Glenn Harrison

The Welfare Evaluation of Insurance

Joint with Jia Min Ng (GSU RMI Ph.D. student)

ETH RISK CENTER

AXA Research Fund
Through Research, Protection

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Center for the Economic Analysis of Risk

Georgia State University
J. MACK ROBINSON COLLEGE OF BUSINESS

Metrics for evaluating insurance

- Selling more of the “same” product
  - Is “take-up” or “profit” the metric?
  - Short-term or long-term profit?
- Designing new products
- Evaluating welfare effects for cost-benefit analysis
  - Cost-benefit analysis is not cost effectiveness
- Designing better insurance policies

How insurance products are evaluated

- Take-up itself
  - Revealed preference begs the welfare evaluation issue
  - Particularly when we do not assume “rationality”

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- Average utilization
  - Average consumption, health care, crop size, herd size…

FIGURE 9 THE IMPACT OF MICROINSURANCE

A review of 38 studies on the impact of microinsurance provides the following insights

Lower out-of-pocket spending

15 studies linked microinsurance to a reduction of expenditures

Reduction in expenditures was also found in **Cambodia, Ghana, India, Rwanda, Senegal** and **Vietnam**

44% average decrease found in treatment costs for a community health scheme in Cambodia (Levine and Polimeni, 2012)

In China, however, no impact on expenditure was found (Lei and Lin, 2012)

Lower reliance on burdensome coping strategies

7 studies linked the adoption of microinsurance to the reduction of costly risk coping strategies such as

assets sales
child labour
indebtedness
dissaving

Livestock insurance in Kenya: 29% less asset selling

Health insurance in India: 33% less borrowing

Health insurance in Pakistan: 7% less child labour

Janzen and Carter (2013), Aggarwal (2010), Landmann and Frohlich (2013)

Better financial choices in the absence of a shock

8 studies found an improvement in agricultural production due to microinsurance

Higher investments and outputs were found in **China, Ethiopia, India** and **Ghana**

In China, insurance was responsible for **27%** higher investment in cross-bred pigs among policyholders (Chen et al, 2012)

In Ghana, insured farmers increased expenditure on fertilizer by **24%** and the area of land cultivated by **17%** (Karlan et al, 2013)

Increase in the utilization of health-care services

20 studies found an increase in the use of health services

15% average increase for a community-based health scheme in Nigeria (Gustafsson-Wright, 2013)

In China, self-medication was reduced **2/3** (Yip et al, 2009)

In Rwanda, children covered by the Mutuelles de Santé were about **22%** more likely to receive treatment when sick than non-insured (Dimaras et al, 2012)

In India, an OP community scheme was found to reduce days of hospitalization and health expenses (Mahal et al, 2013)

In Kenya, however, no significant improvement in utilization of health facilities was found (De Leener et al, 2012)

Better health outcomes

Improvements in health conditions found in **5** studies include:

increase in the body mass index of adults and height and weight of young children (Arthur and Gingerich, 2009)

reduction of infant mortality (Dimaras et al, 2012)

and in the risk of infection (Quimbo et al, 2011)

In Cambodia, however, no impact on children's health was found (Levine and Polimeni, 2012)

TO SUM IT UP:

Outcomes & impacts	Evidence available
Lower out-of-pocket spending	☺☺☺ / ☹
Lower reliance on burdensome strategies	☺☺☺
Better financial choices in the absence of a shock	☺☺
Increase in the utilization of health-care services	☺☺☺ / ☹
Better health outcomes	☺ ☺ / ☹

Source: De Bock and Ugarte Ontiveros, 2013.

How insurance products are evaluated

- Take-up itself
  - Revealed preference begs the welfare evaluation issue
  - Particularly when we do not assume “rationality”
- Average utilization
  - Average consumption, health care, crop size, herd size…
  - Popular metric for randomized evaluations (for no good reason)
  - Irrelevant!
    - In fact, insurance works when it lowers the average by a premium in order to reduce variability!
    - At best, a third-order, indirect criterion

Behavior and insurance

- The basic insurance contract
  - I give you money now and you promise to pay me something if some bad things happen to me in the future
- Connections to behavioral economics
  - Obviously risk attitudes play a role
  - Impatience plays a role
  - Subjective beliefs of risk play a role
    - Subjective risk of the “bad thing” occurring
    - Subjective basis risk if an index contract
    - Updating if the “bad thing” does not occur in one year
    - Subjective non-performance risk

