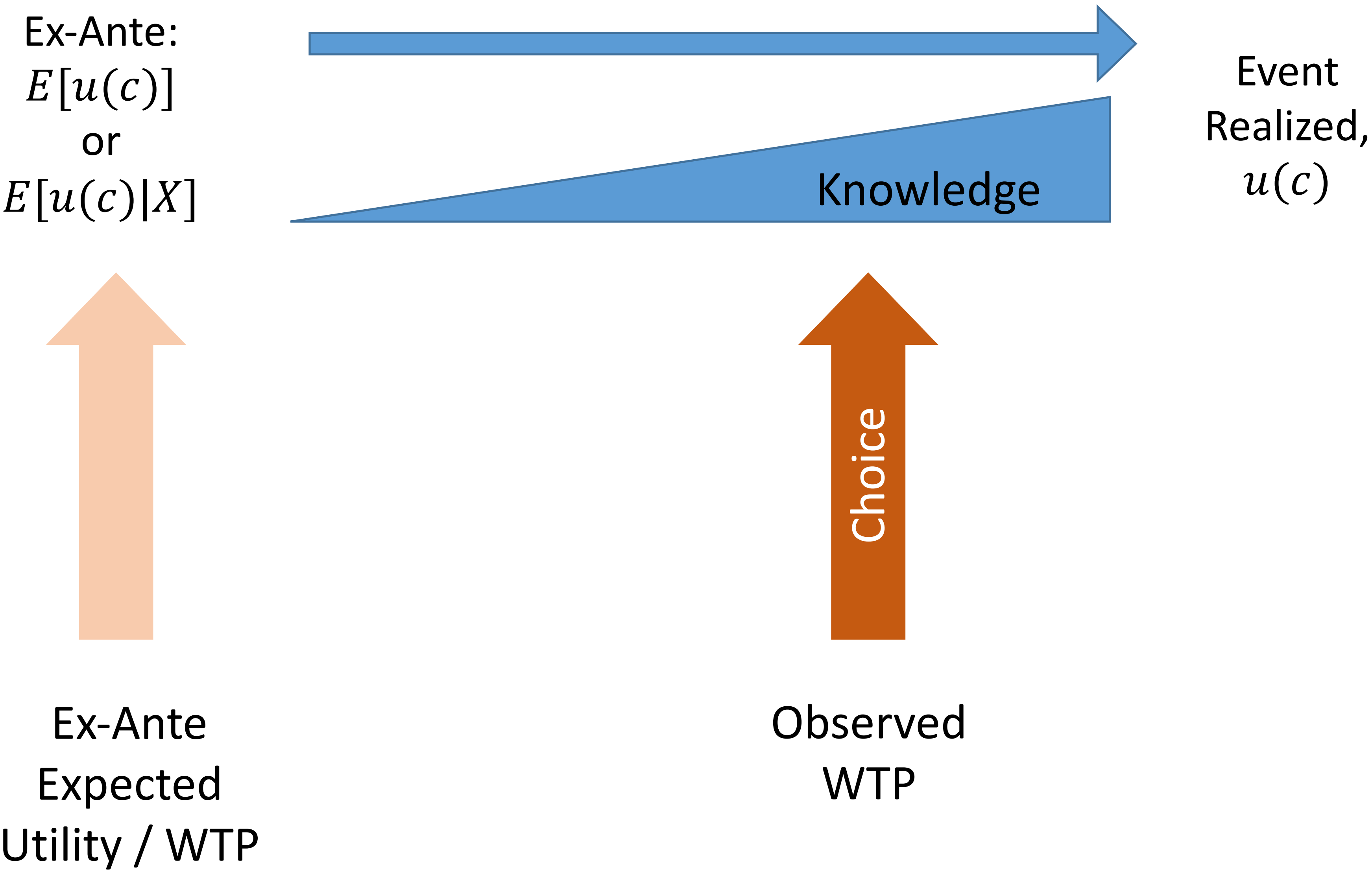
Event
Realized,
$u(c)$

Choice

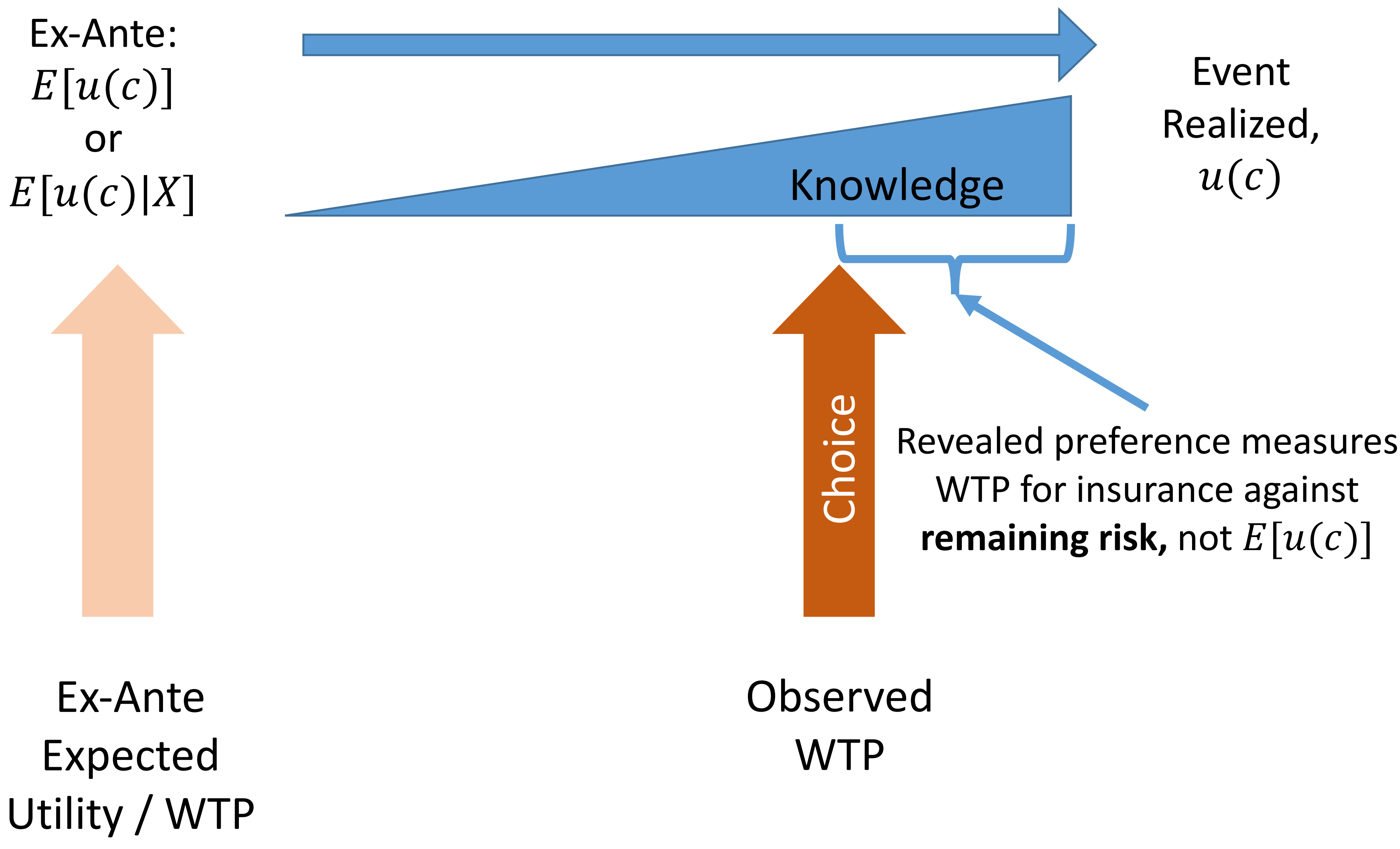
If choices are made prior to info revelation, revealed preference measures ex-ante utility, E[u(c)]

Ex-Ante
Expected
Utility / WTP

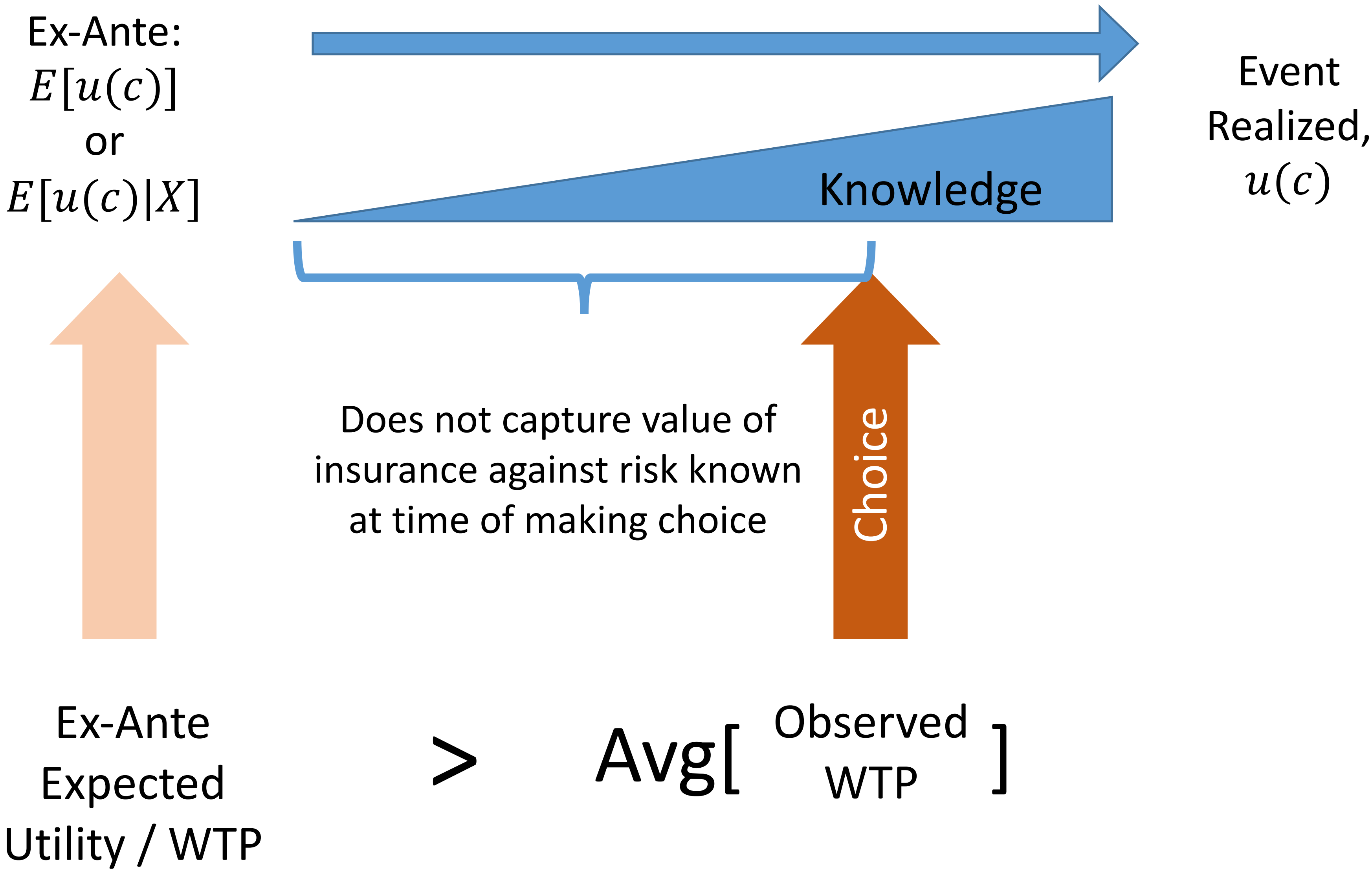
Timeline of Information Revelation and Insurance Purchase



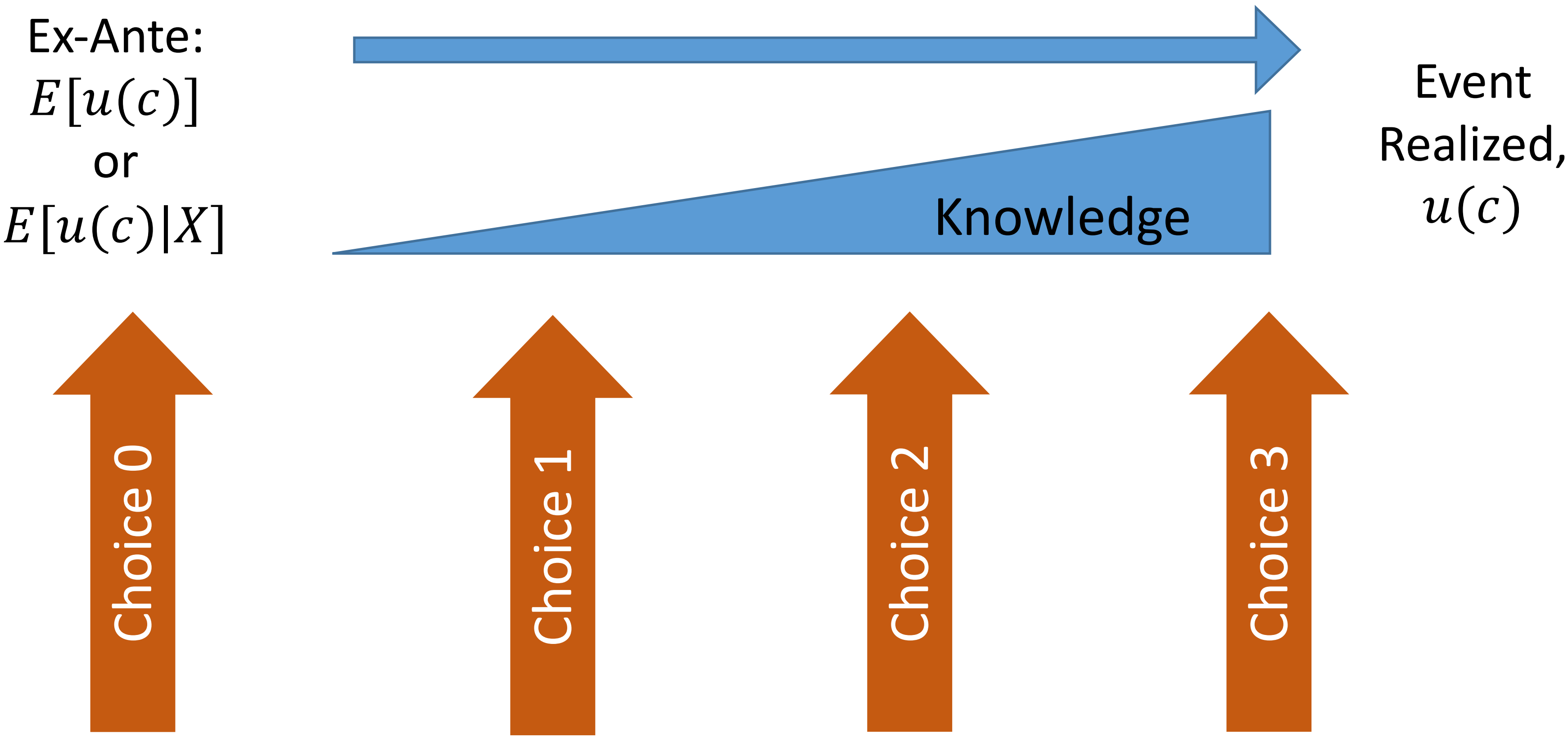
Timeline of Information Revelation and Insurance Purchase



Timeline of Information Revelation and Insurance Purchase

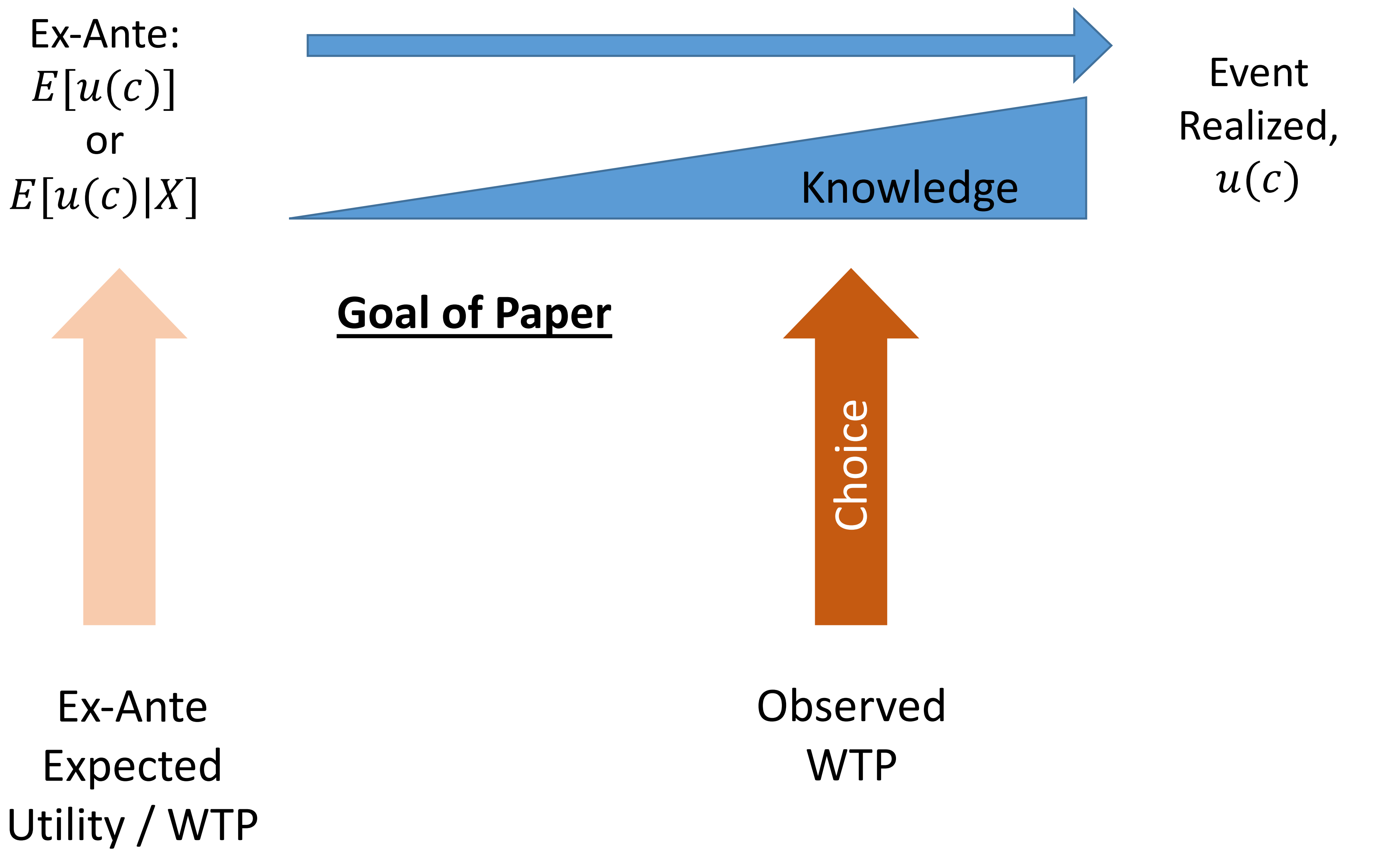


Market Surplus/DWL Depends on When WTP is Measured

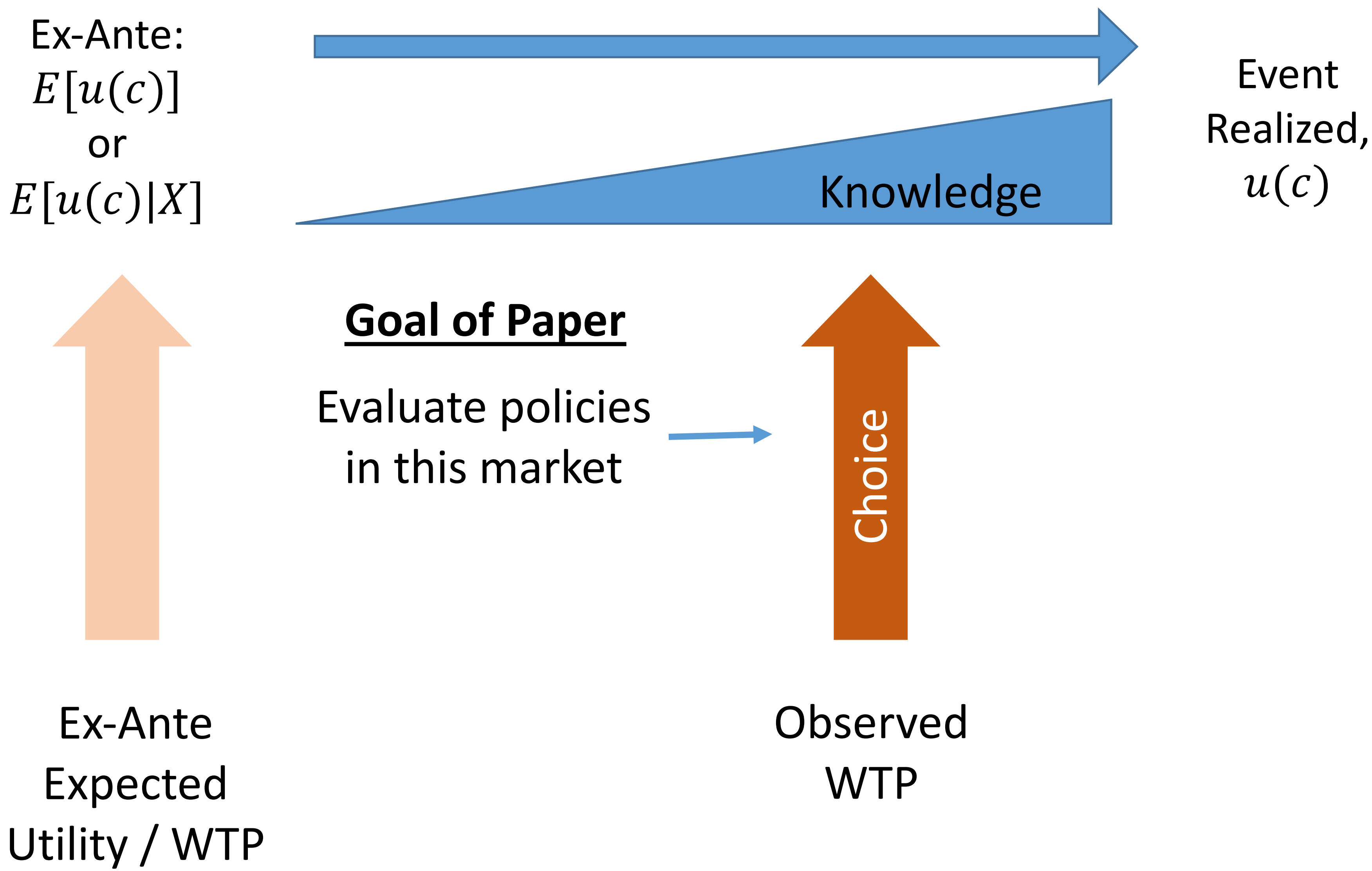


$$\text{WTP}_{\text{Ex-Ante}} \geq E[\text{WTP}_1] \geq E[\text{WTP}_2] \geq E[\text{WTP}_3] = \text{Cost}$$

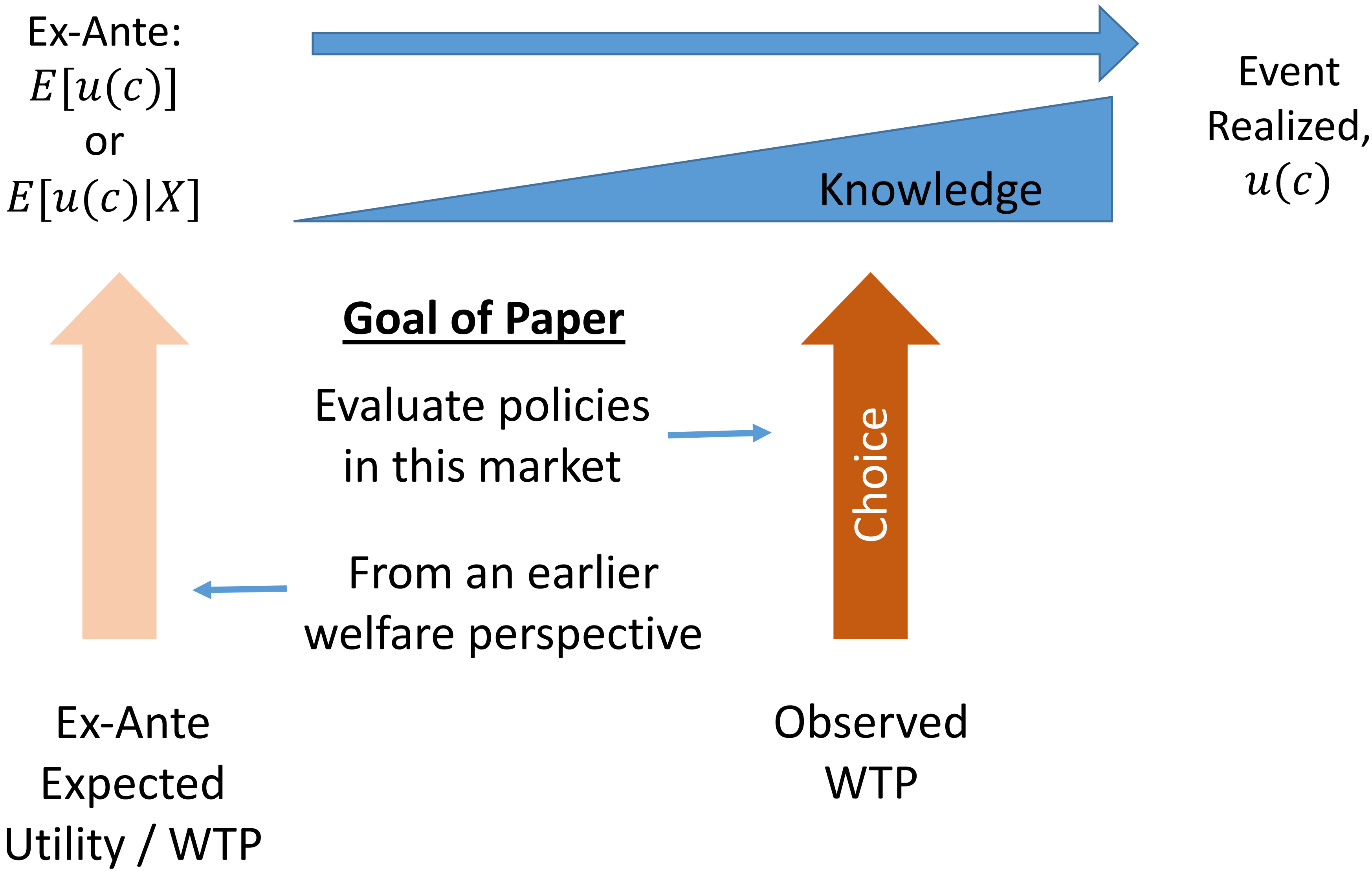
Goal of Paper: Recover Expected Utility



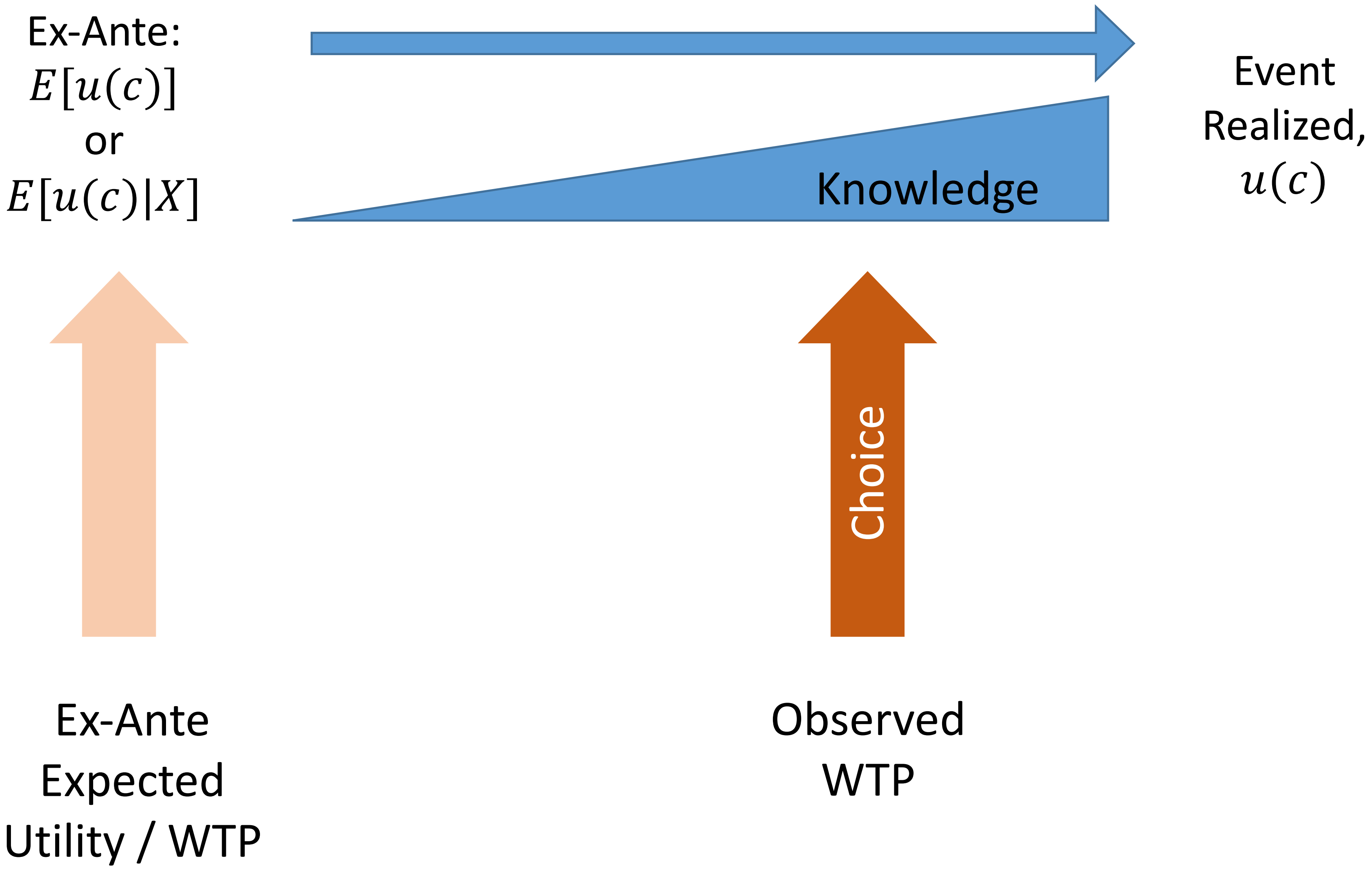
Goal of Paper: Recover Expected Utility



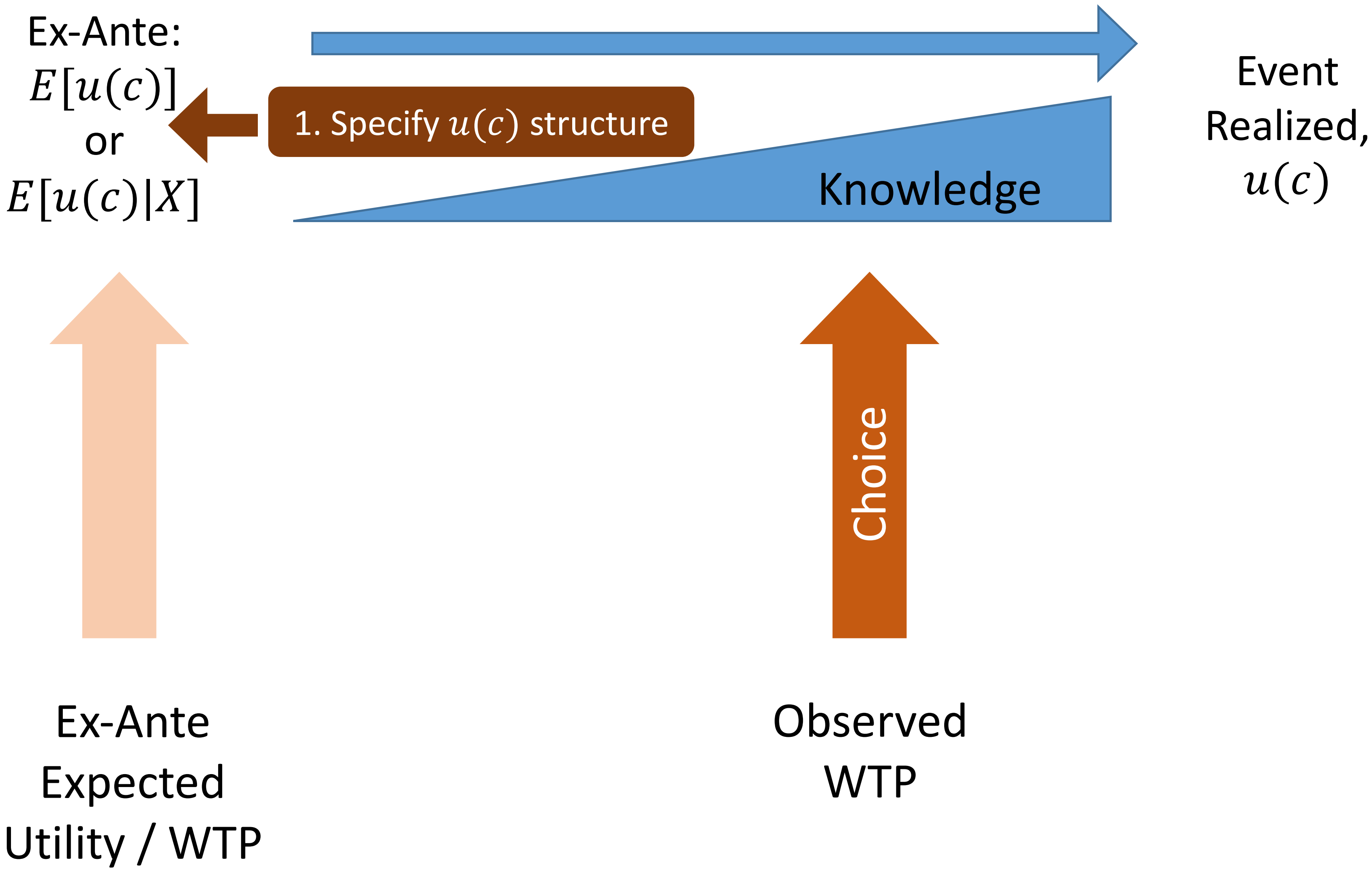
Goal of Paper: Recover Expected Utility



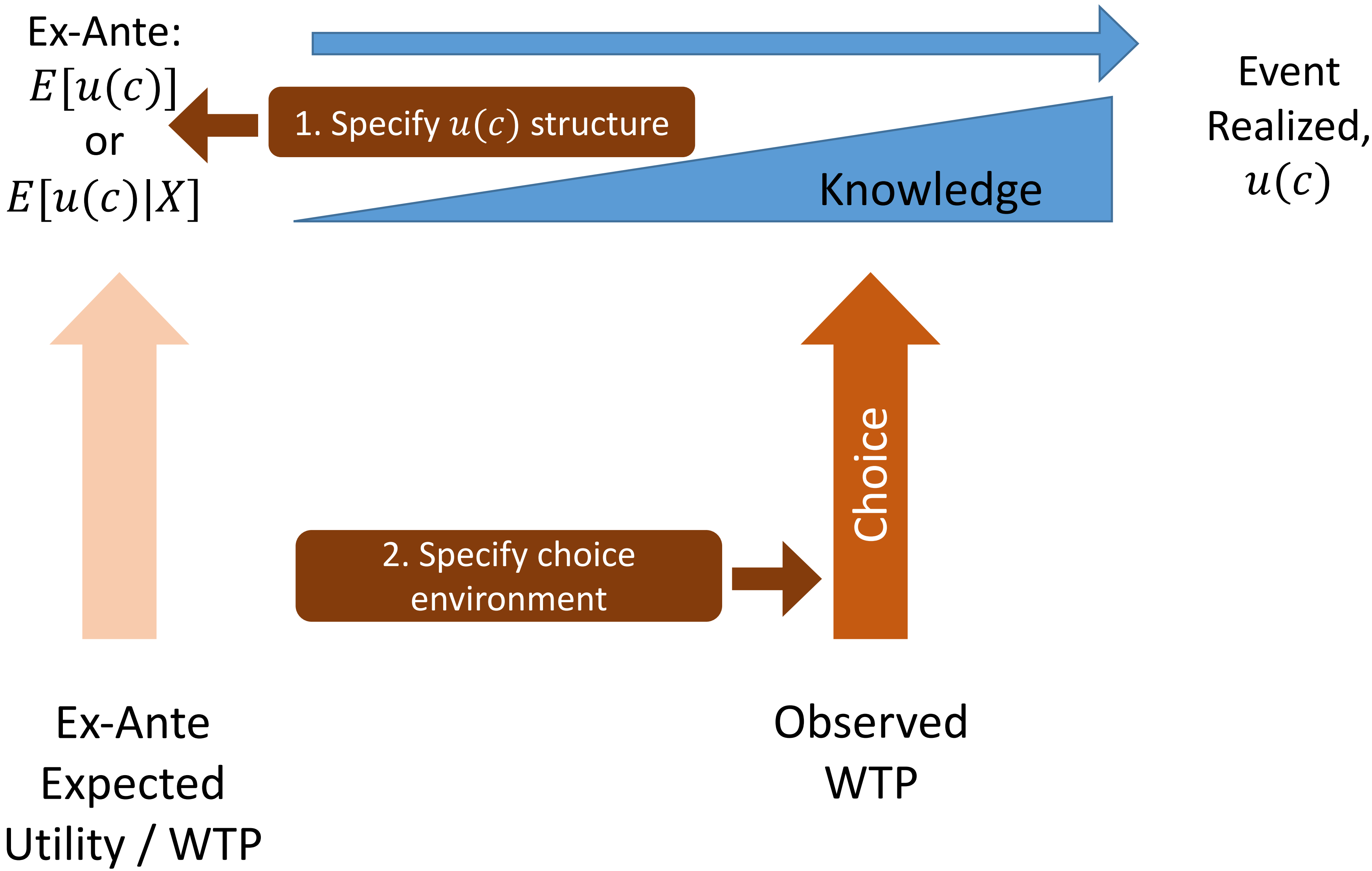
Traditional Approach



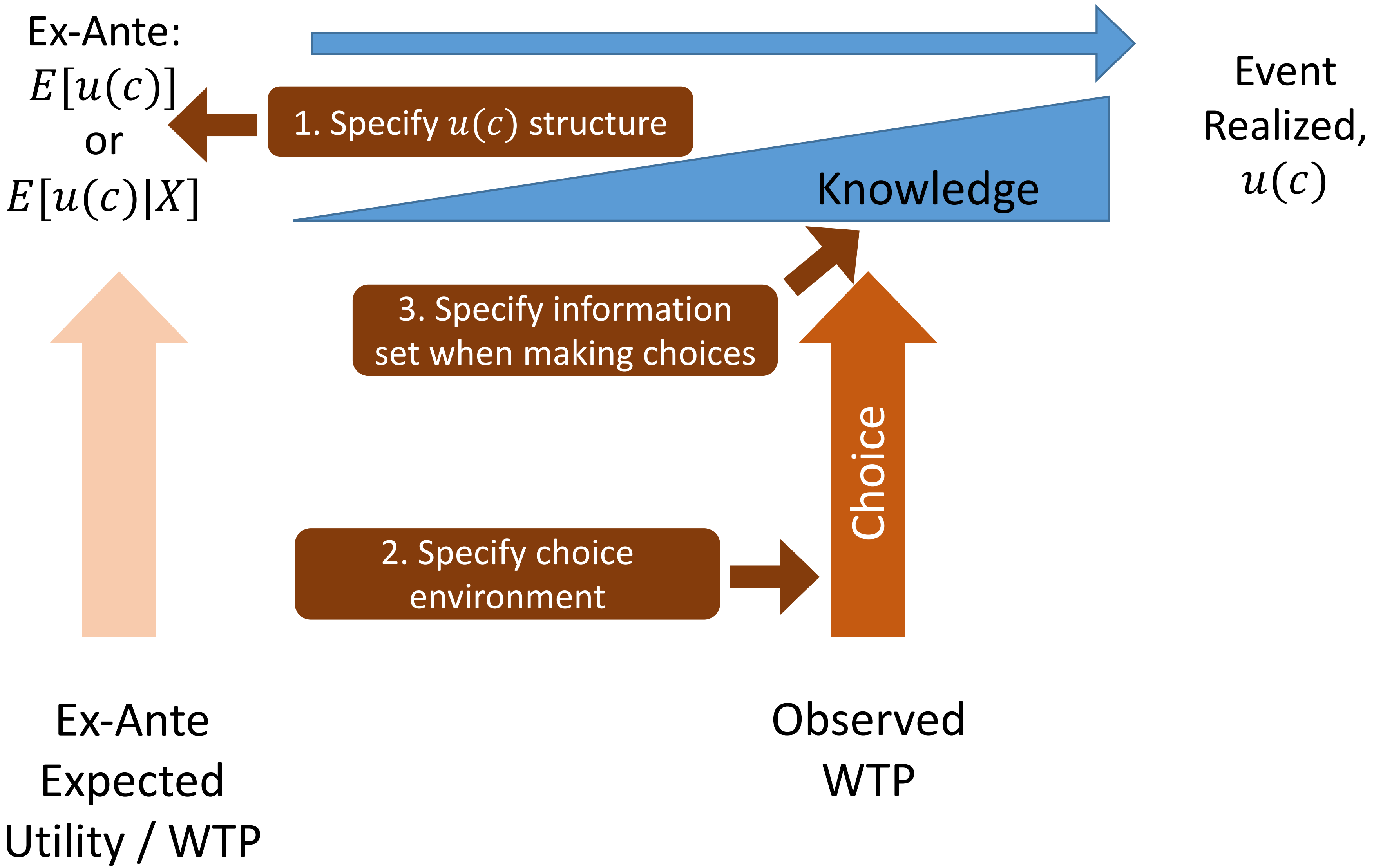
Traditional Approach



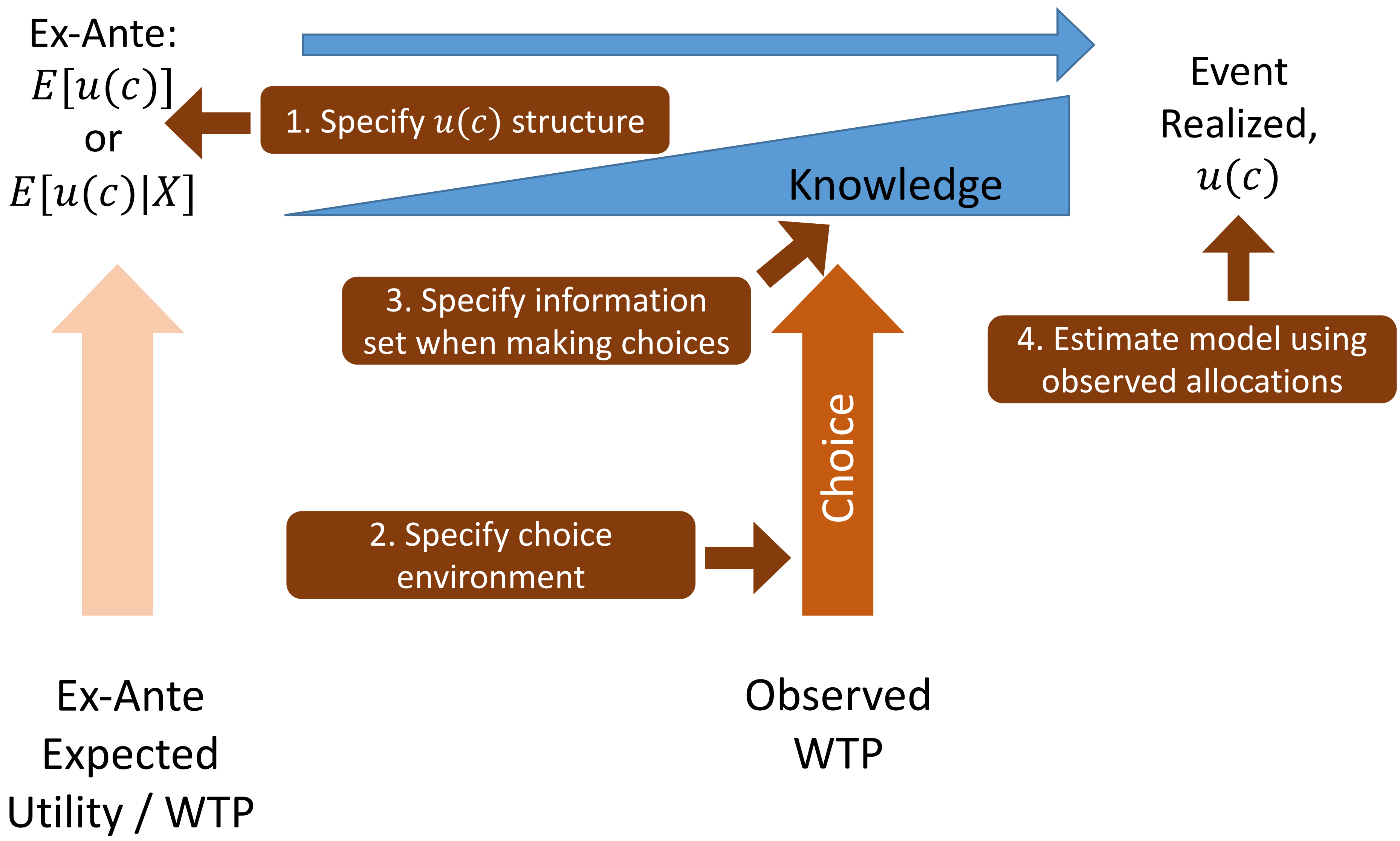
Traditional Approach



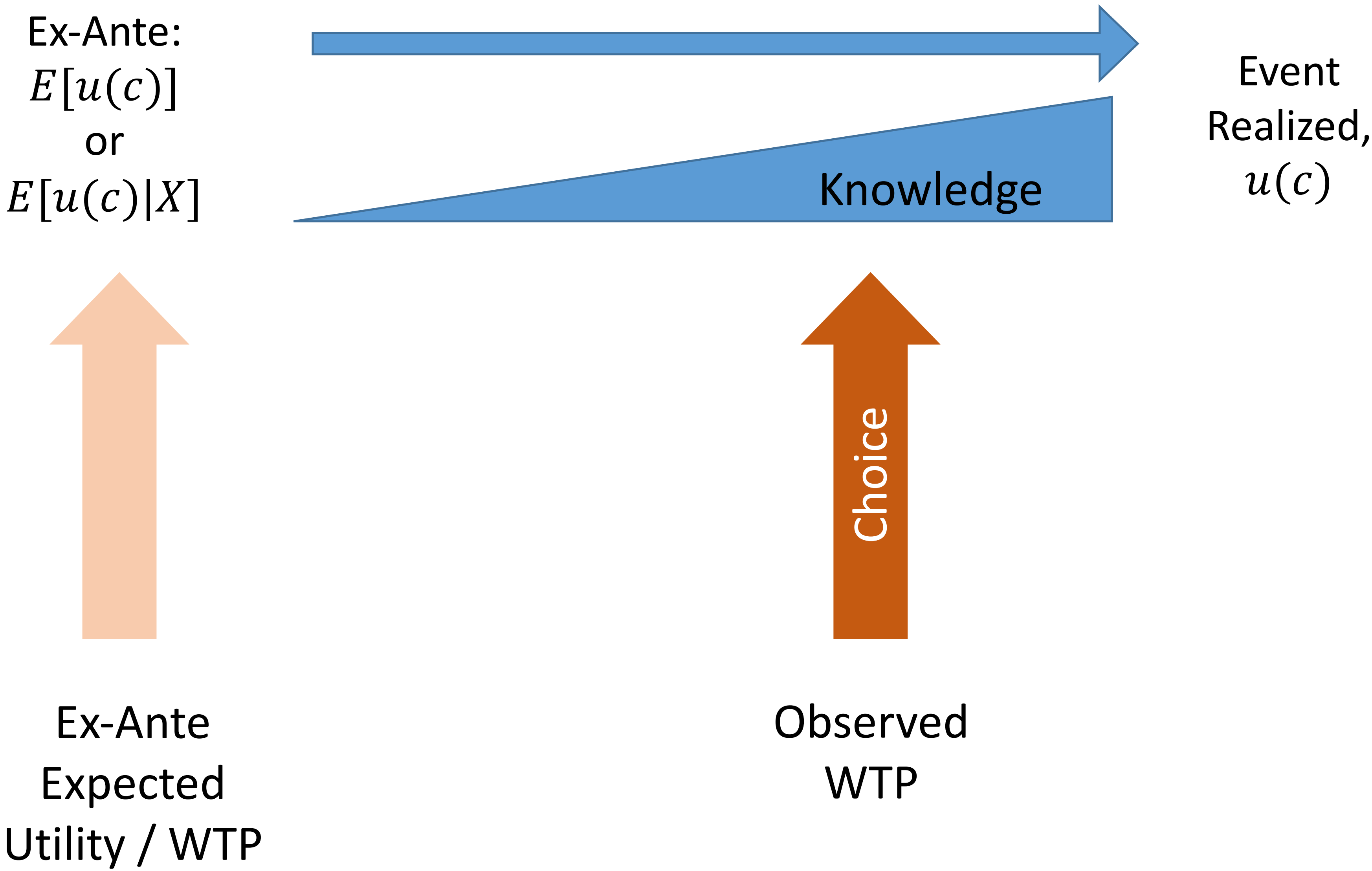
Traditional Approach



Traditional Approach



My Alternative Approach: Reduced Form + Suff. Stats



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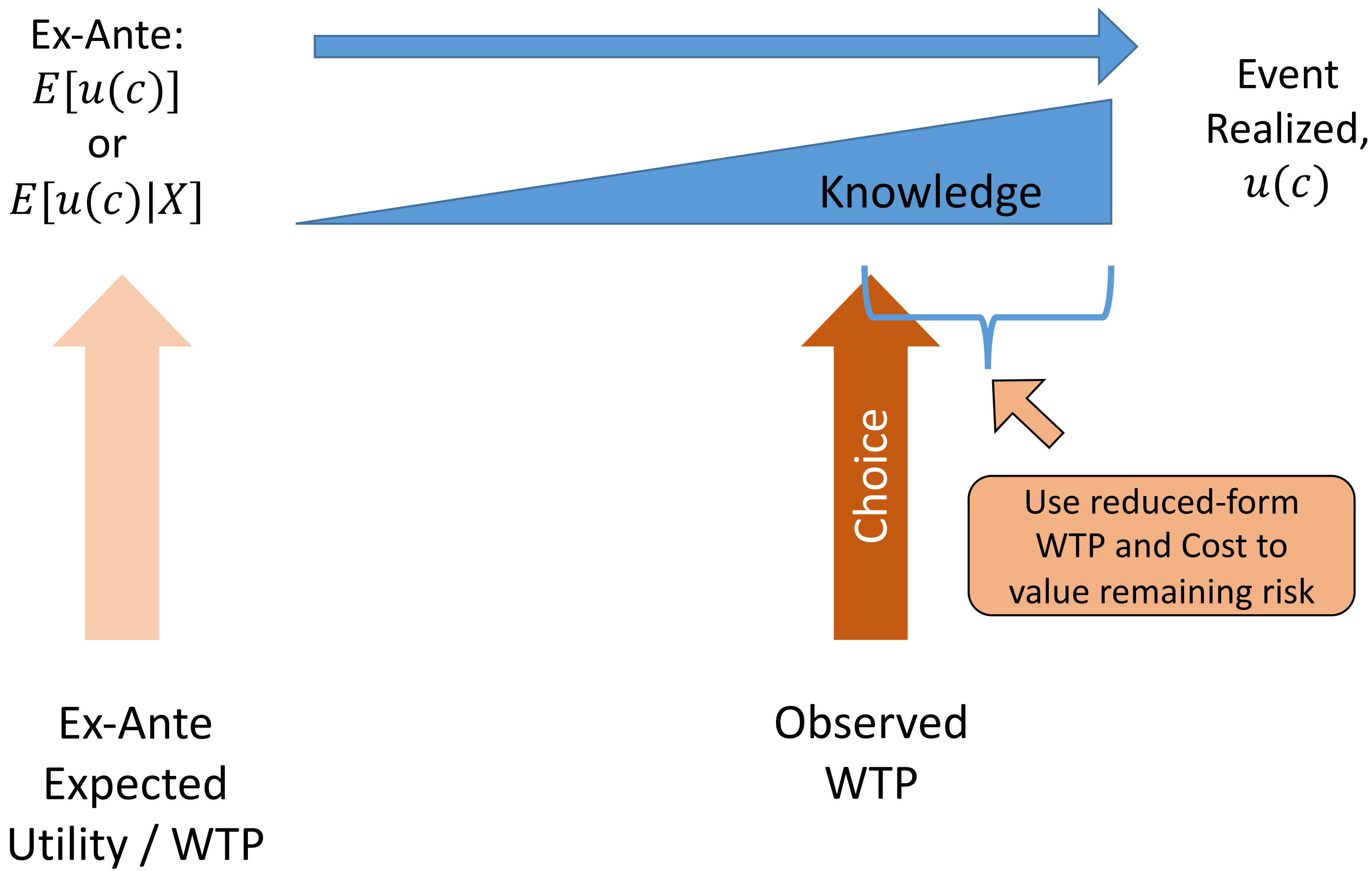