General experimental program

- Examine all of the major issues in the lab first
  - Theory
  - Experimental design and behavioral econometrics
- Insurance demand issues
  - Deductibles (another reference point?)
  - Index insurance (ROCL?)
  - Non-performance risk (ROCL and downside risk aversion?)
  - Self-protection, self insurance
- Then go to the field
  - Application #1: Portfolios of the Atlanta Poor
  - Application #2: index insurance products in Africa

Expected welfare gain @ base camp

- Consumer surplus from insurance
  - CE(with insurance) – CE(without insurance)
- Define the simplest possible insurance contract
  - Full indemnity insurance
    - Initial endowment = $20, loss amount = $15, loss probability = 10%
    - RN individual would pay $1.50 for insurance

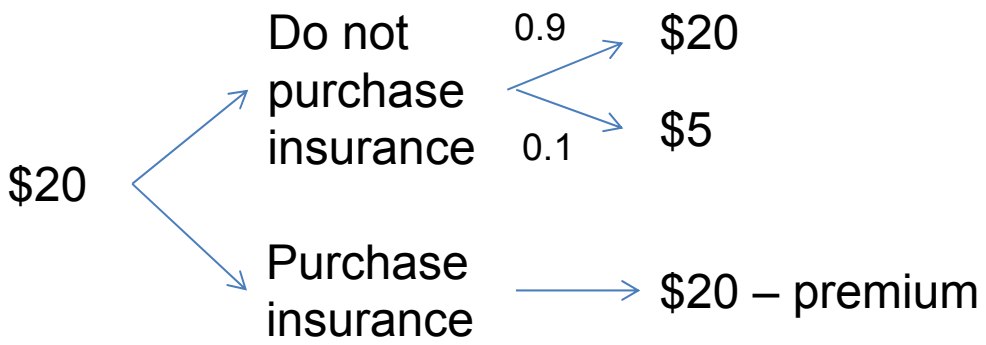
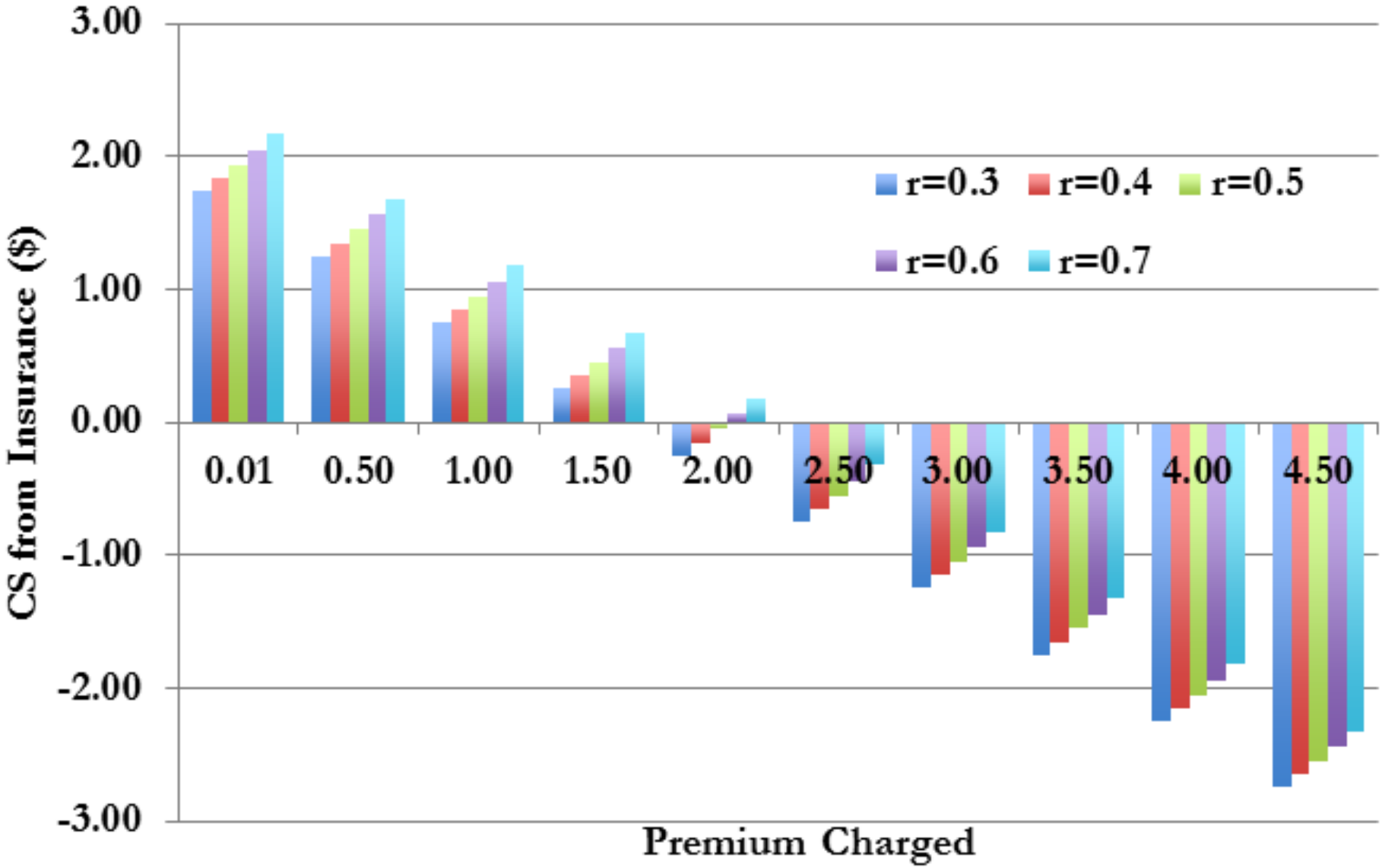