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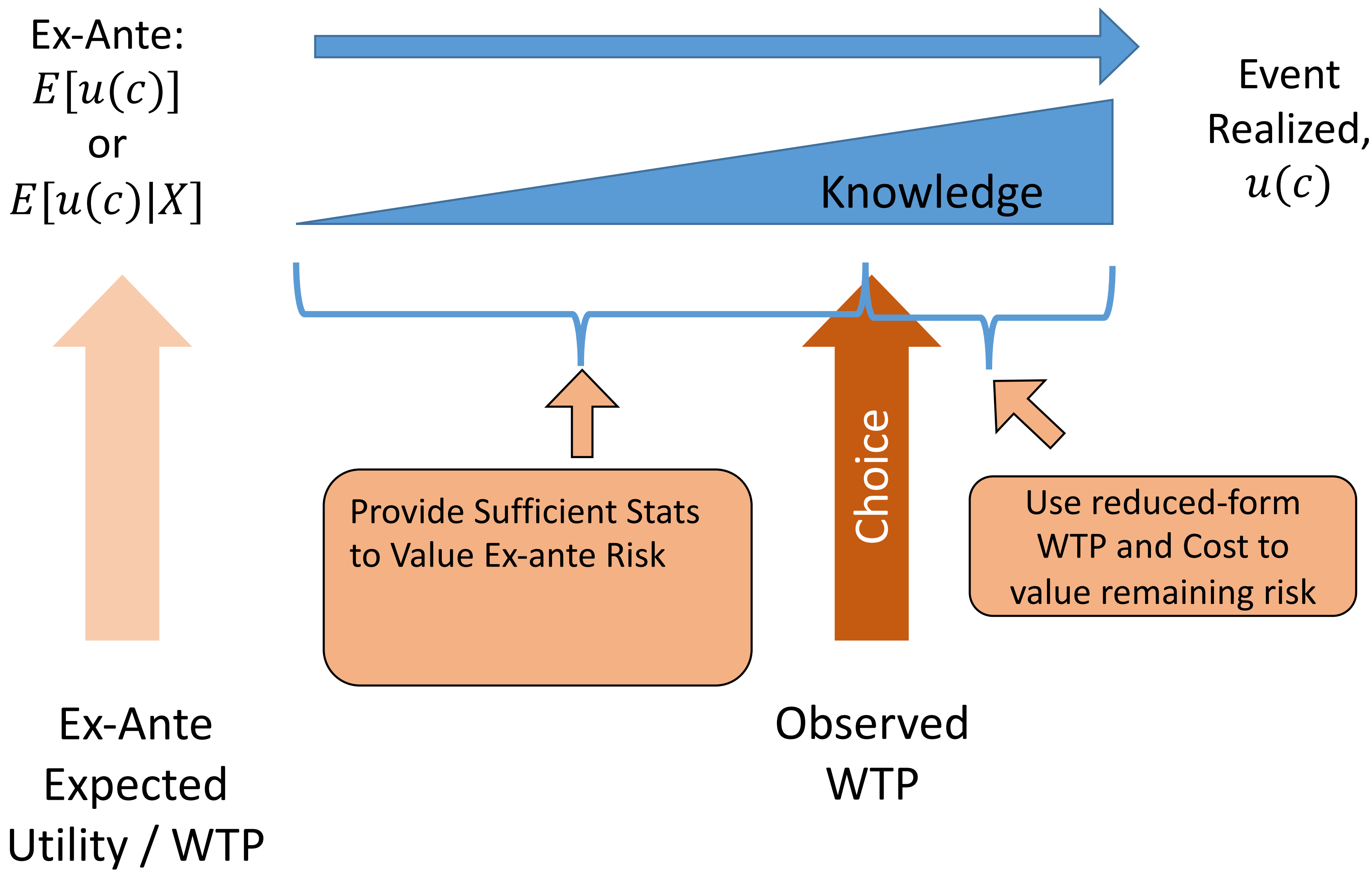

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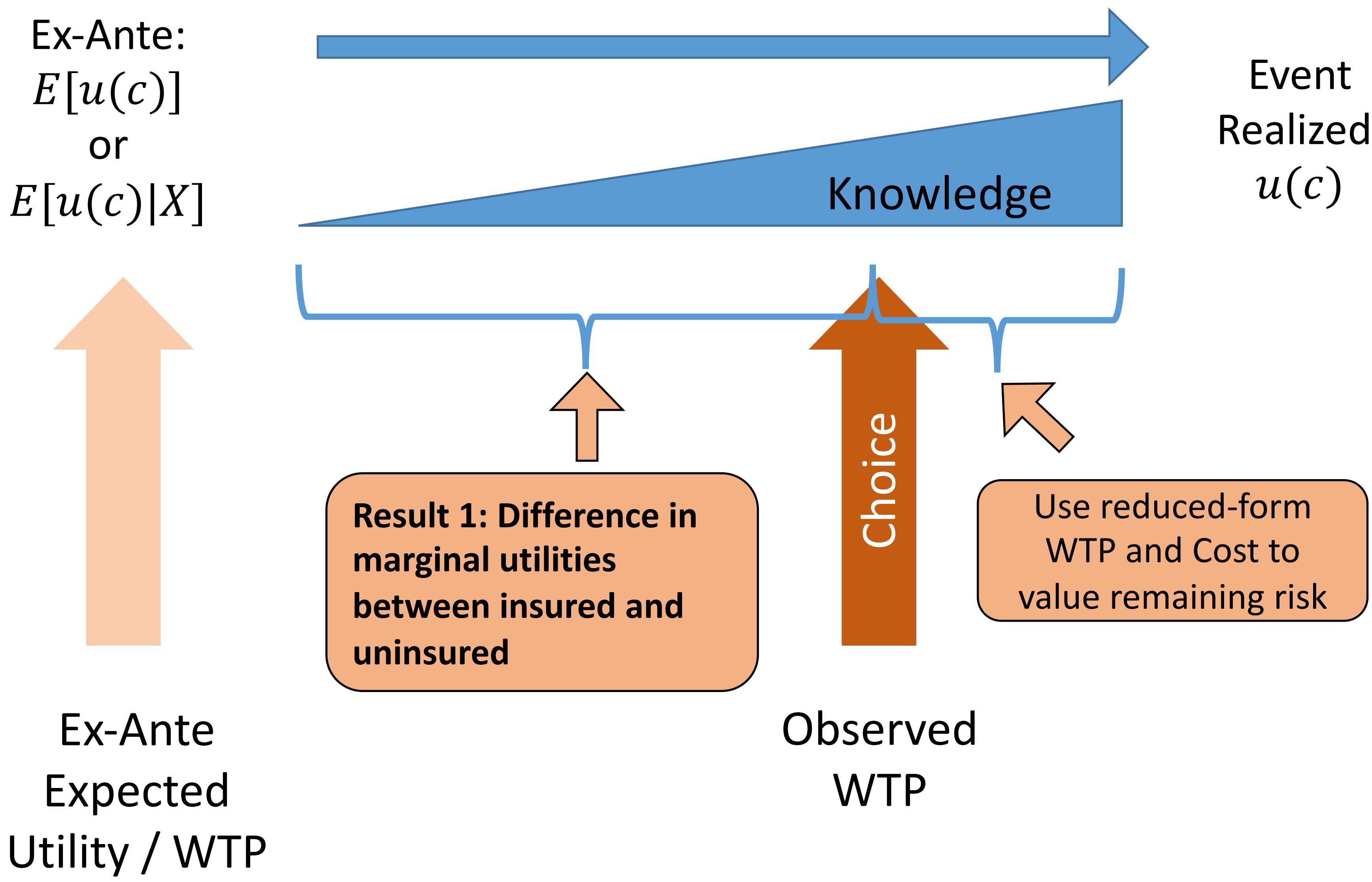

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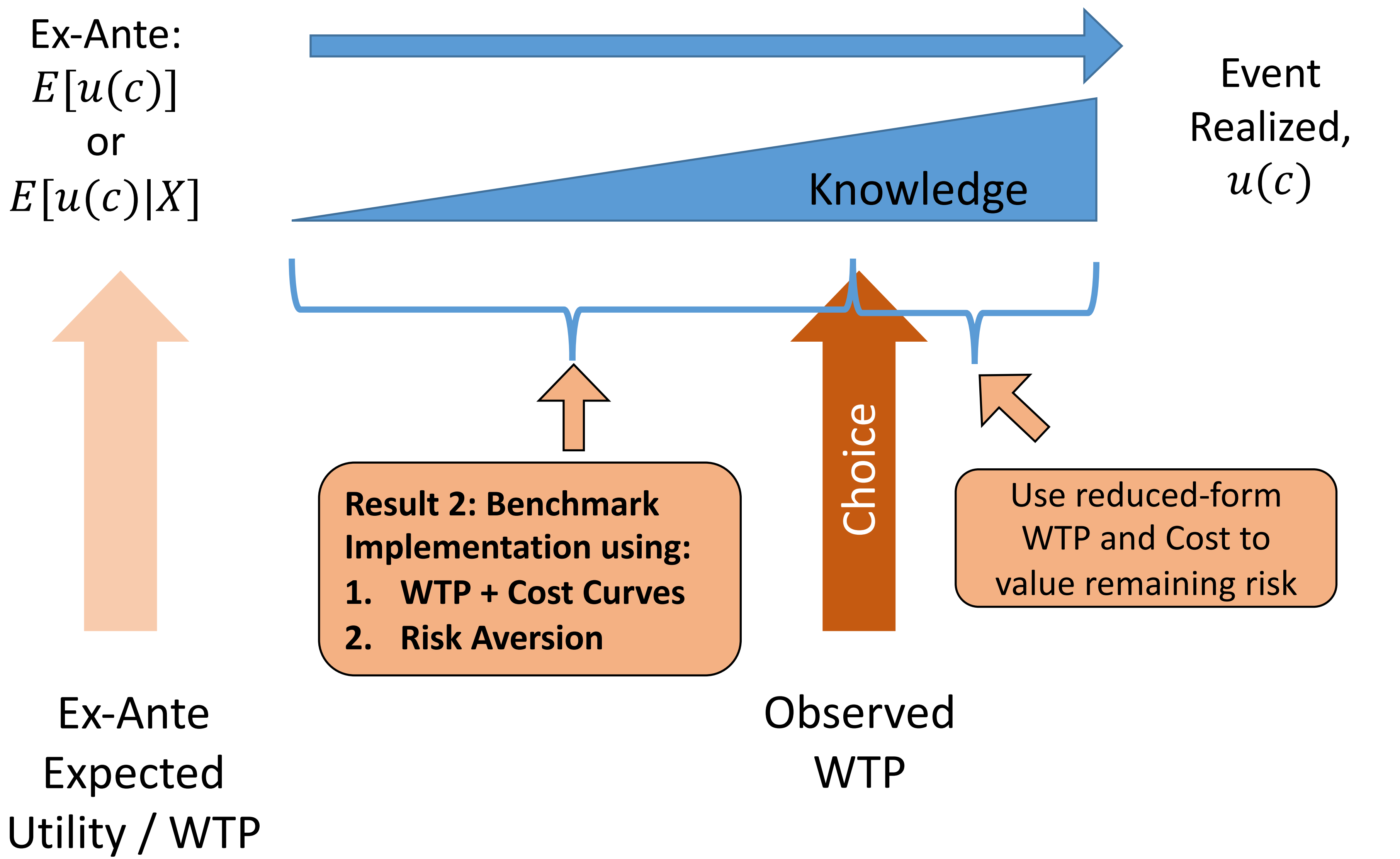


Remainder of Talk

- Characterize “Ex-Ante” WTP in Simple Example

- Extend to General Case and Apply to Low-Income Health Insurance Subsidies in Massachusetts

Measuring Ex-Ante Willingness to Pay

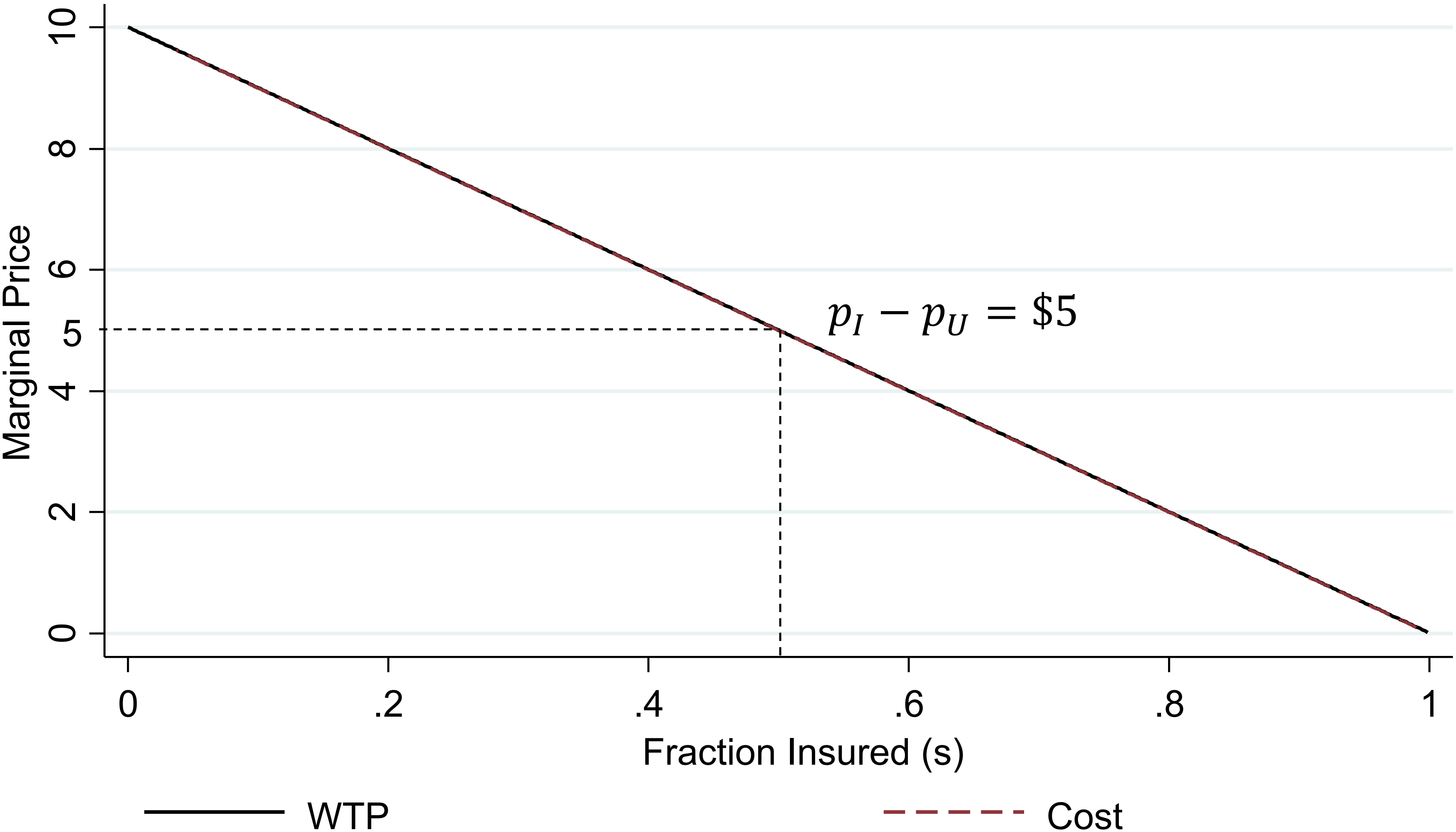
- Return to example in which $D(s) = m(s)$

- 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 $sp_I + (1 - s)p_U = sAC(s)$

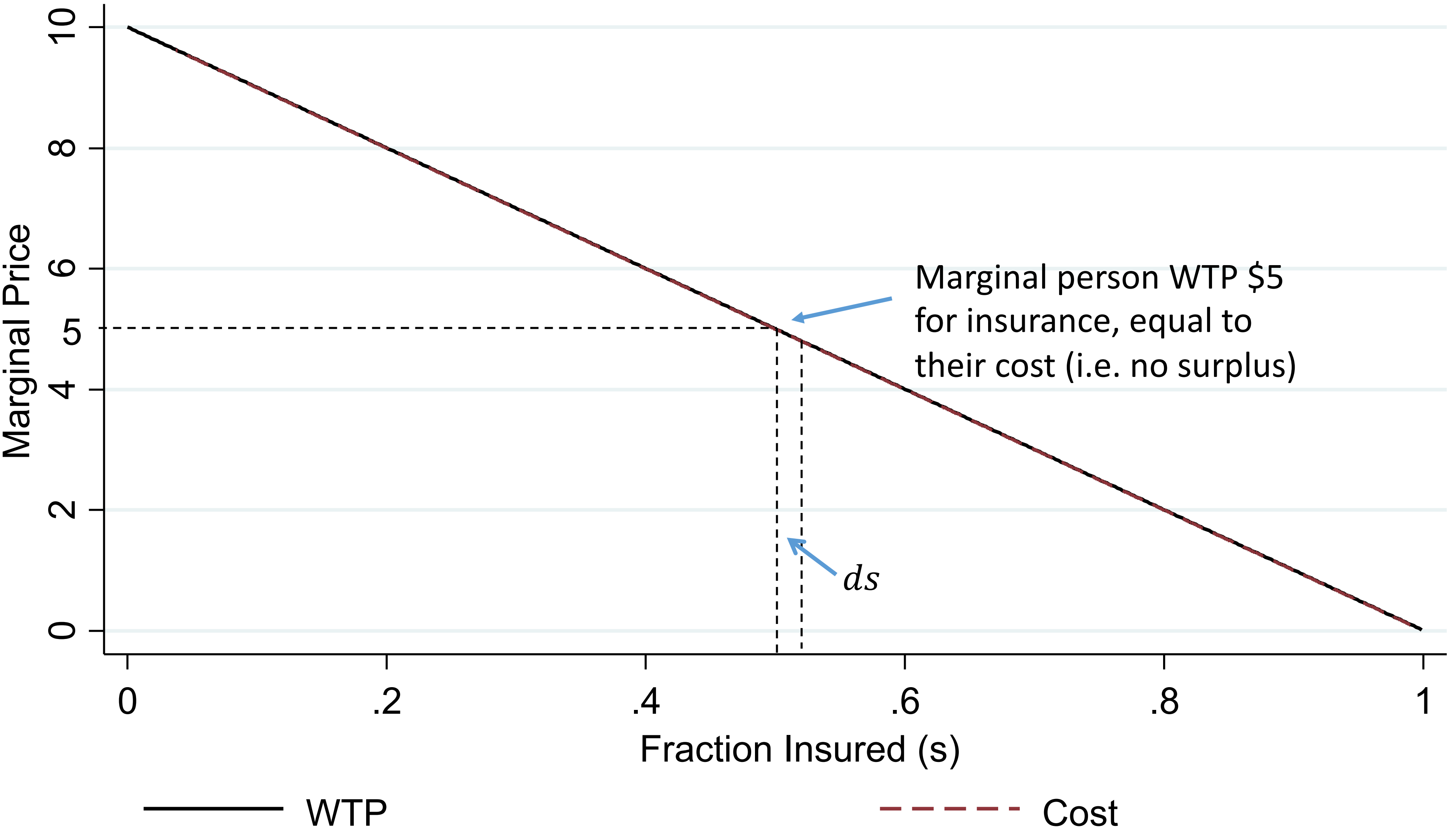
- Paper: Consider non-budget neutral policies
  - Impact on MVPF in Hendren (2016)

From Observed WTP to Ex-Ante WTP

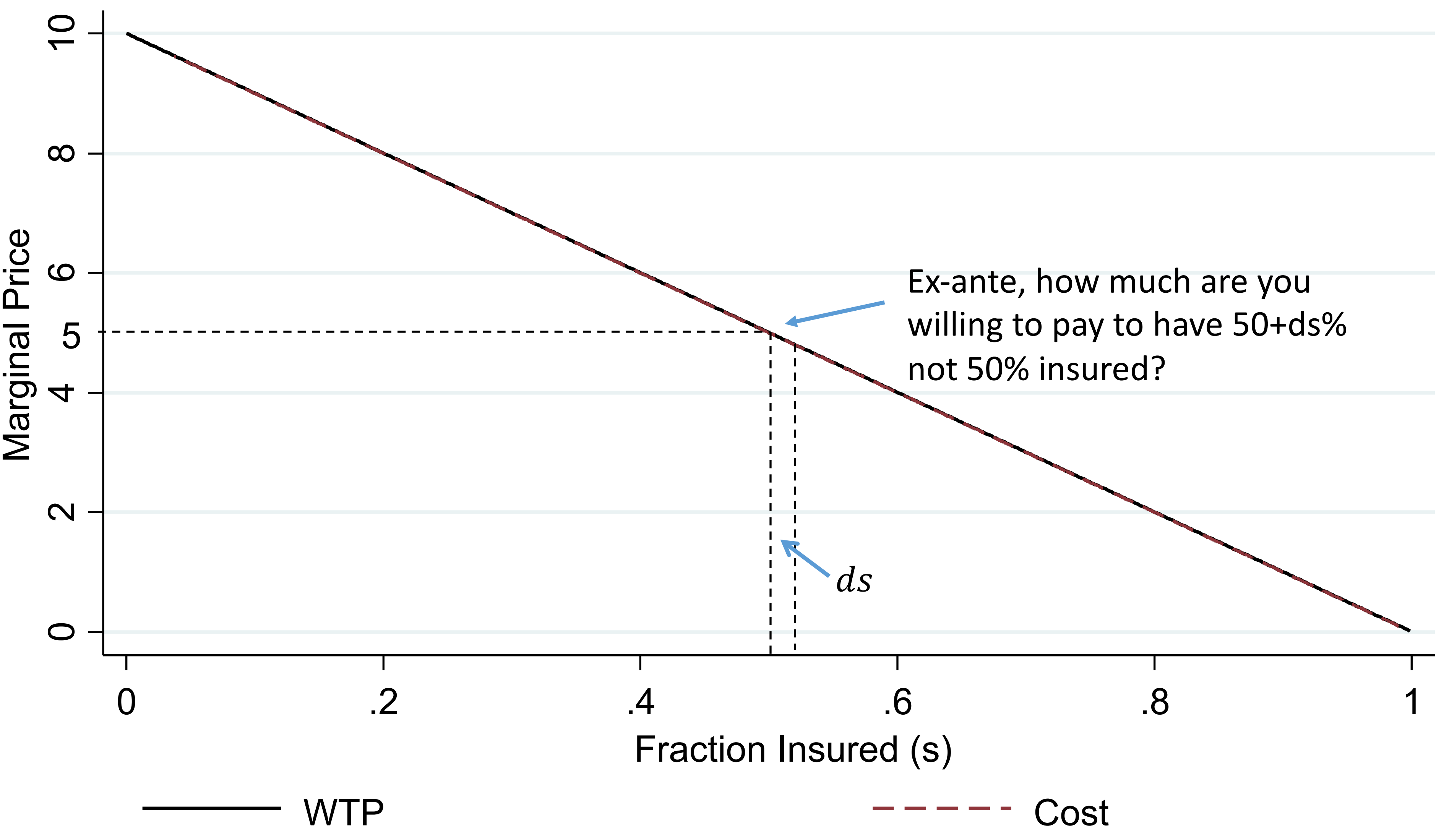


Price Calculation

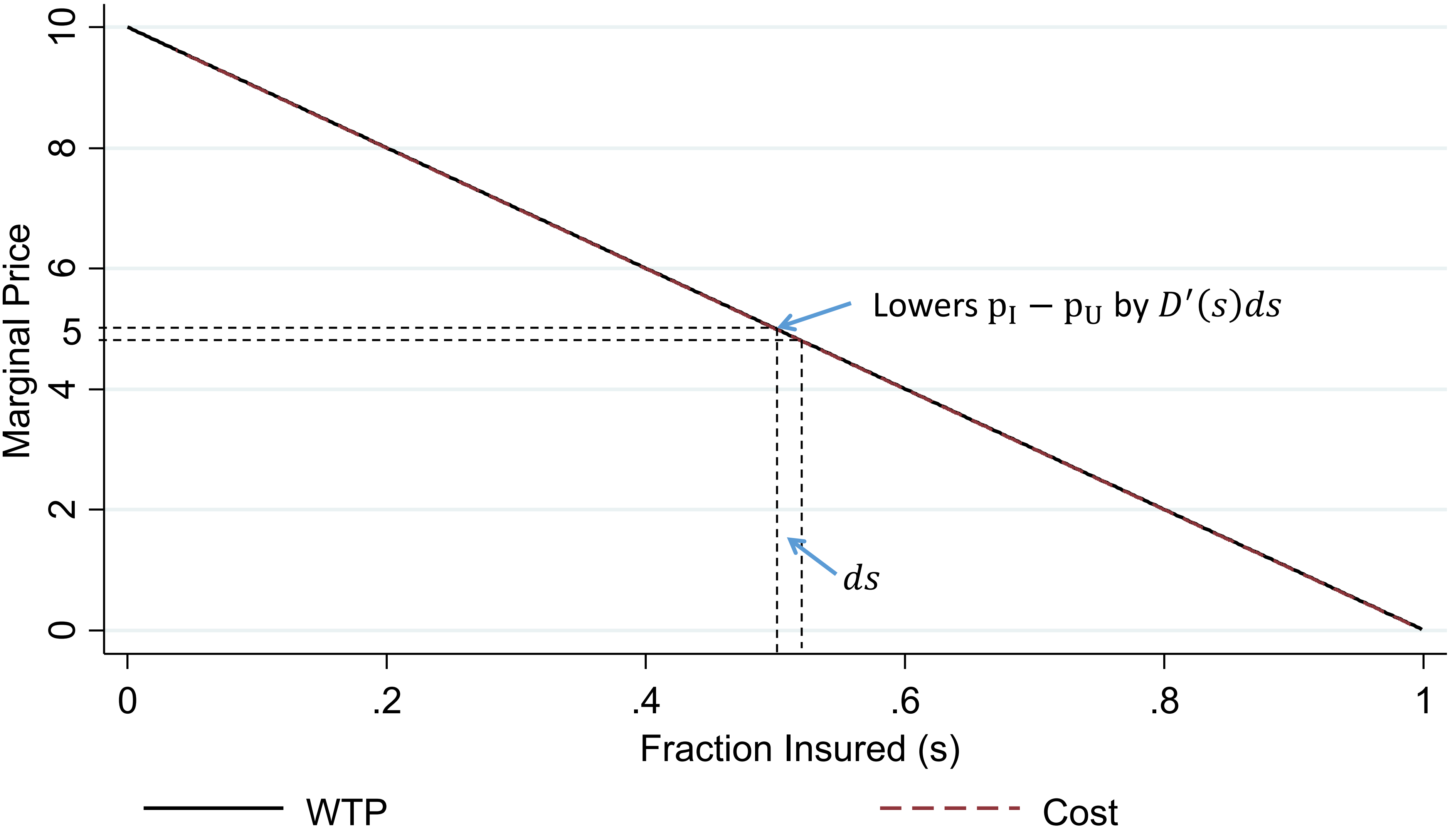
From Observed WTP to Ex-Ante WTP



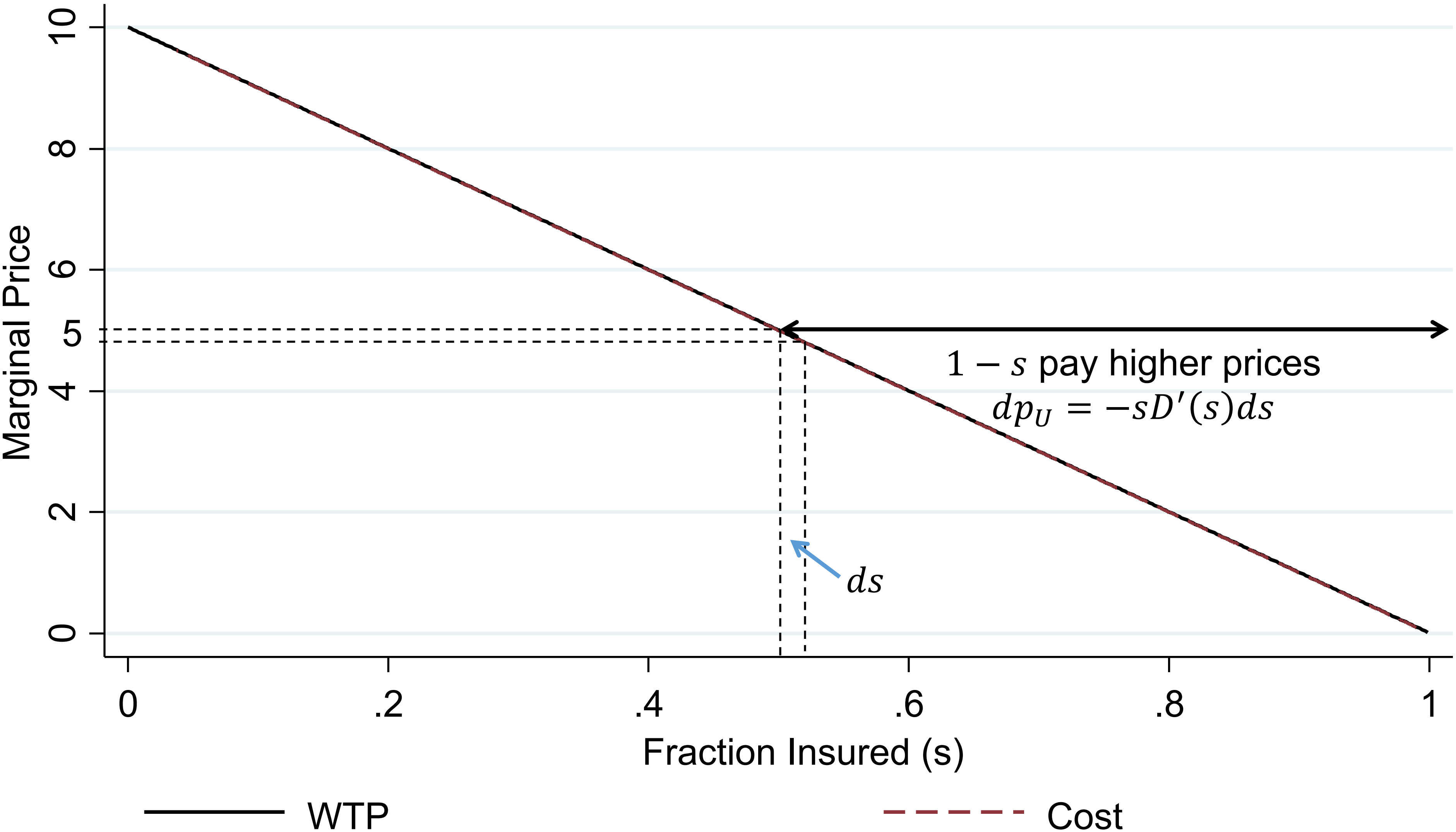
From Observed WTP to Ex-Ante WTP

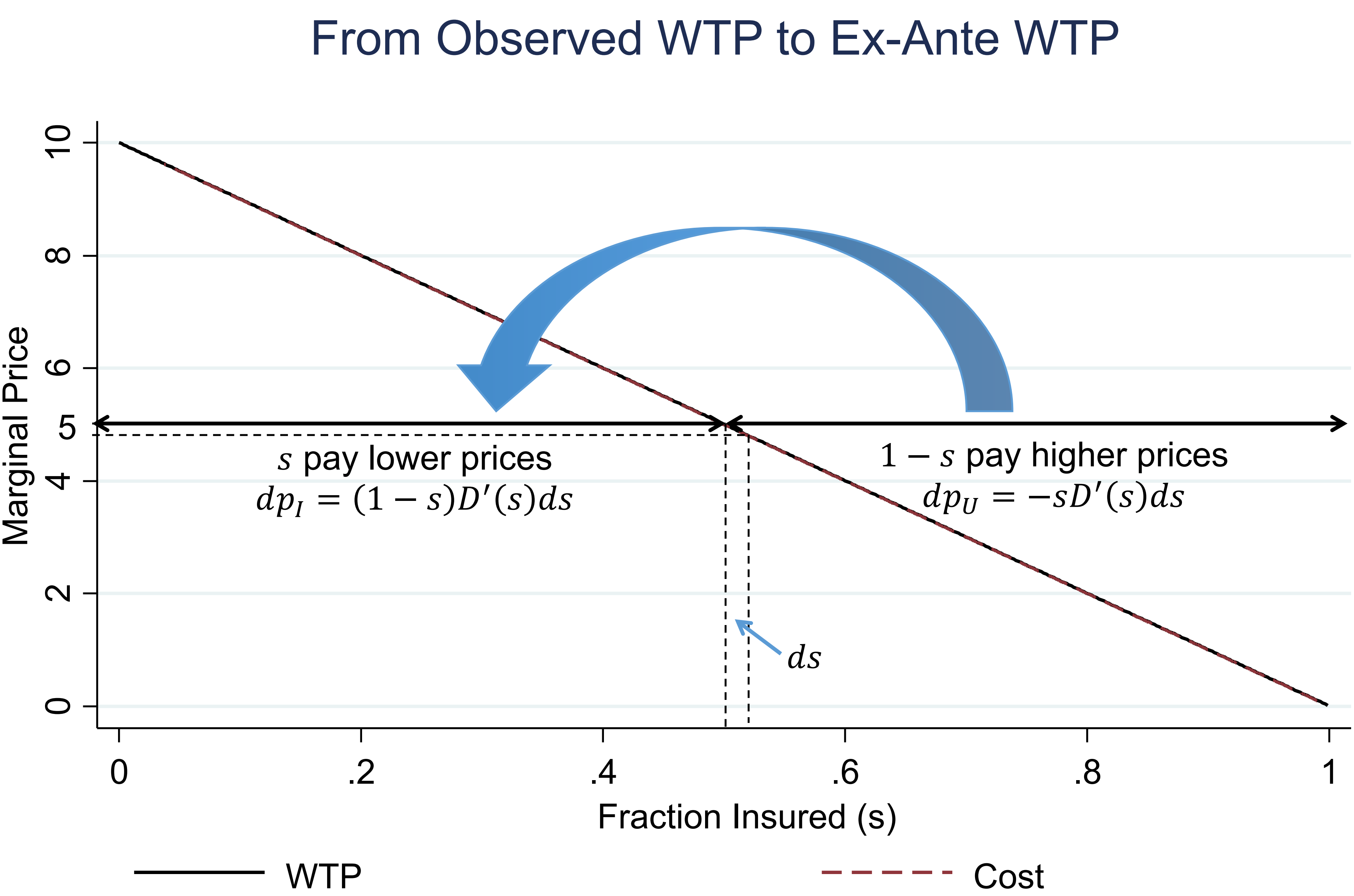


From Observed WTP to Ex-Ante WTP



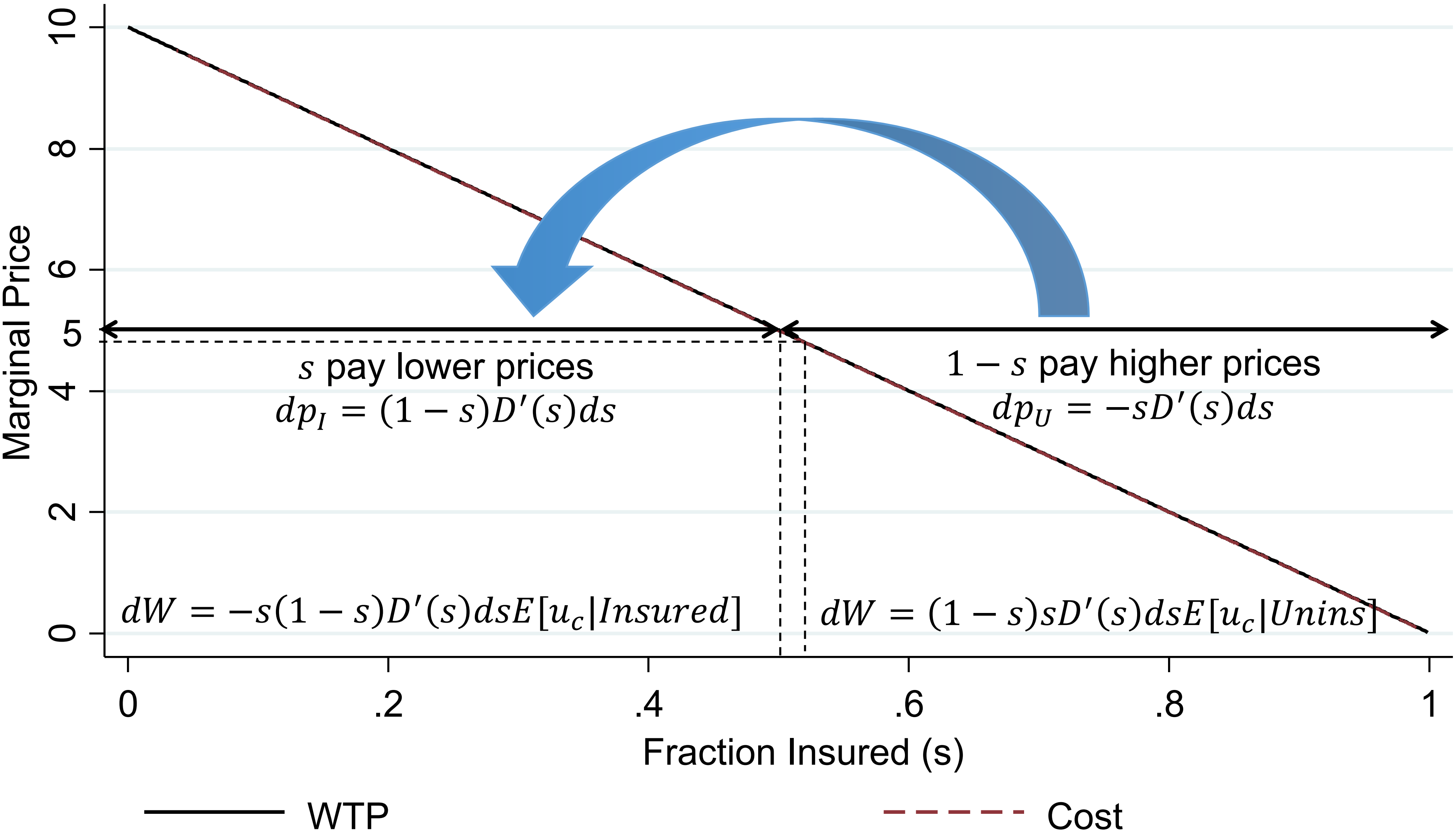
From Observed WTP to Ex-Ante WTP



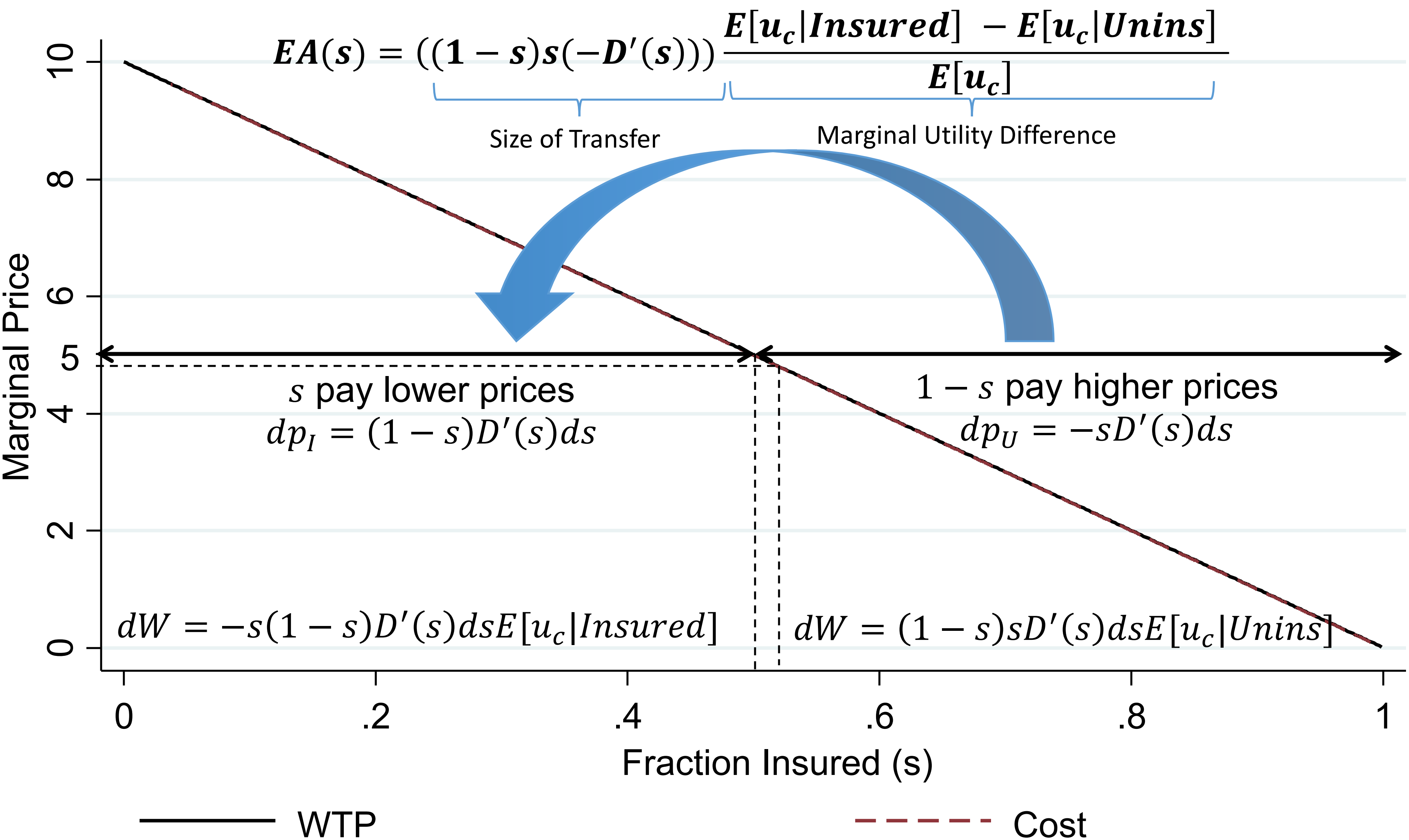


From Observed WTP to Ex-Ante WTP
Marginal Price
10
8
6
5
4
2
0
s pay lower prices
$dp_I = (1-s)D'(s)ds$
$1-s$ pay higher prices
$dp_U = -sD'(s)ds$
ds
0
.2
.4
.6
.8
1
Fraction Insured (s)
WTP
Cost