Figure 1. Consumer Surplus Across EUT CRRA Coefficients



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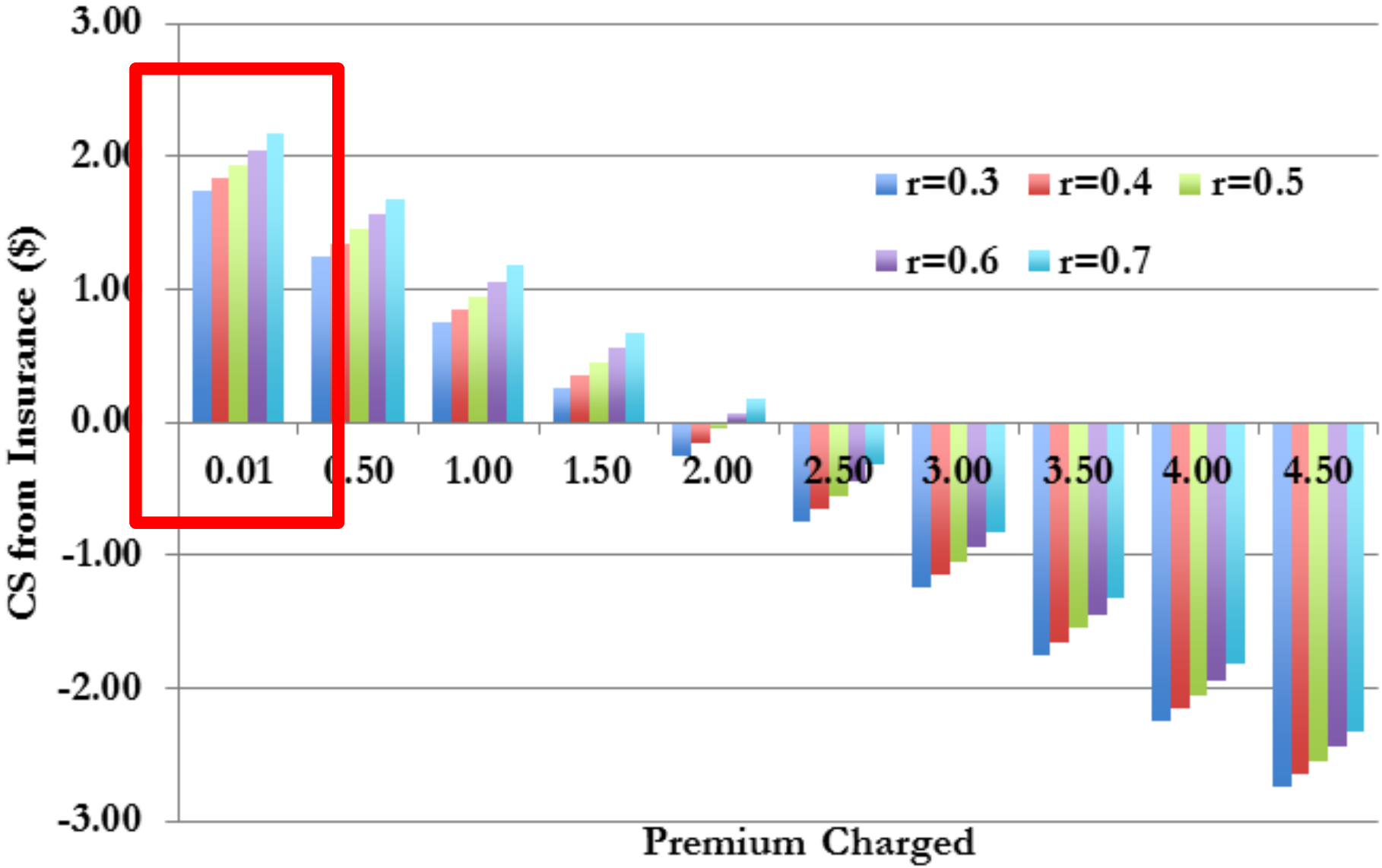