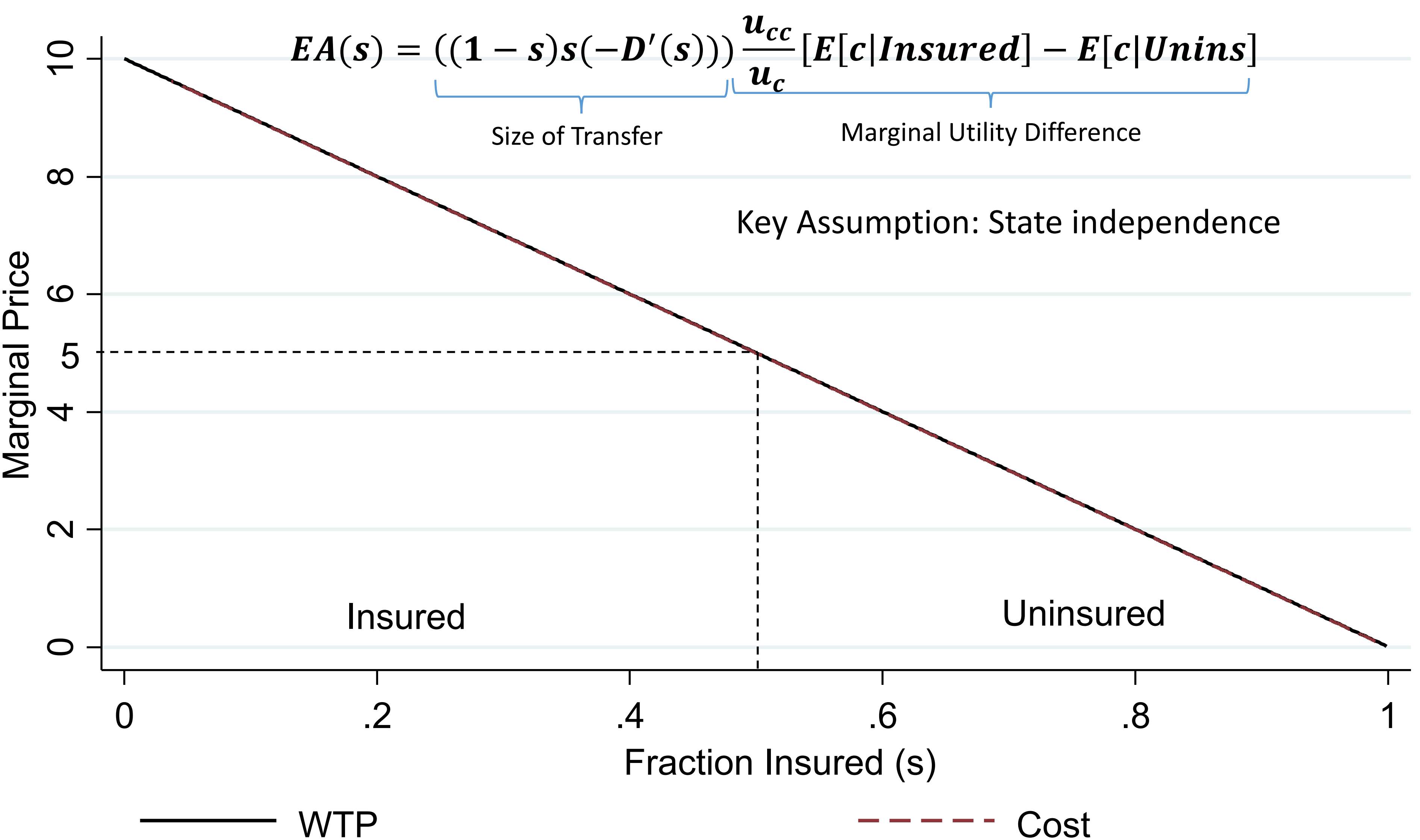
From Observed WTP to Ex-Ante WTP



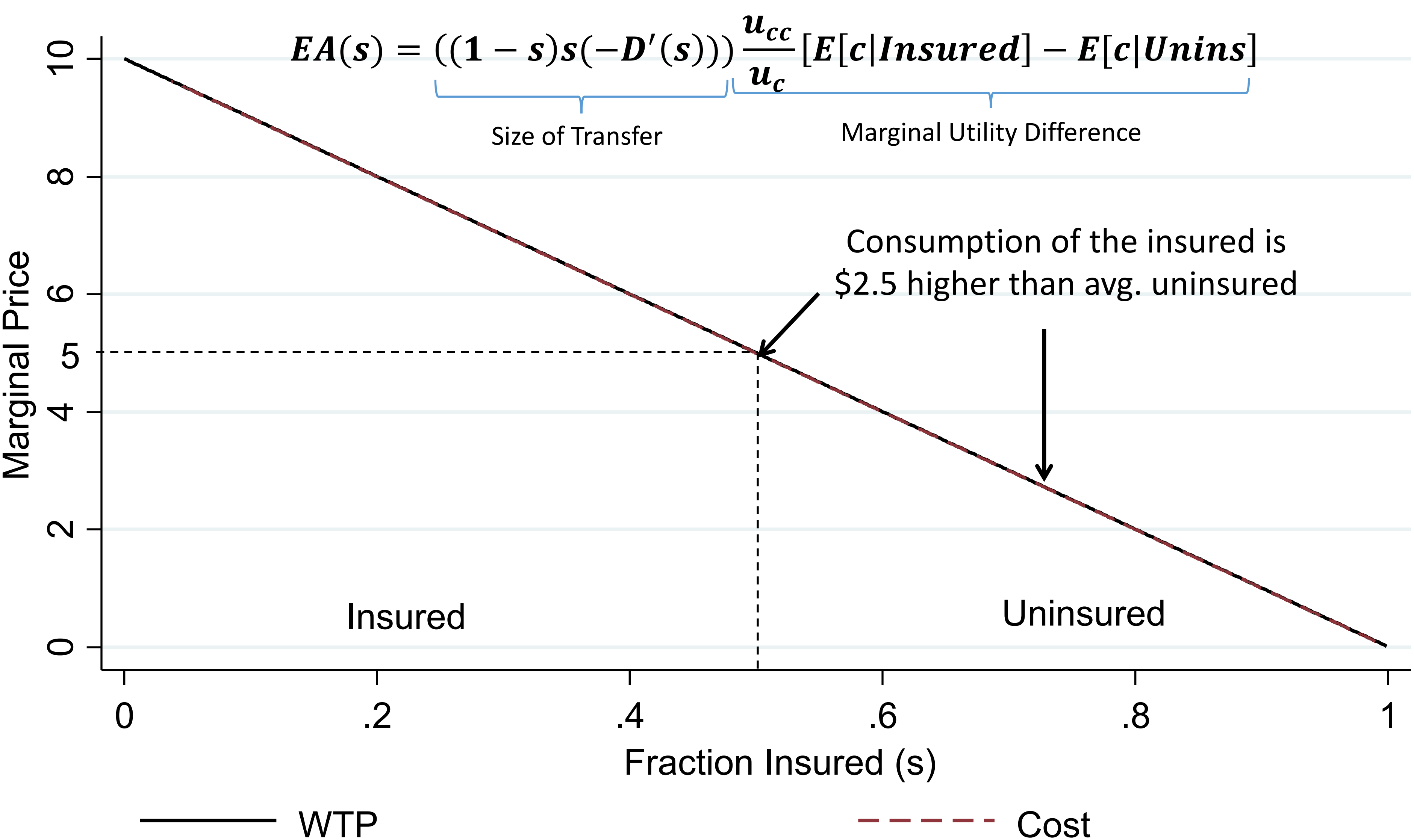
Result #1: General Formula for Ex-Ante WTP for Insurance



Implementing Ex-Ante WTP: Consumption Difference

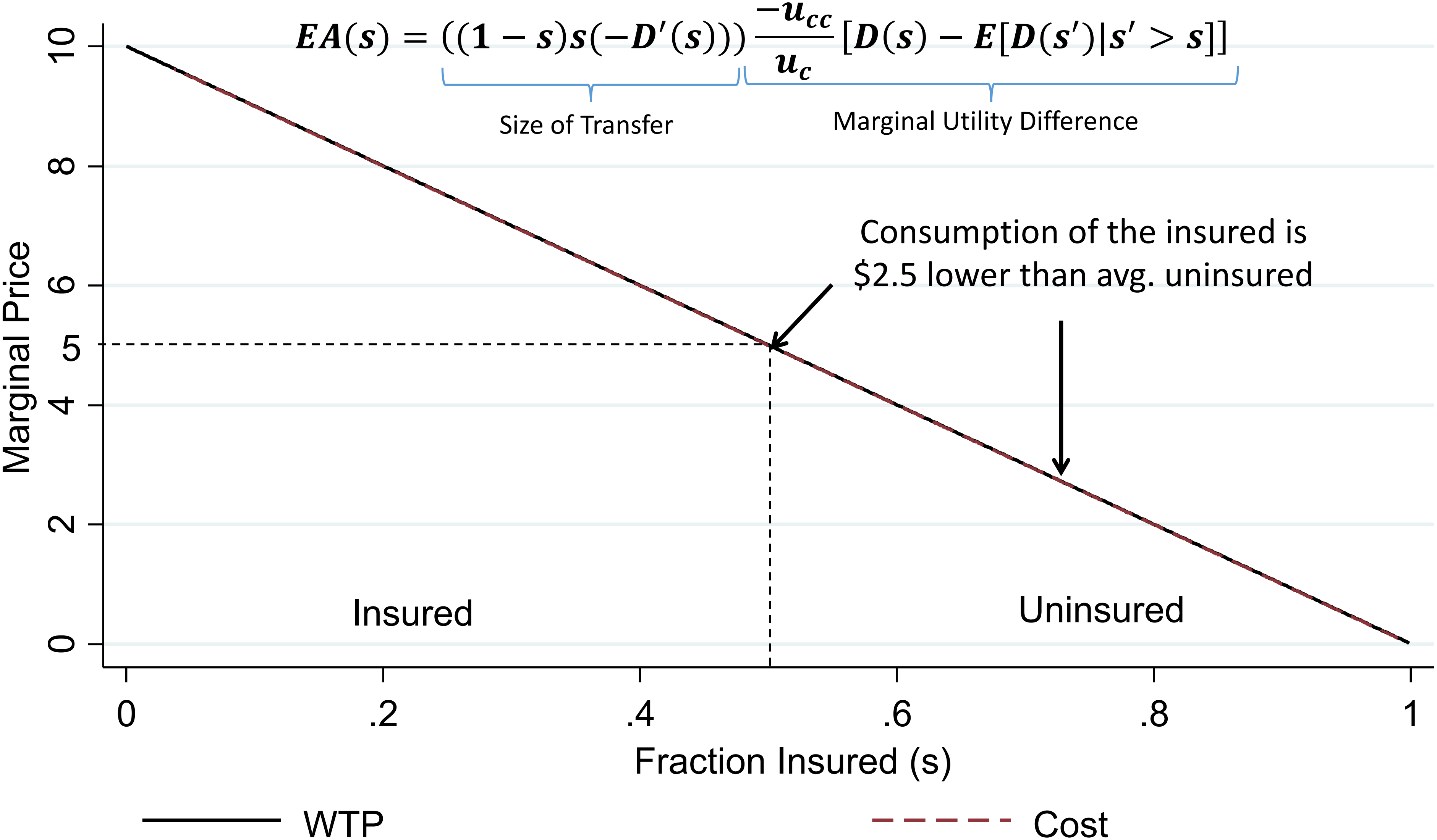


Implementing Ex-Ante WTP: Consumption Difference

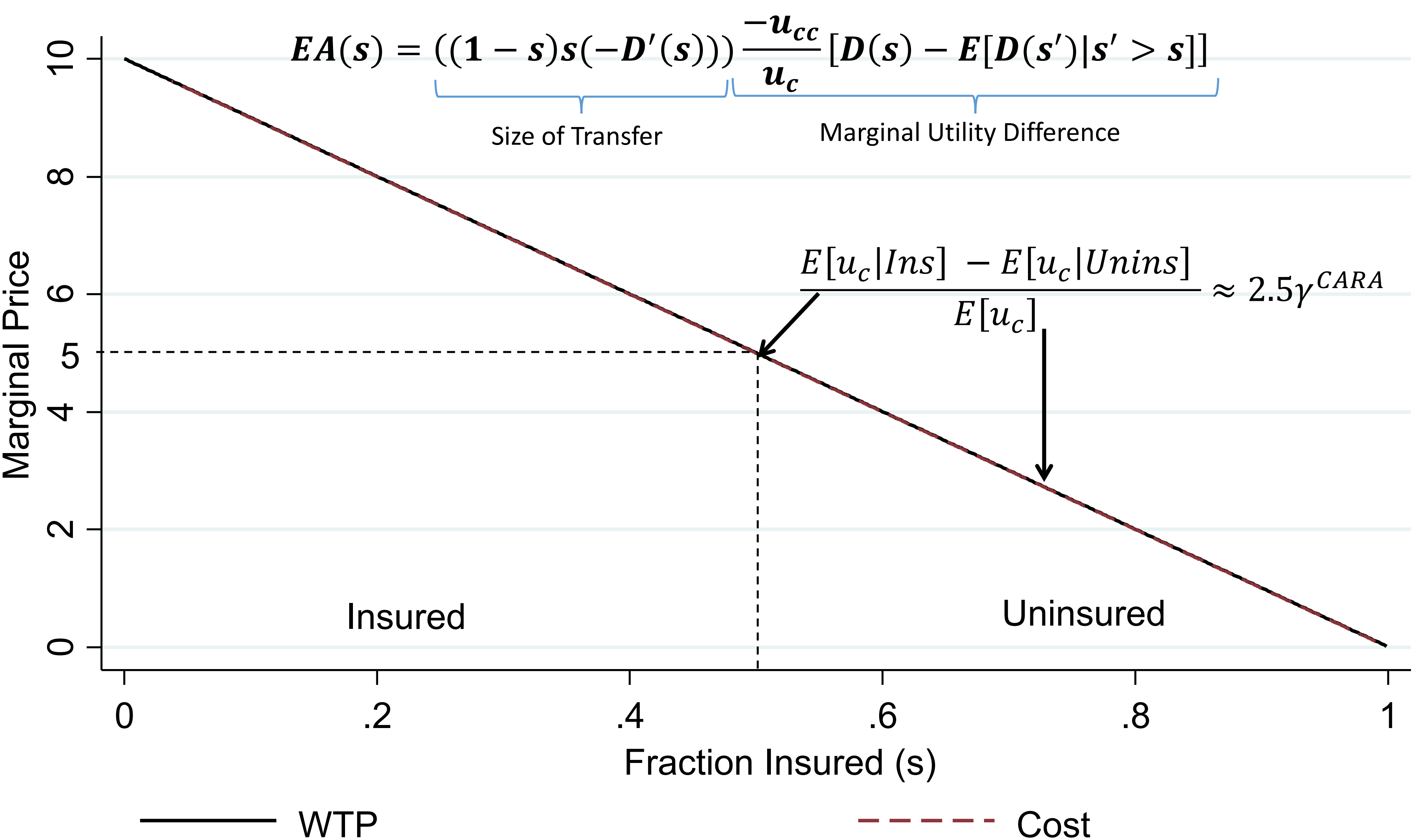


Result #2: Implement with WTP Curve + Risk Aversion

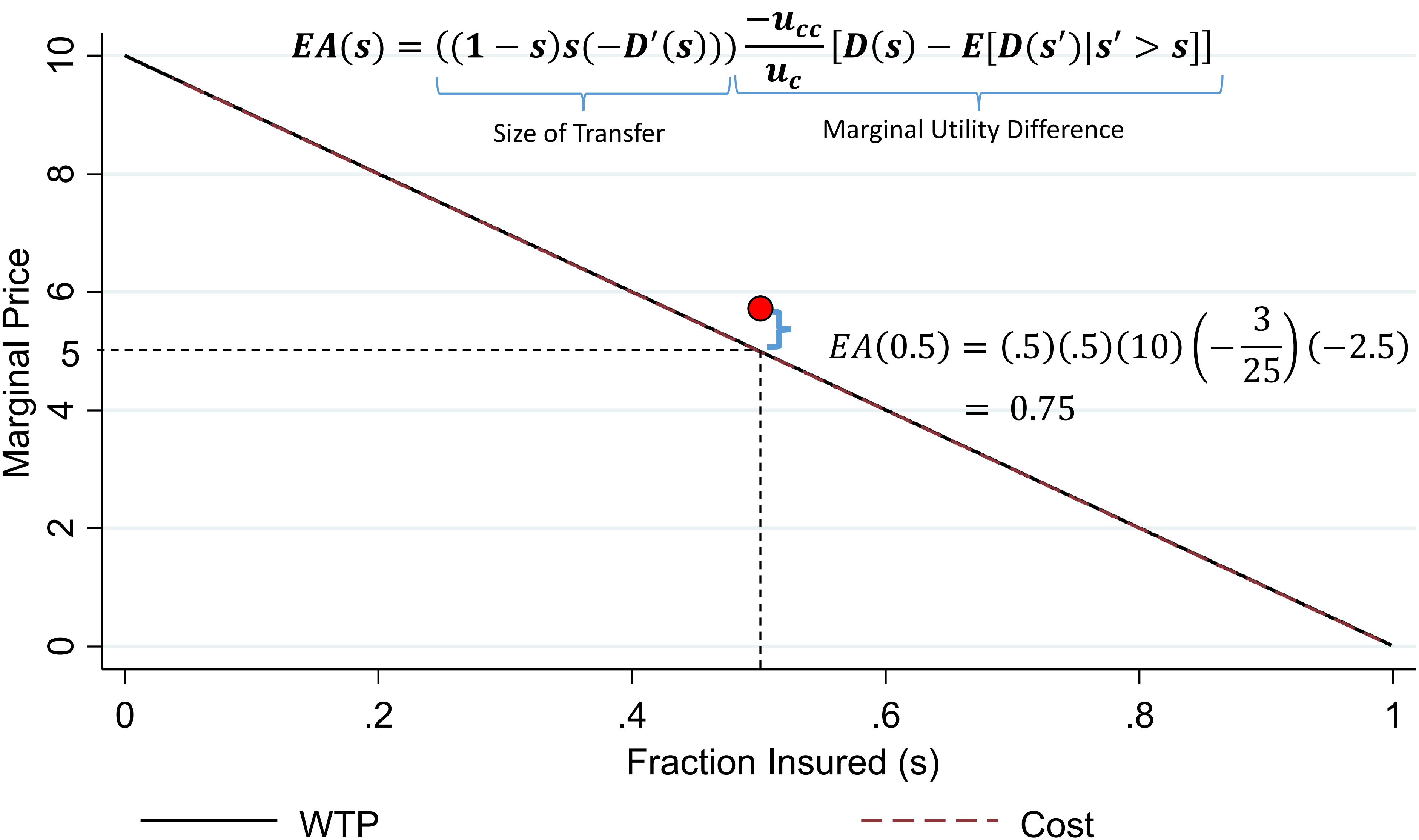
$$EA(s) = \underbrace{((1-s)s(-D'(s)))}_{\text{Size of Transfer}} \underbrace{\frac{-u_{cc}}{u_c}[D(s) - E[D(s')|s' > s]]}_{\text{Marginal Utility Difference}}$$



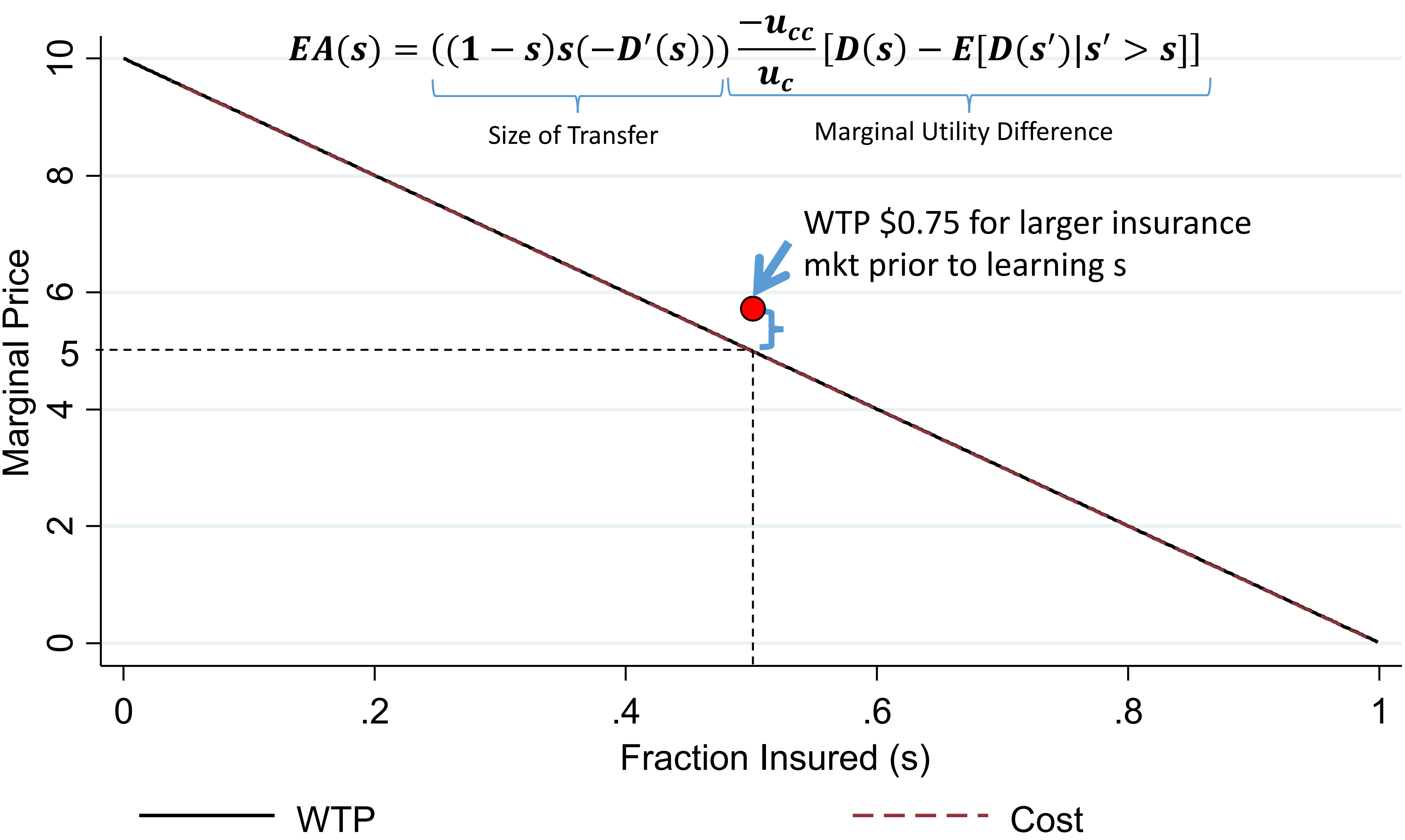
Result #2: Implement with WTP Curve + Risk Aversion