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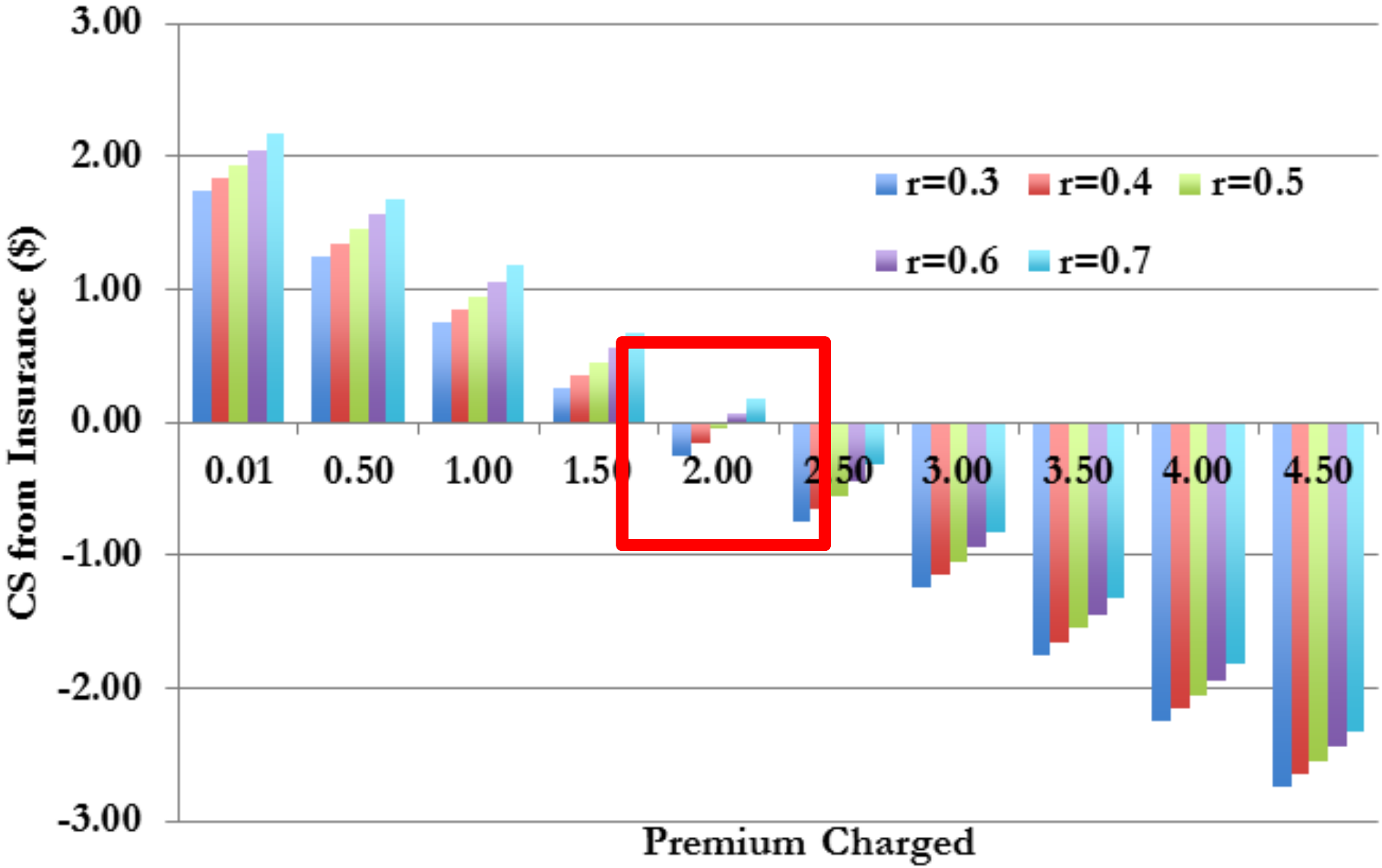