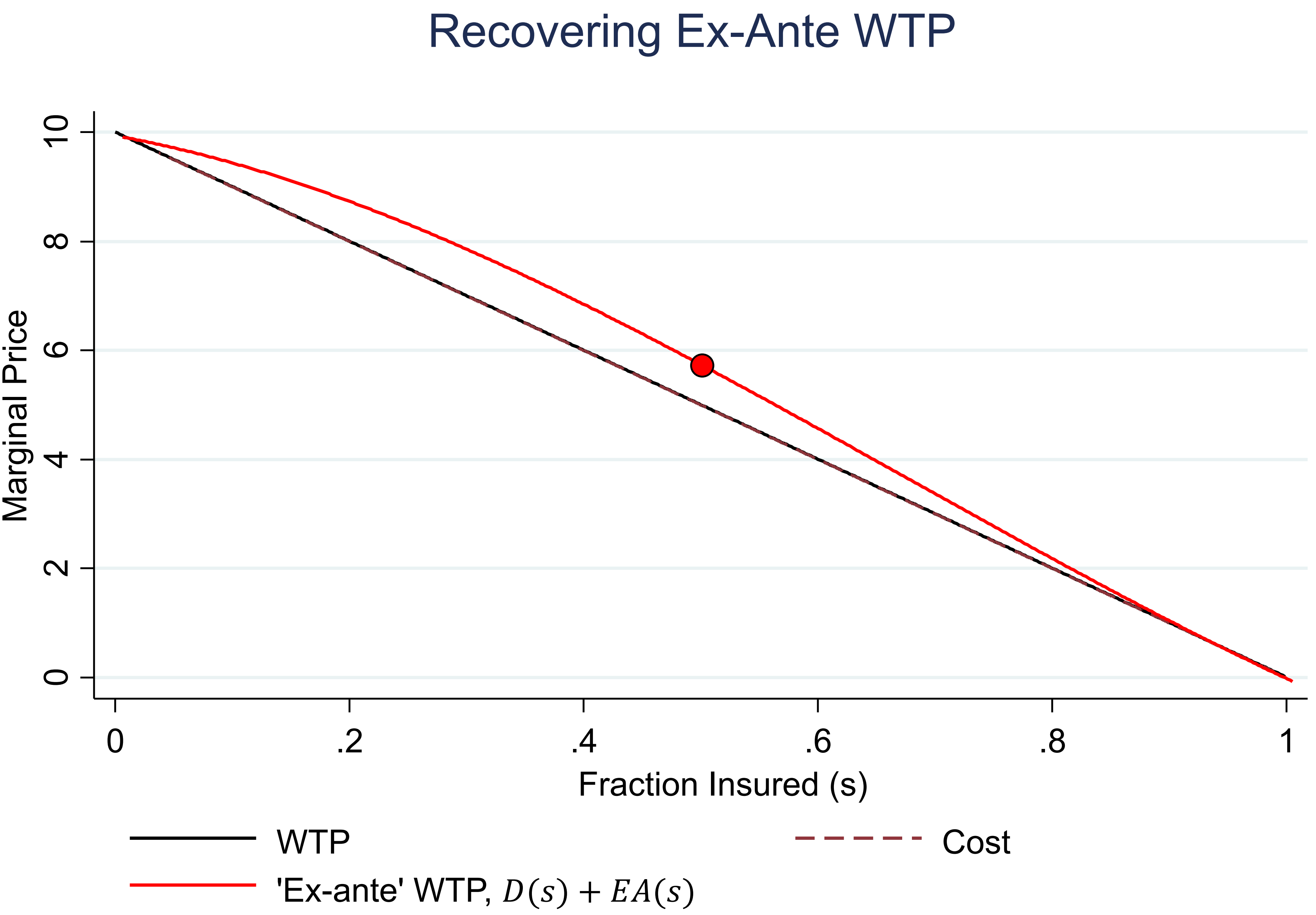


Result #2: Implement with WTP Curve + Risk Aversion

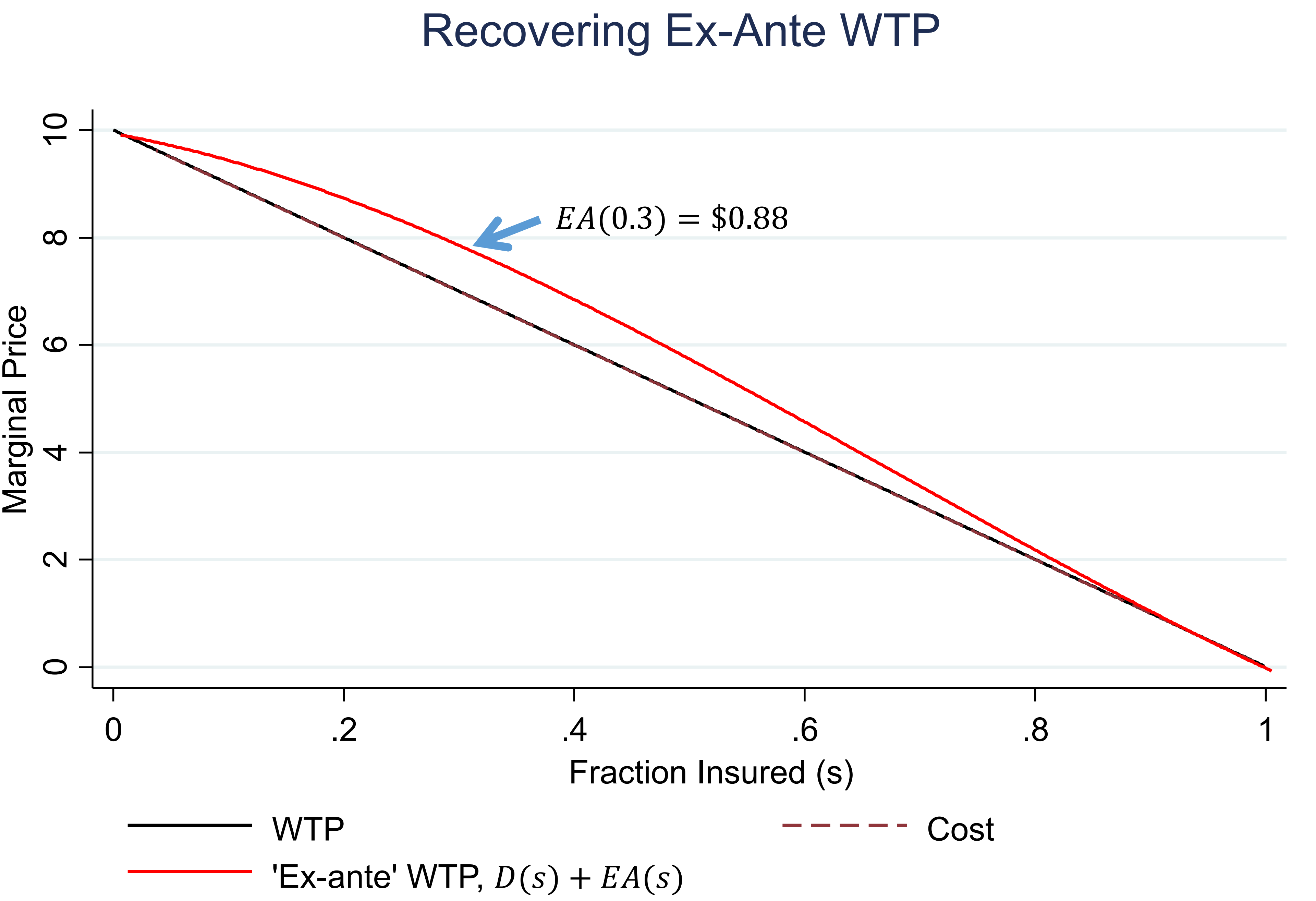


Result #2: Implement with WTP Curve + Risk Aversion

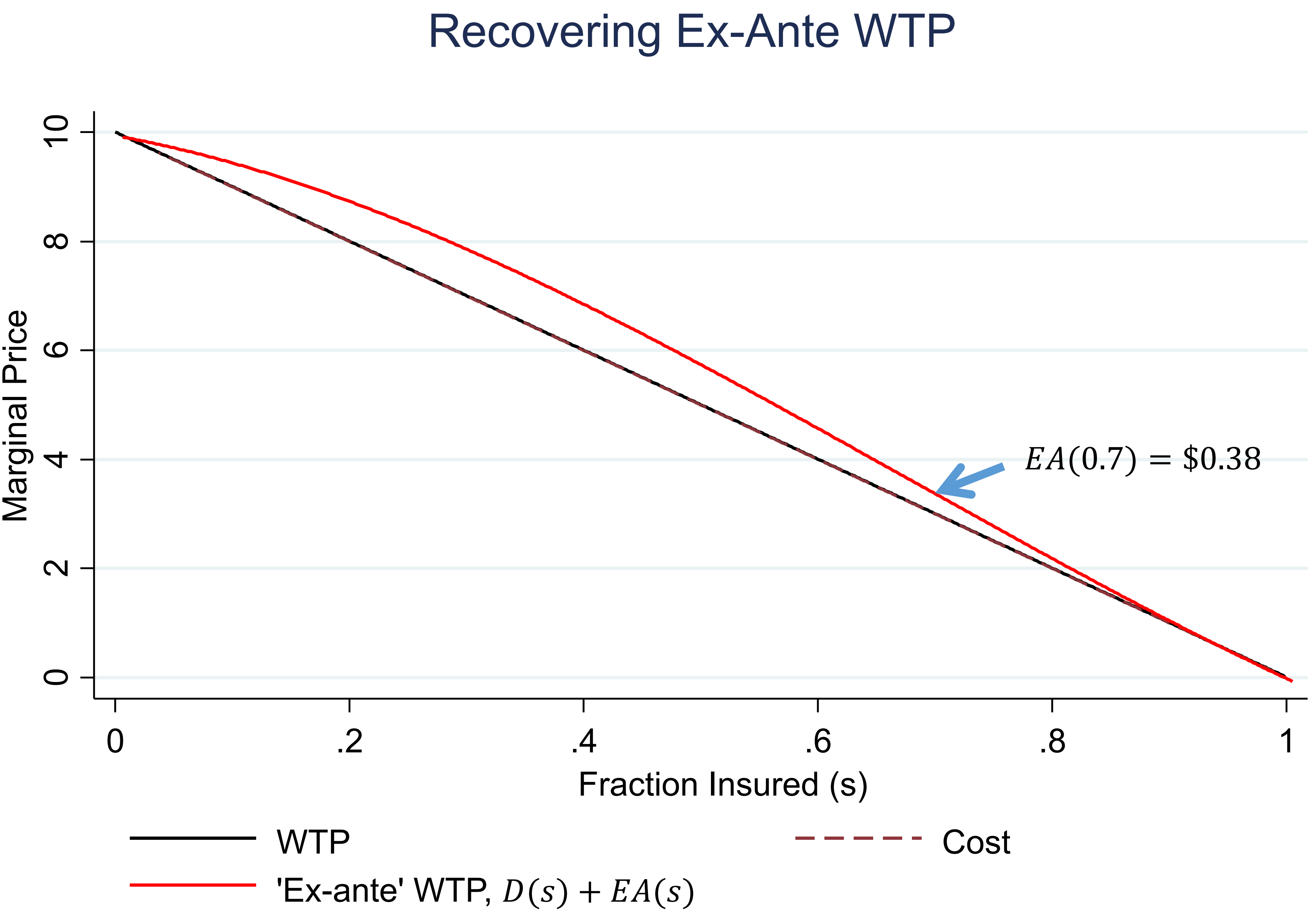


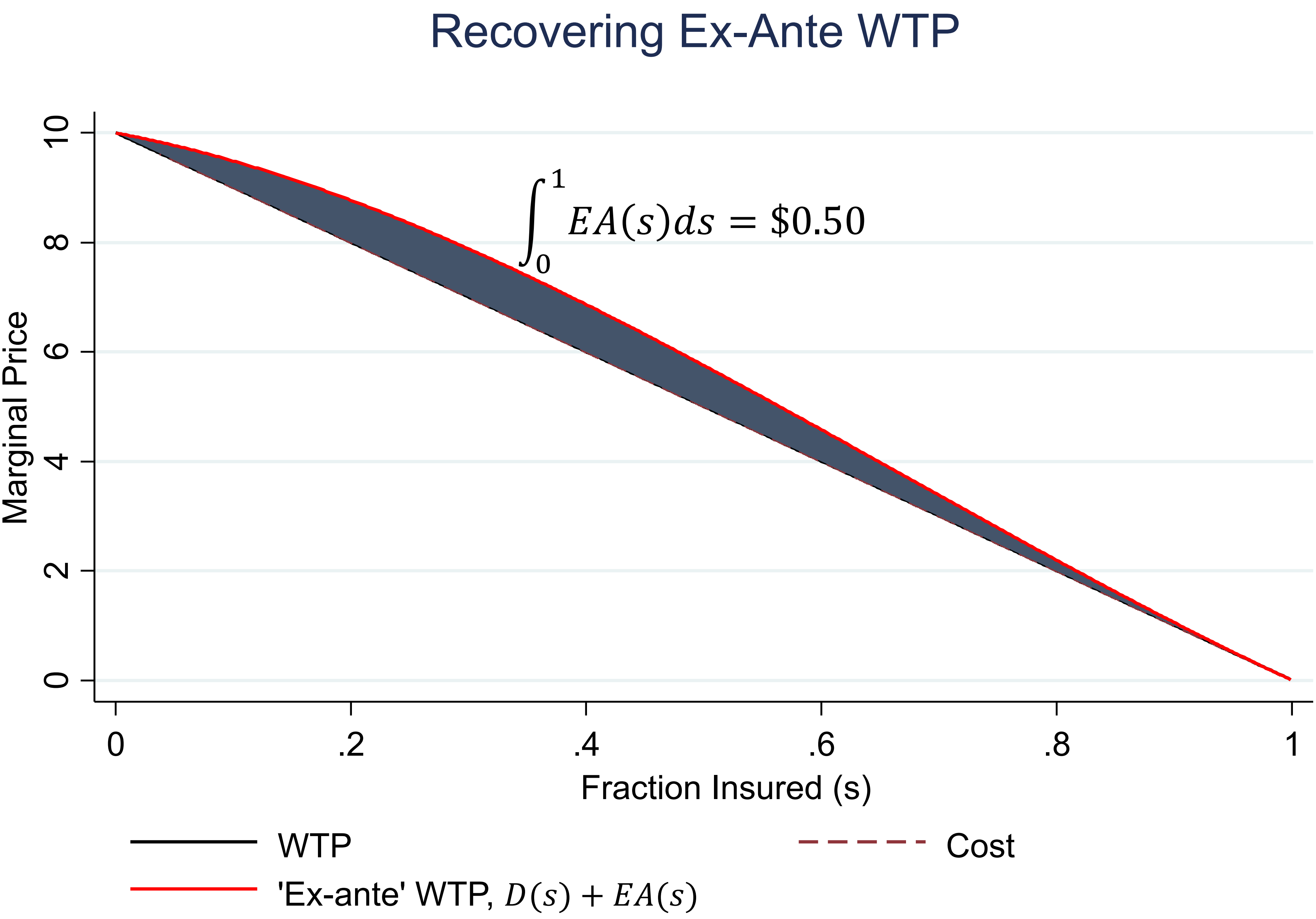


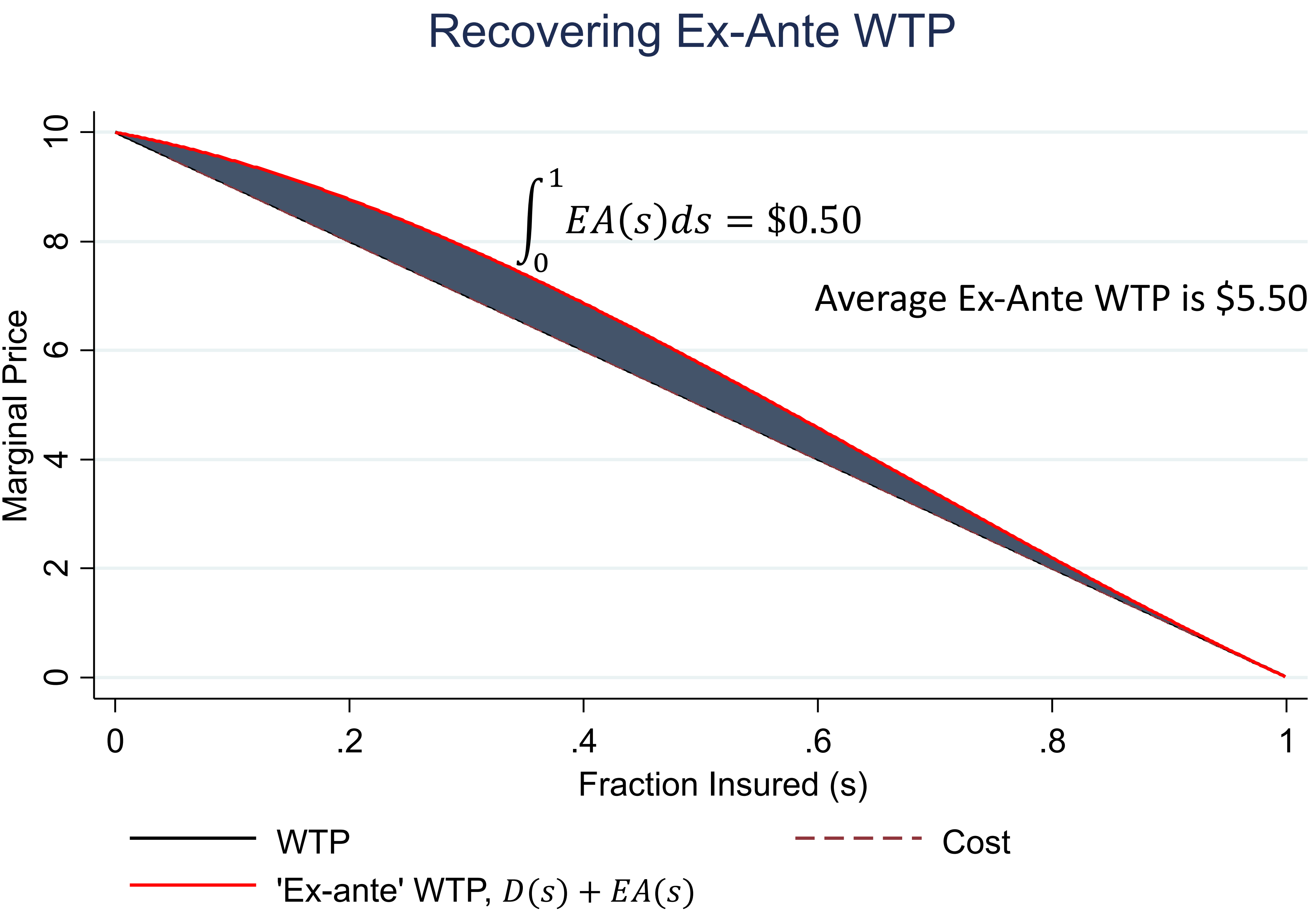
Recovering Ex-Ante WTP
Marginal Price
0
2
4
6
8
10
0
.2
.4
.6
.8
1
Fraction Insured (s)
WTP
Cost
'Ex-ante' WTP, $D(s) + EA(s)$



Recovering Ex-Ante WTP
$EA(0.3) = \$0.88$
Marginal Price
0
2
4
6
8
10
0
.2
.4
.6
.8
1
Fraction Insured (s)
WTP
Cost
'Ex-ante' WTP, $D(s) + EA(s)$


Recovering Ex-Ante WTP
Marginal Price
10
8
6
4
2
0
0
.2
.4
.6
.8
1
Fraction Insured (s)
$EA(0.7) = \$0.38$
WTP
Cost
'Ex-ante' WTP, $D(s) + EA(s)$


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


Recovering Ex-Ante WTP
$\int_0^1 EA(s)ds = \$0.50$
Average Ex-Ante WTP is $5.50
Marginal Price
0
2
4
6
8
10
0
.2
.4
.6
.8
1
Fraction Insured (s)
WTP
Cost
'Ex-ante' WTP, $D(s) + EA(s)$

Remainder of Talk

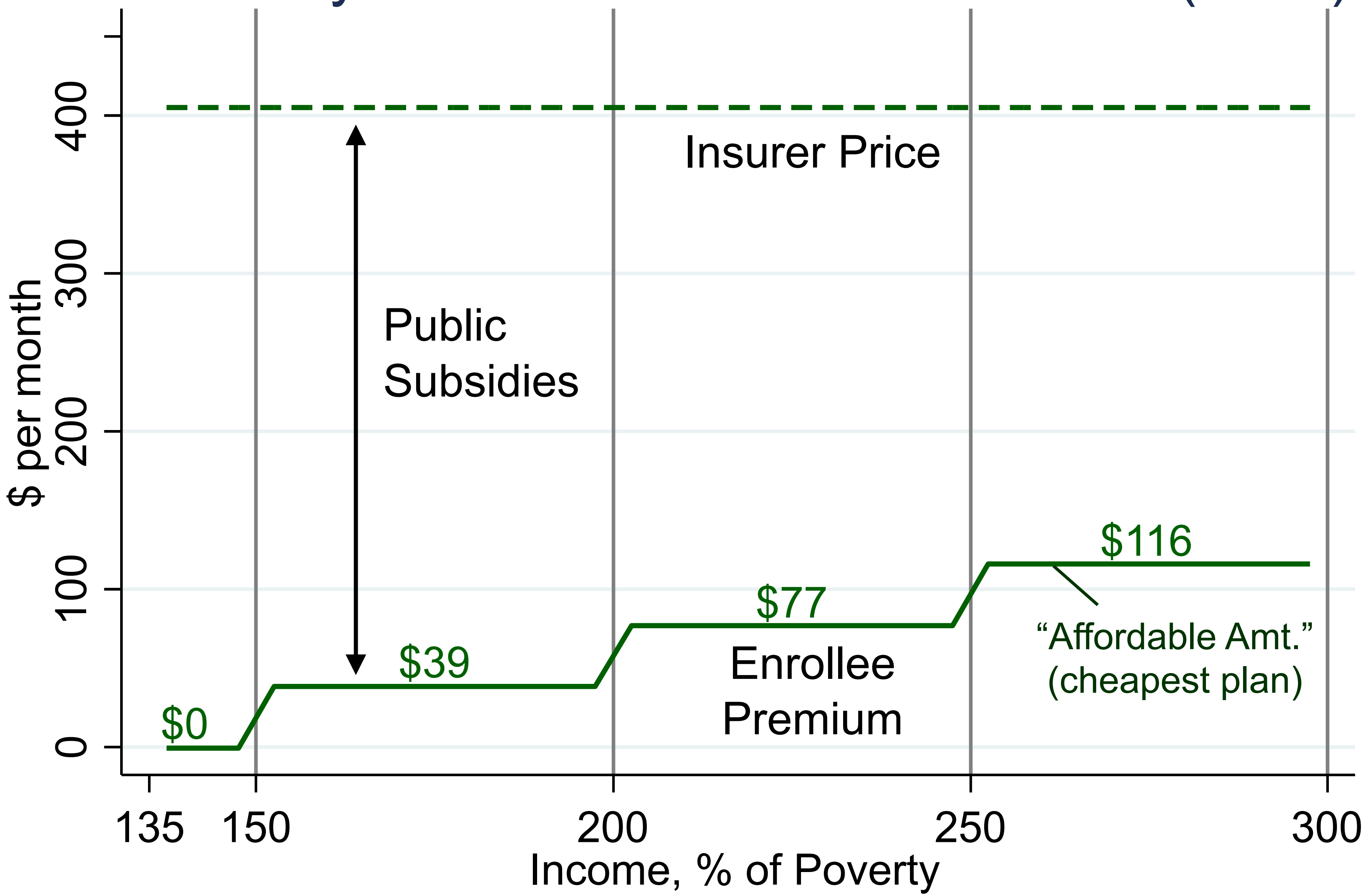
- Characterize “Ex-Ante” WTP in Simple Example

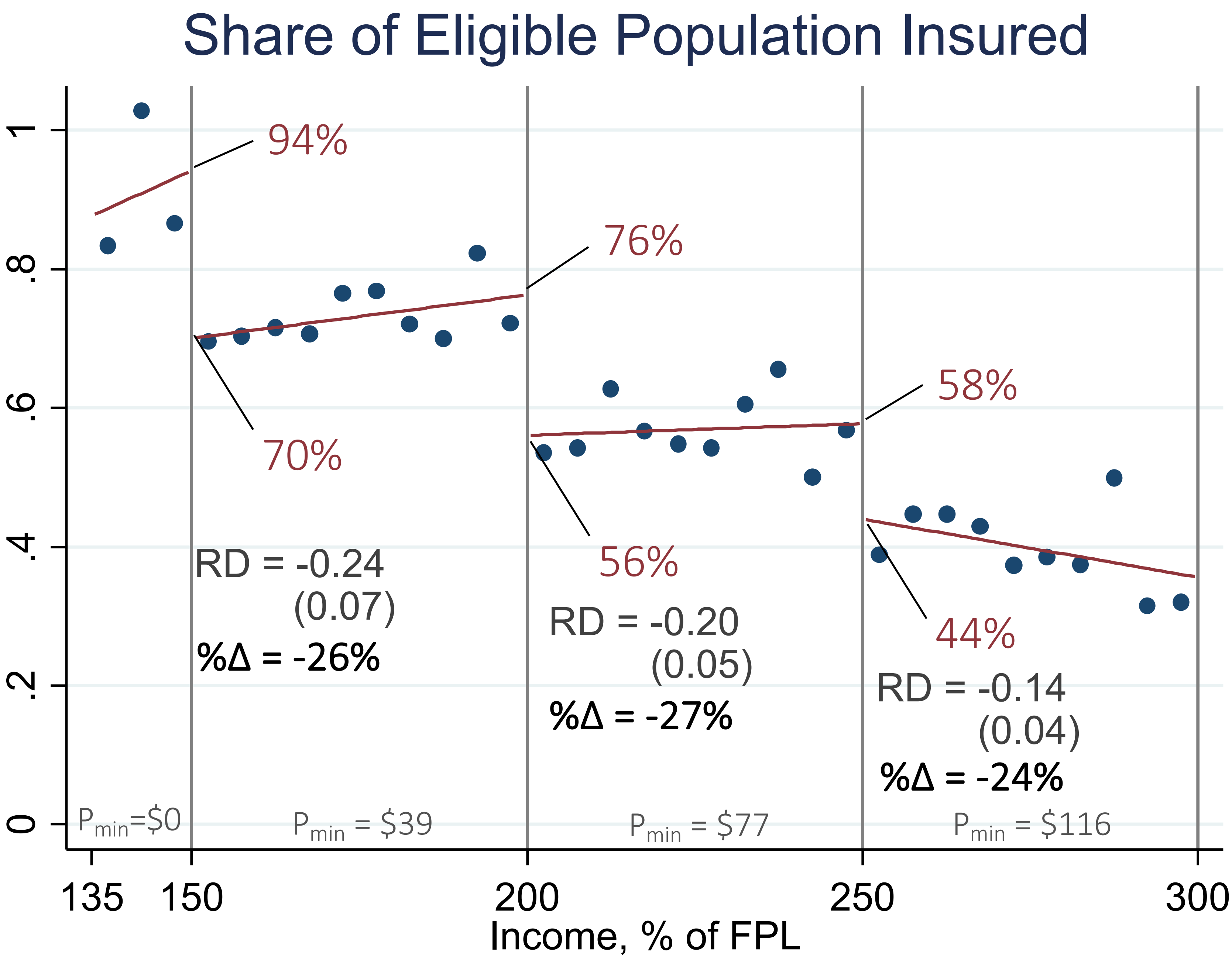
- Extend to General Case and Apply to Low-Income Health Insurance Subsidies

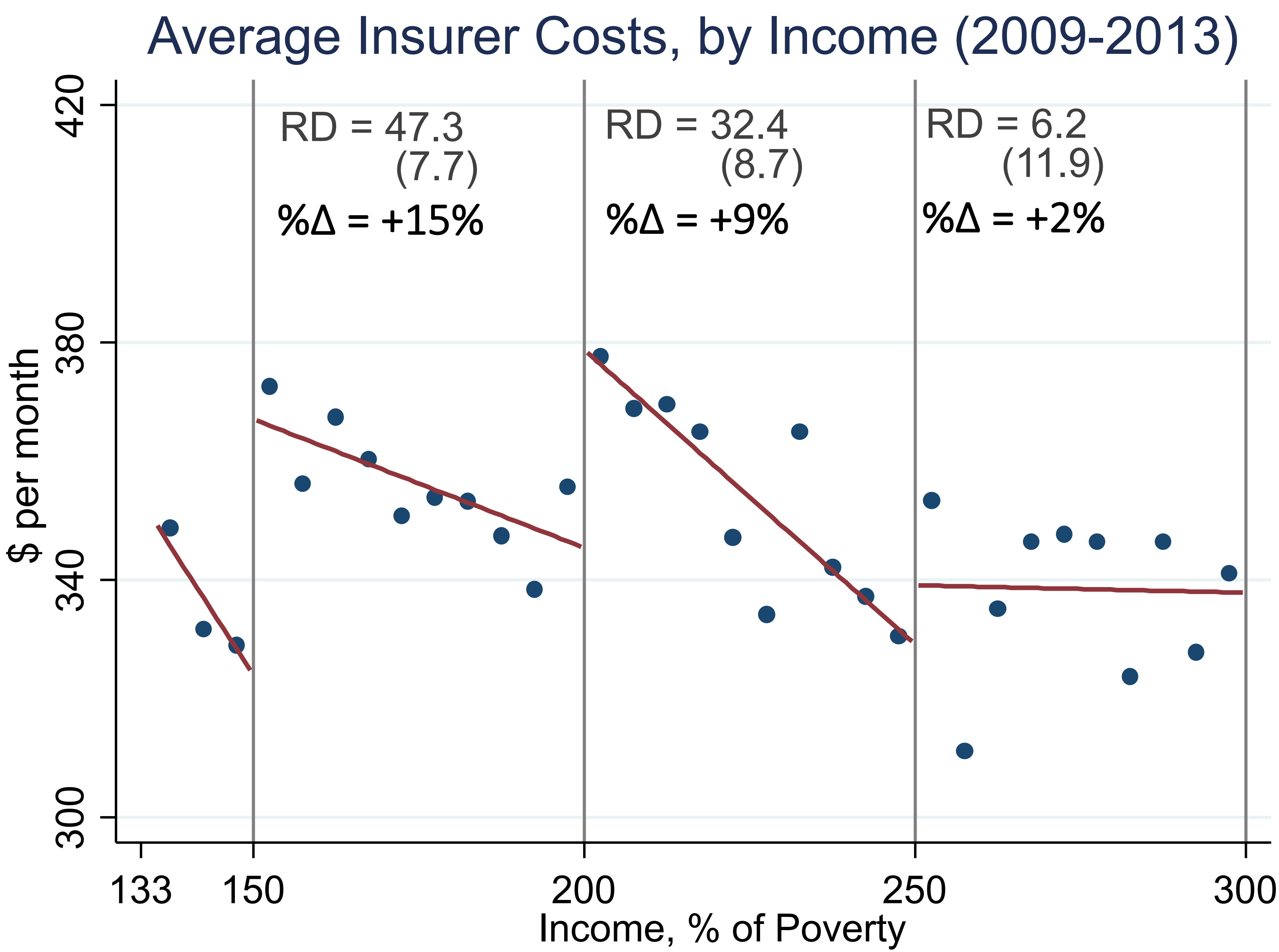
Low-Income Health Insurance Subsidies

- Finkelstein, Hendren, and Shepard study subsidized exchange in Massachusetts (pre-ACA)
  - Model for ACA: Similar design, low-income population choosing b/n heavily subsidized coverage vs. uninsurance
- Key feature: Subsidies vary by discrete income bin
  - Creates RD variation in premiums owed by enrollees
  - E.g., 149% poverty person has $0 plan; 151% poverty pays $39/month
- Use price variation to estimate WTP, cost of insurance

Subsidy and Premium Discontinuities (2011)

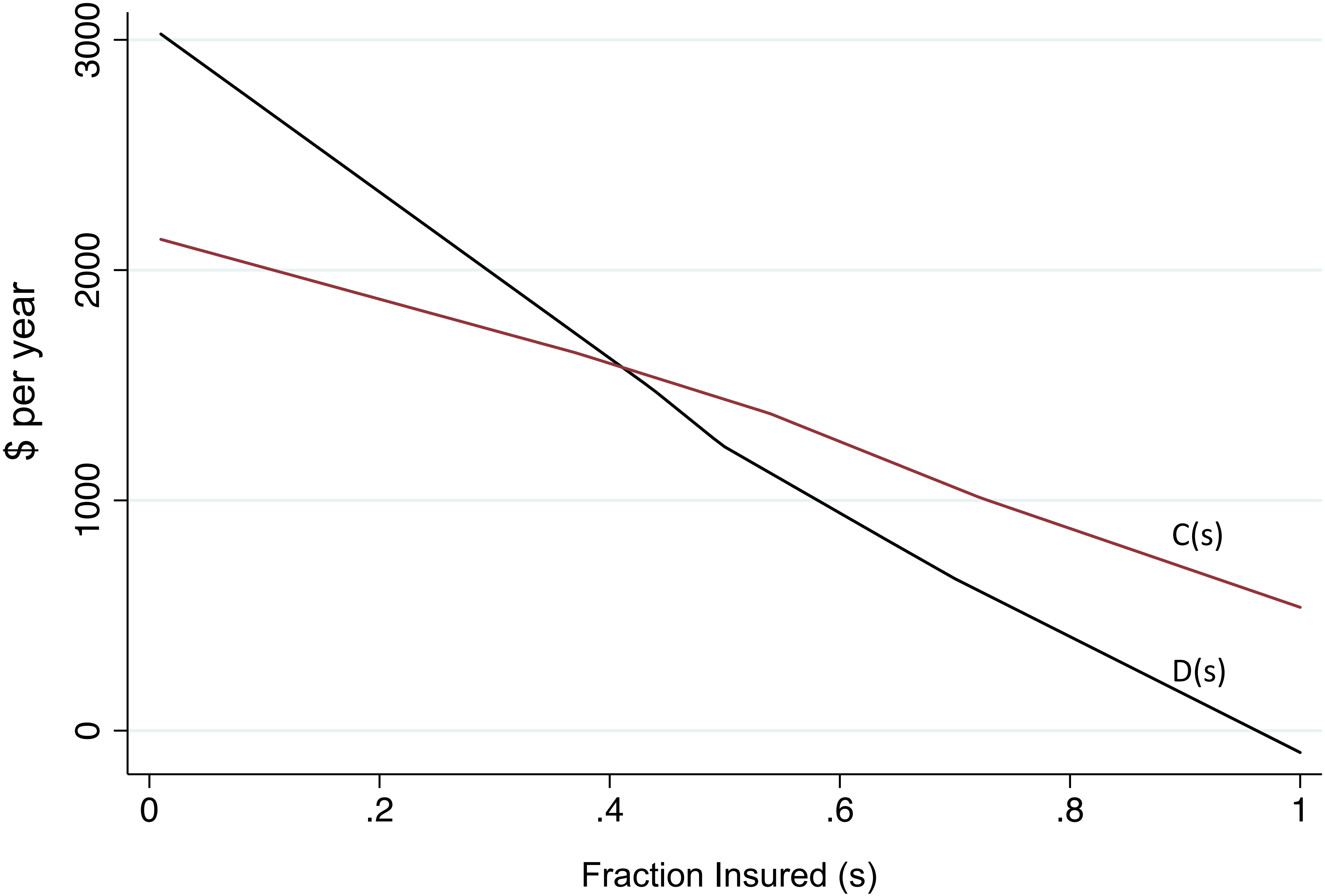



Share of Eligible Population Insured
94%
76%
70%
58%
56%
44%
RD = -0.24
(0.07)
%Δ = -26%
RD = -0.20
(0.05)
%Δ = -27%
RD = -0.14
(0.04)
%Δ = -24%
Pmin=$0
Pmin = $39
Pmin = $77
Pmin = $116
0
.2
.4
.6
.8
1
135
150
200
250
300
Income, % of FPL

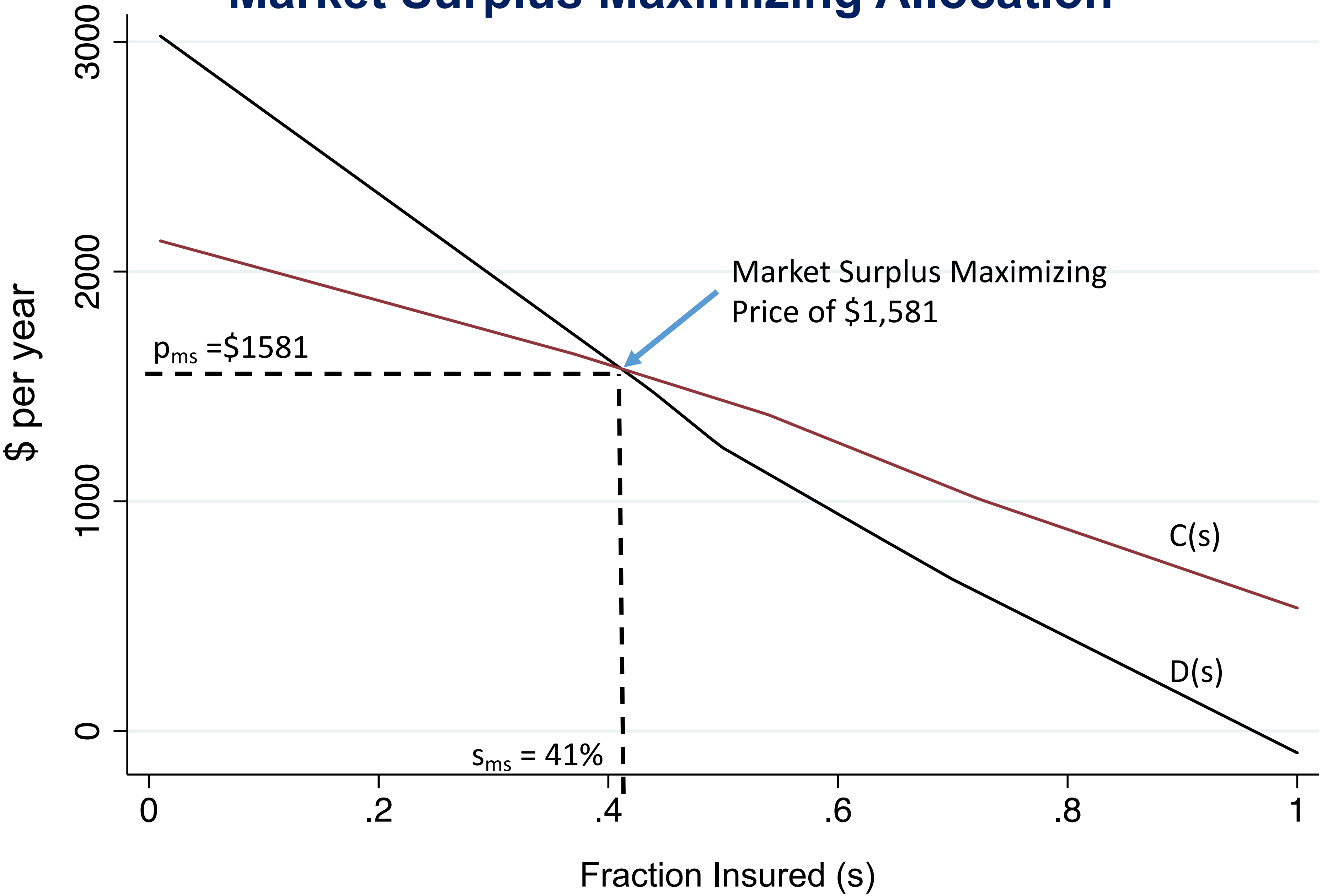


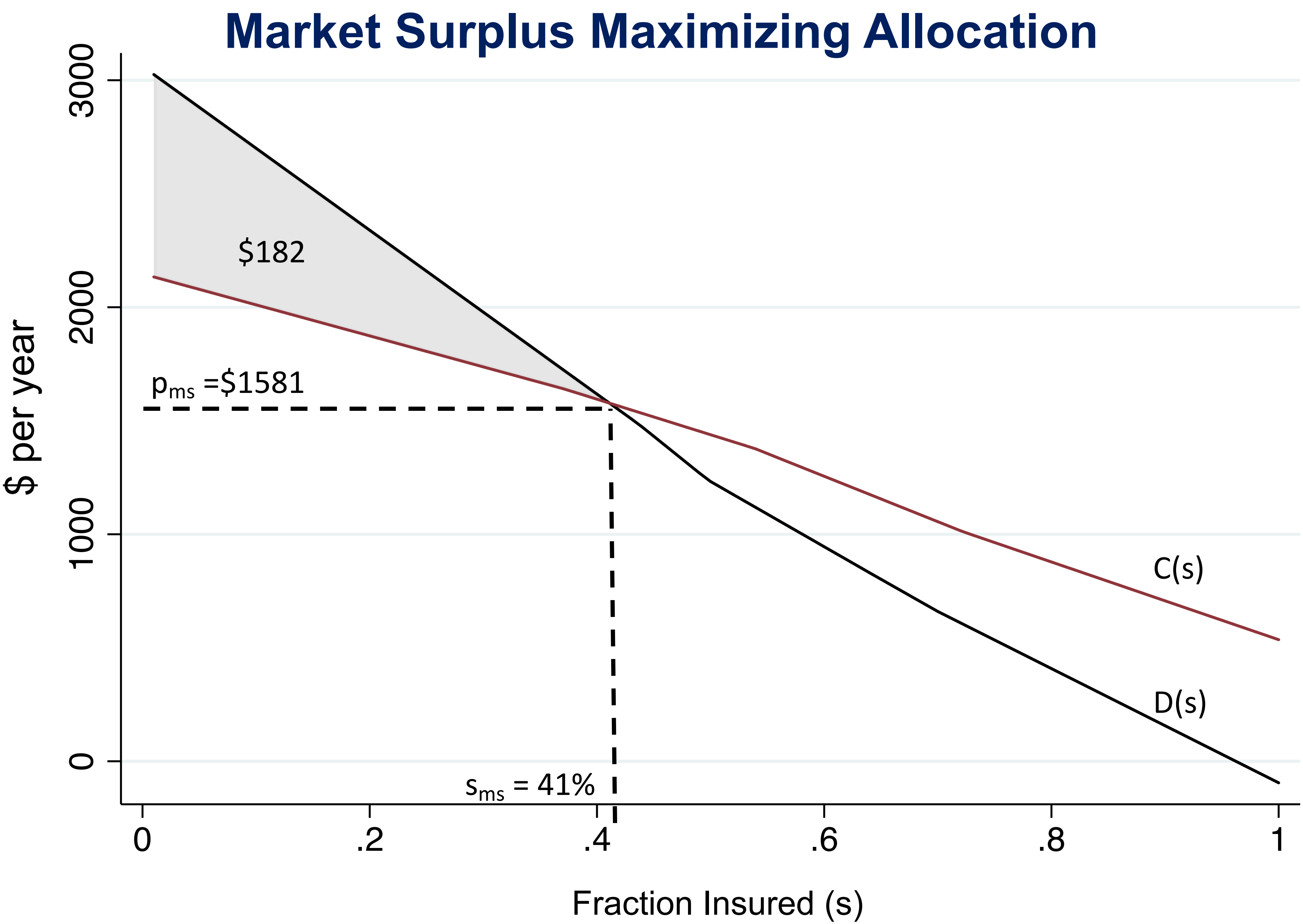
Average Insurer Costs, by Income (2009-2013)
RD = 47.3
(7.7)
%Δ = +15%
RD = 32.4
(8.7)
%Δ = +9%
RD = 6.2
(11.9)
%Δ = +2%
$ per month
420
380
340
300
133
150
200
250
300
Income, % of Poverty

WTP and Cost in Finkelstein, Hendren, and Shepard (2017)

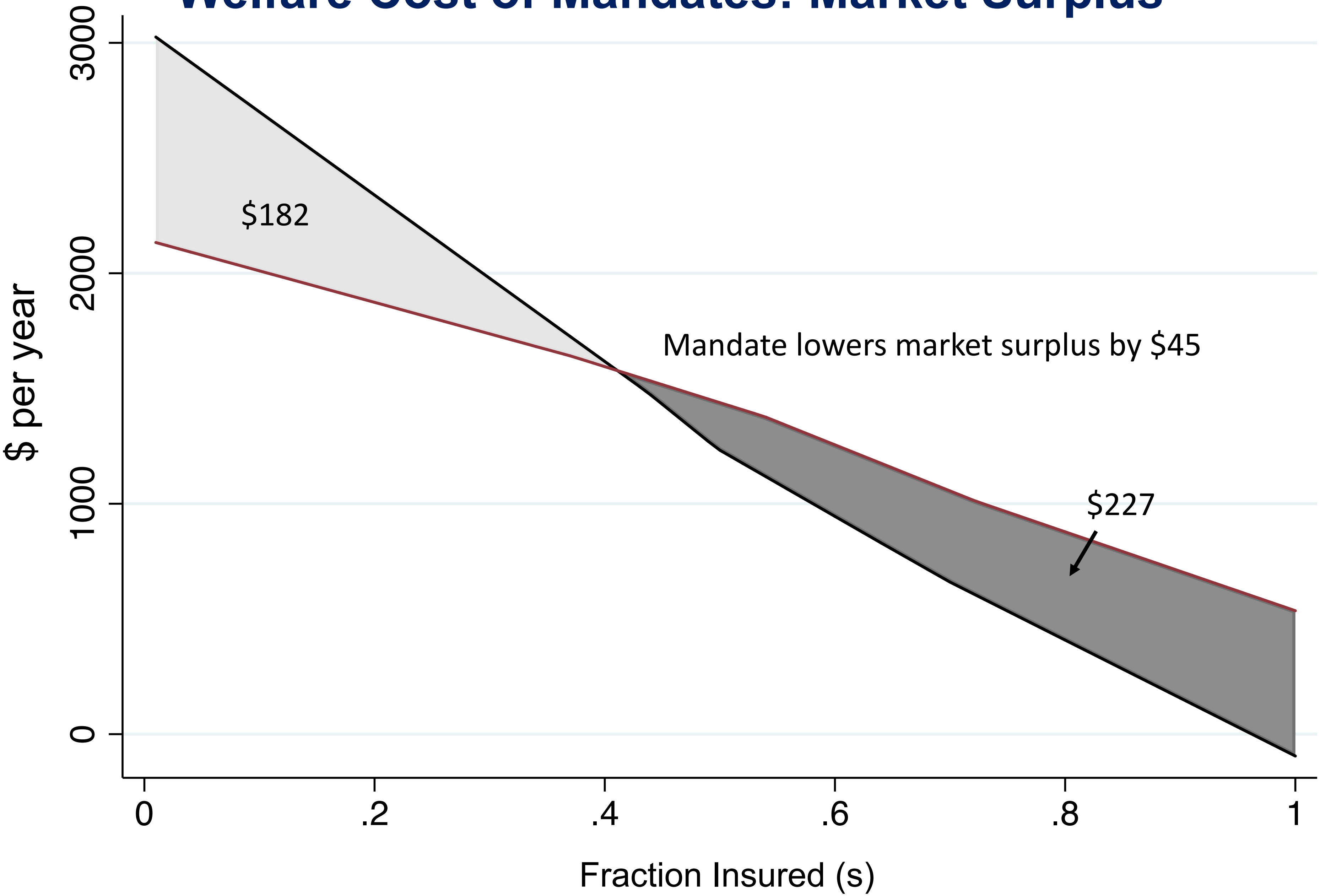


Market Surplus Maximizing Allocation




Market Surplus Maximizing Allocation
3000
2000
1000
0
$ per year
$182
p_ms =$1581
s_ms = 41%
C(s)
D(s)
0
.2
.4
.6
.8
1
Fraction Insured (s)

Welfare Cost of Mandates: Market Surplus



Ex-Ante WTP: General Model

What about Ex-Ante WTP?

Paper provides generalized model that incorporates:

- Moral Hazard
  - Cost responds to insurance coverage
  - WTP can lie below cost
- Preference Heterogeneity
- Imperfect information about costs
  - Key advantage: yields internal measure of risk aversion

General Formula for Ex-Ante WTP

- Marginal Ex-ante WTP for larger insurance market:

$$\frac{W'(s)}{E[u_c]} = \underbrace{D(s) - C(s)}_{\text{Market Surplus}} + EA(s) = \underbrace{D(s) + EA(s)}_{\text{"Ex-Ante" WTP}} - C(s)$$

where

$$EA(s) = \underbrace{(1-s)\left(C(s) - D(s) - sD'(s)\right)}_{\text{Size of Transfer}} \beta(s)$$

and

$$\beta(s) = \underbrace{\frac{E[u_c|Insured] - E[u_c|Unins]}{E[u_c]}}_{\text{Marginal Utility Difference}}$$

General Formula for Ex-Ante WTP

- Marginal Ex-ante WTP for larger insurance market:

$$\frac{W'(s)}{E[u_c]} = \underbrace{D(s) - C(s)}_{\text{Market Surplus}} + EA(s) = \underbrace{D(s) + EA(s)}_{\text{"Ex-Ante" WTP}} - C(s)$$

where

$$EA(s) = \underbrace{(1-s)(C(s) - D(s) - sD'(s))}_{\text{Size of Transfer}} \beta(s)$$

and

$$\beta(s) = \underbrace{\frac{E[u_c|Insured] - E[u_c|Unins]}{E[u_c]}}_{\text{Marginal Utility Difference}}$$

Need to estimate $\beta(s)$

Implementation Assumptions

- Step 1: No complementarities/substitutability + common prefs:

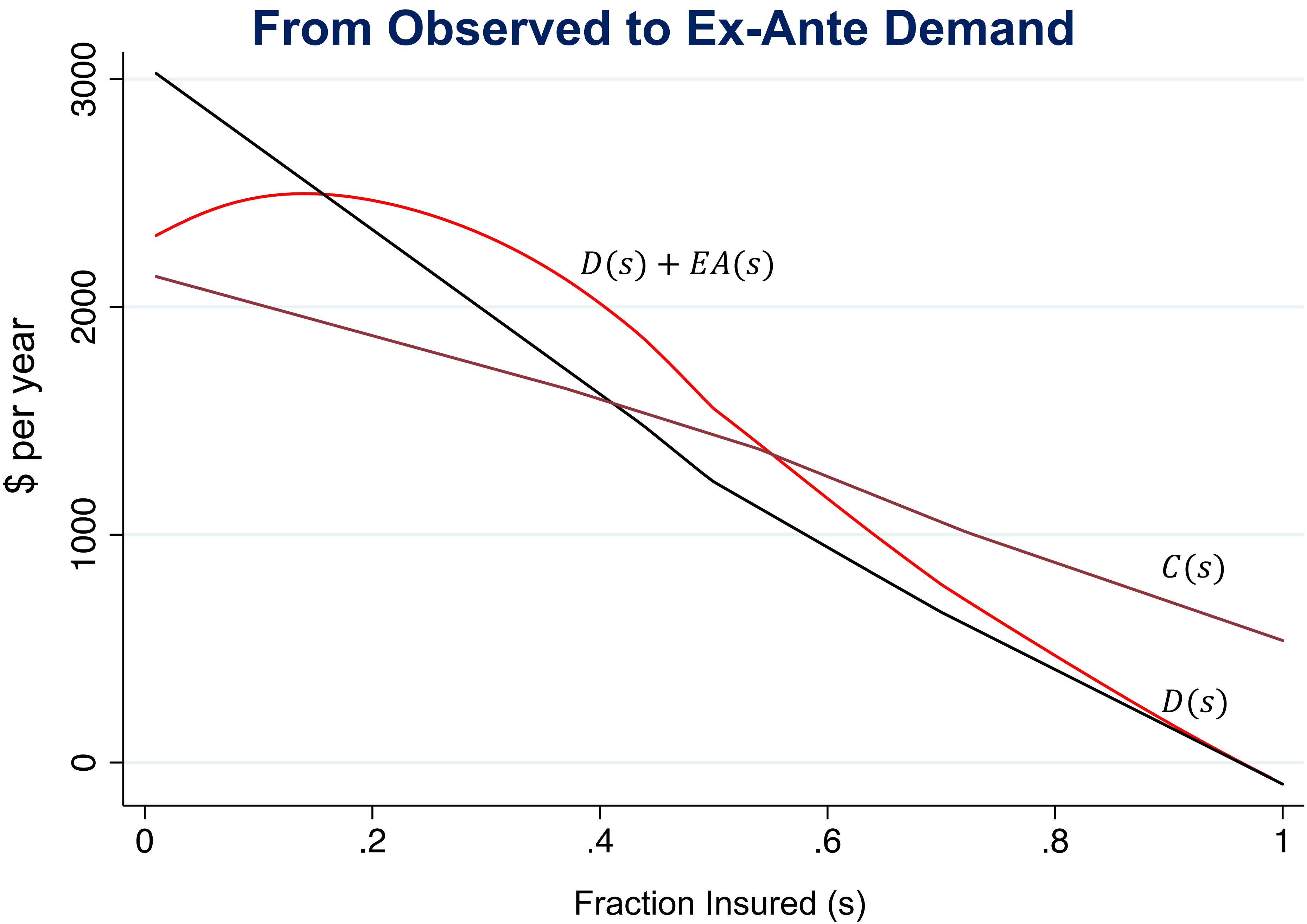
$$\beta(s) = \gamma[E[C(s')|s' \geq s] - E[C(s')|s < s']]$$

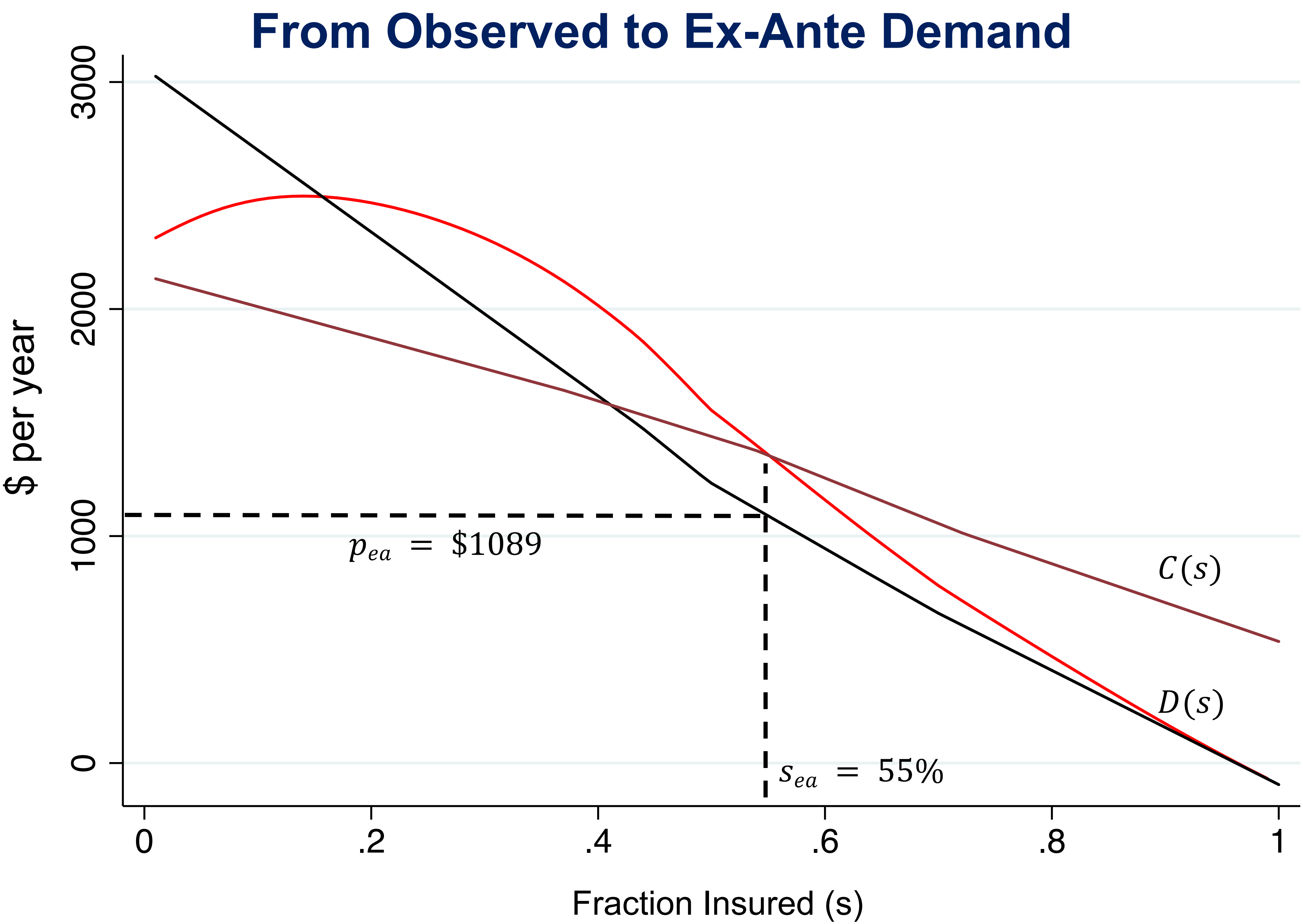
  - Where $\gamma = \frac{-u_{cc}}{u_c}$ is the CARA

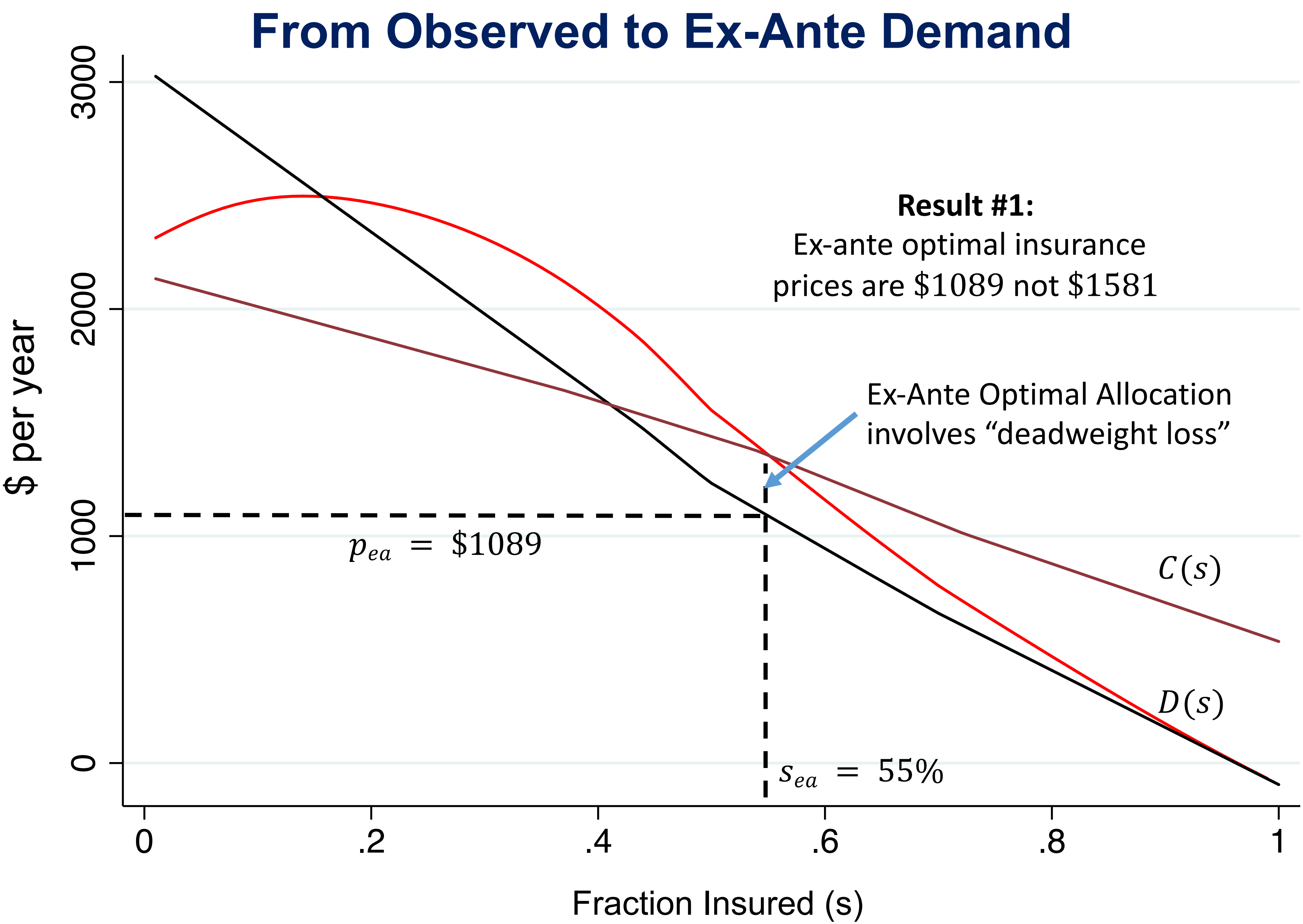
- Step 2: No liquidity / income differences between insured and uninsured

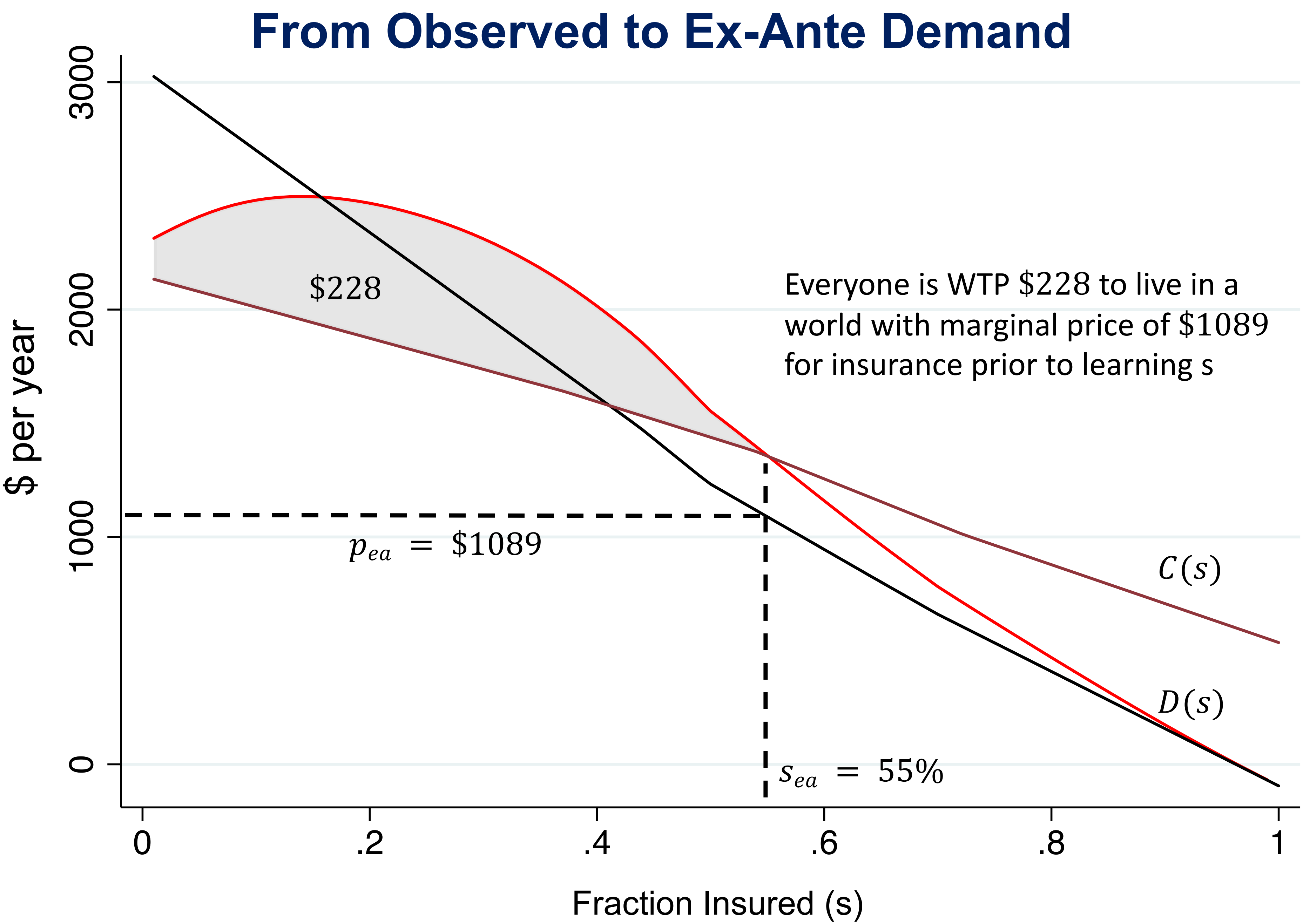
$$\beta(s) = \gamma[D(s) - E[D(s')|s' \geq s]\,]$$

- Key additional input: External/Internal measure of risk aversion
  - Baseline case: $\gamma = \ 5x10^{-4}$ (Handel, Hendel, and Whinston 2016)


From Observed to Ex-Ante Demand
$ per year
3000
2000
1000
0
0
.2
.4
.6
.8
1
Fraction Insured (s)
$D(s) + EA(s)$
$C(s)$
$D(s)$

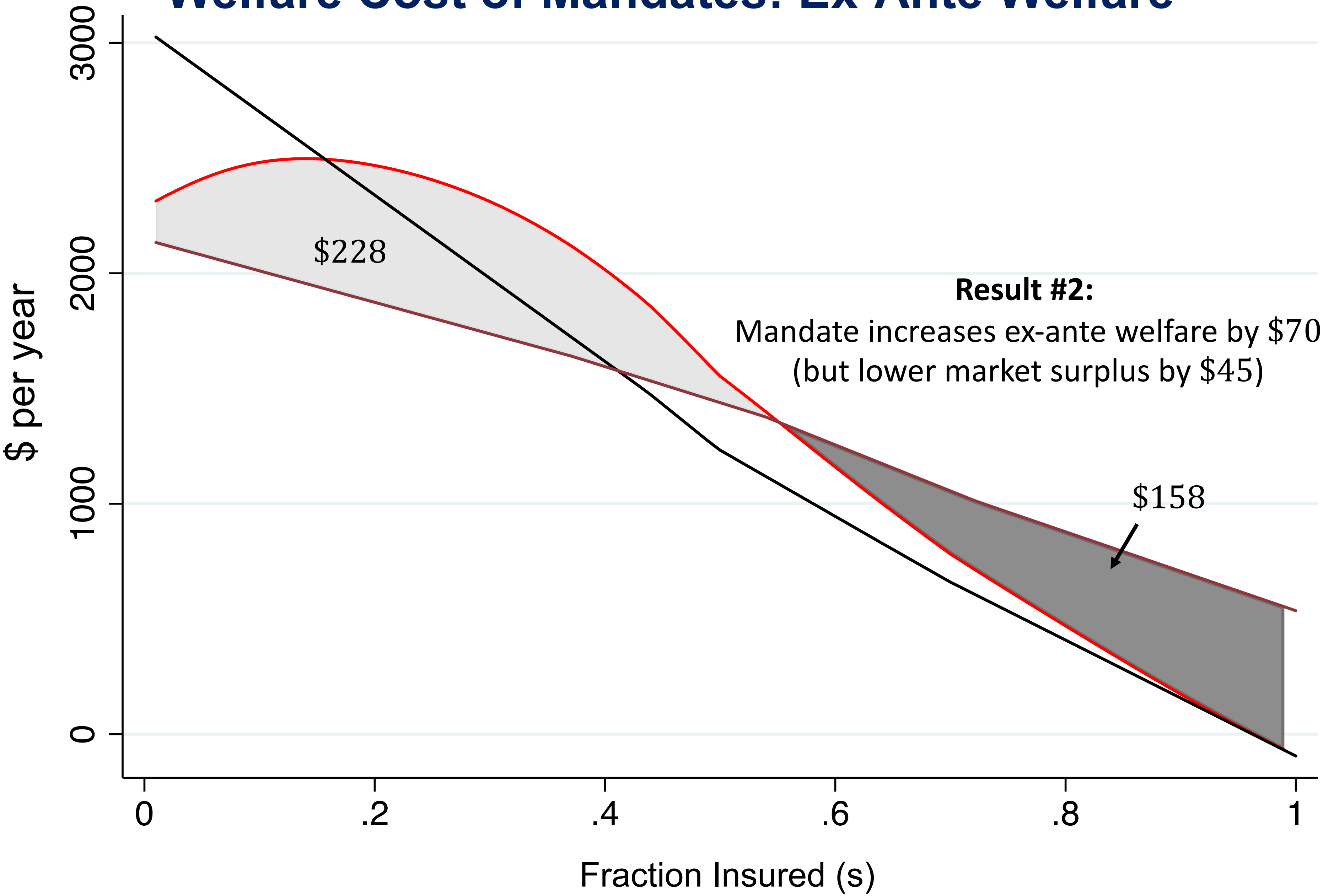

From Observed to Ex-Ante Demand
3000
2000
1000
0
$ per year
$p_{ea} = \$1089$
$s_{ea} = 55\%$
$C(s)$
$D(s)$
0
.2
.4
.6
.8
1
Fraction Insured (s)


From Observed to Ex-Ante Demand
$ per year
3000
2000
1000
0
Fraction Insured (s)
0
.2
.4
.6
.8
1
Result #1:
Ex-ante optimal insurance prices are $1089 not $1581
Ex-Ante Optimal Allocation involves "deadweight loss"
$p_{ea} = \$1089$
$s_{ea} = 55\%$
$C(s)$
$D(s)$



From Observed to Ex-Ante Demand
$ per year
3000
2000
1000
0
0
.2
.4
.6
.8
1
Fraction Insured (s)
$228
Everyone is WTP $228 to live in a world with marginal price of $1089 for insurance prior to learning s
$p_{ea} = \$1089$
$s_{ea} = 55\%$
$C(s)$
$D(s)$

Welfare Cost of Mandates: Ex-Ante Welfare



Non-Budget Neutral Policies: Modified MVPF

- For non-budget neutral policies, consider the marginal WTP per dollar of government revenue (MVPF)
  - Mayshar (1990); Hendren (2016)
  - Can be compared to the MVPF of alternative policies (e.g. EITC)

$$MVPF = \frac{\text{Marginal WTP for Beneficiaries}}{\text{Marginal Cost to Govt}}$$

Non-Budget Neutral Policies: Modified MVPF

- Insured value \$1 lower premium at \$1

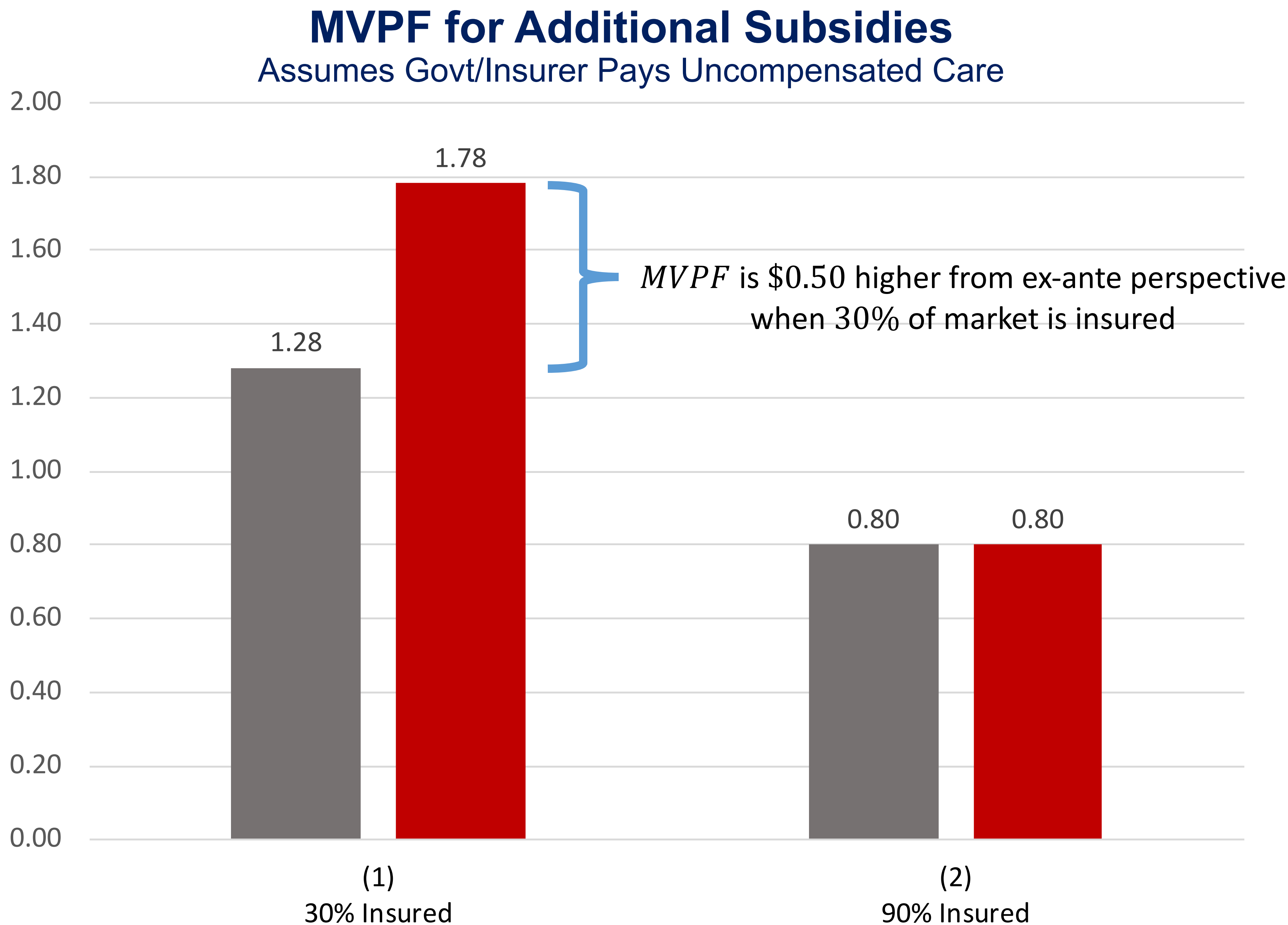
- Implies $$MVPF_{Ex-Post} = \frac{1}{1 + \frac{C(s)-D(s)}{sD'(s)}}$$

- But, prior to learning they will be insured, additional value

$$MVPF_{Ex-Ante} = \frac{E\left[u_c | Insured\right]}{E\left[u_c\right]} \frac{1}{1 + \frac{C(s)-D(s)}{sD'(s)}}$$

where $$\frac{E\left[u_c | Insured\right]}{E\left[u_c\right]} = 1 - (1-s)\,\beta(s)$$

- Two reasons $MVPF > 1$
  - $C(s)$ is above $D(s)$
  - Ex-ante value of insurance



MVPF for Additional Subsidies
Assumes Govt/Insurer Pays Uncompensated Care
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1.78
1.28
0.80
0.80
$MVPF$ is $0.50 higher from ex-ante perspective
when 30% of market is insured
(1)
30% Insured
(2)
90% Insured

Summary

- Insurance insures against the realization of risk
  - Revealed preference does not measure ex-ante notions of expected utility

- Paper provides method to measure ex-ante expected utility
  - Retain empirical transparency of reduced form WTP and cost curves
  - Augment with diff in marginal utilities between insured and uninsured

- Provide benchmark implementation method

- Requires minimal additional information
  - Exploiting WTP and cost curves
  - Risk aversion (internal or external)

Ex-Ante Perspective Can Change Value of Social Insurance

- Apply to low-income health insurance in Massachusetts
  - Ex-ante optimal prices are roughly 30% lower
  - Mandates increase expected utility despite increasing DWL
  - Higher marginal value of subsidies

- Further applications: Other variation in choice sets
  1. Valuing Medicaid or other social insurance using labor supply responses to eligibility notches [Keane and Moffitt 1998; Gallen 2014; Dague 2014]
     - Papers find low WTP for Medicaid
     - Capture only value of insurance against remaining risk when individuals adjust their labor supply to become eligible
  2. Inferring WTP from consumption changes around a shock [Gruber 1997; Meyer and Mok 2013]
     - Consumption may not respond directly at the time we observe the shock, since some info may have been revealed [Hendren 2017]