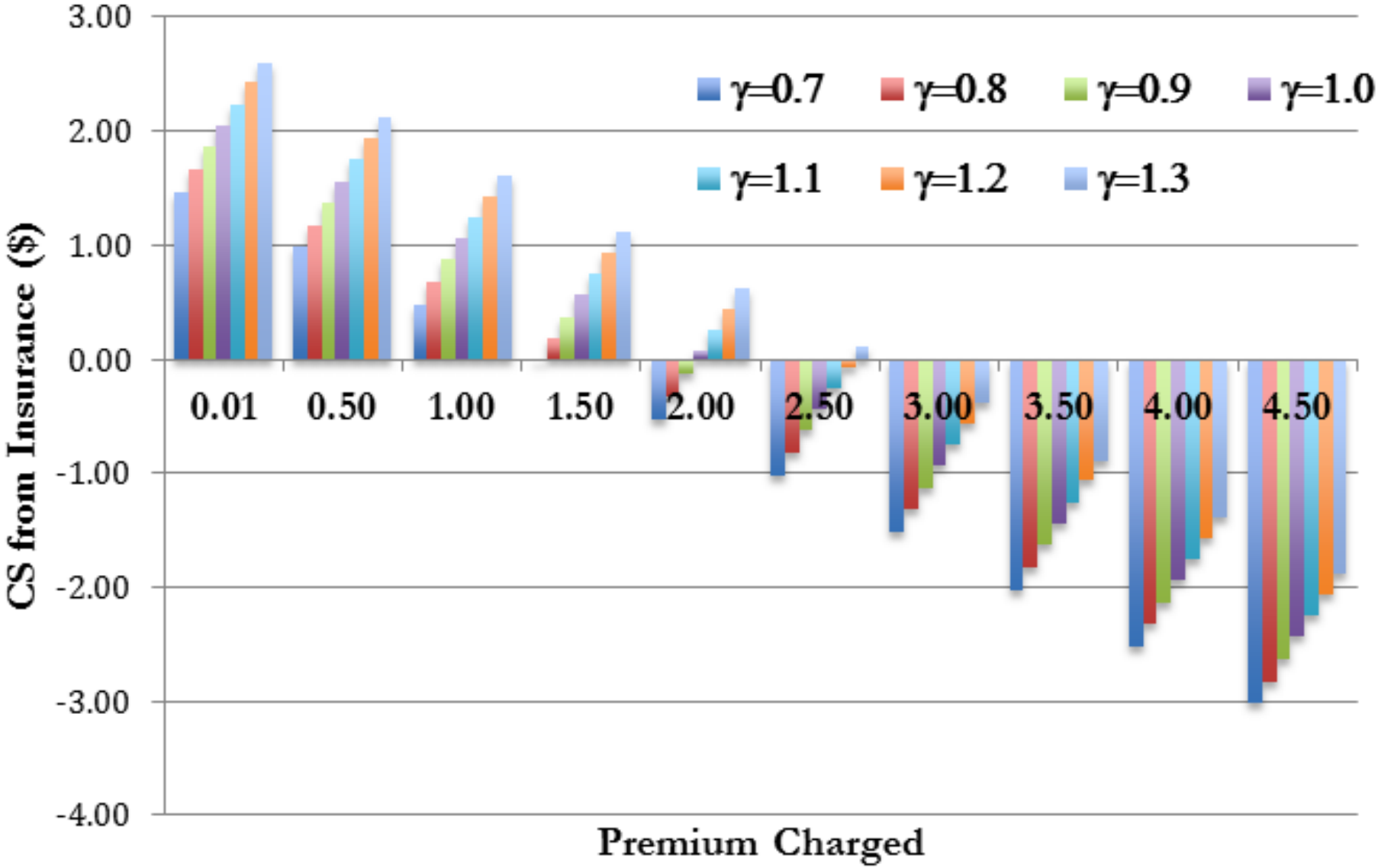
Theories of risk preferences

- Expected utility theory (EUT)

- Rank-dependent utility (RDU)
  - Same aversion to variability of outcomes as EUT
  - But also probability “pessimism” or “optimism”
    - Power probability weighting
    - Inverse-S probability weighting
    - Prelec probability weighting

- Could extend to Cumulative Prospect Theory (CPT)

Figure 3. Consumer Surplus Across Power Probability Weighting Parameter (r = 0.6)



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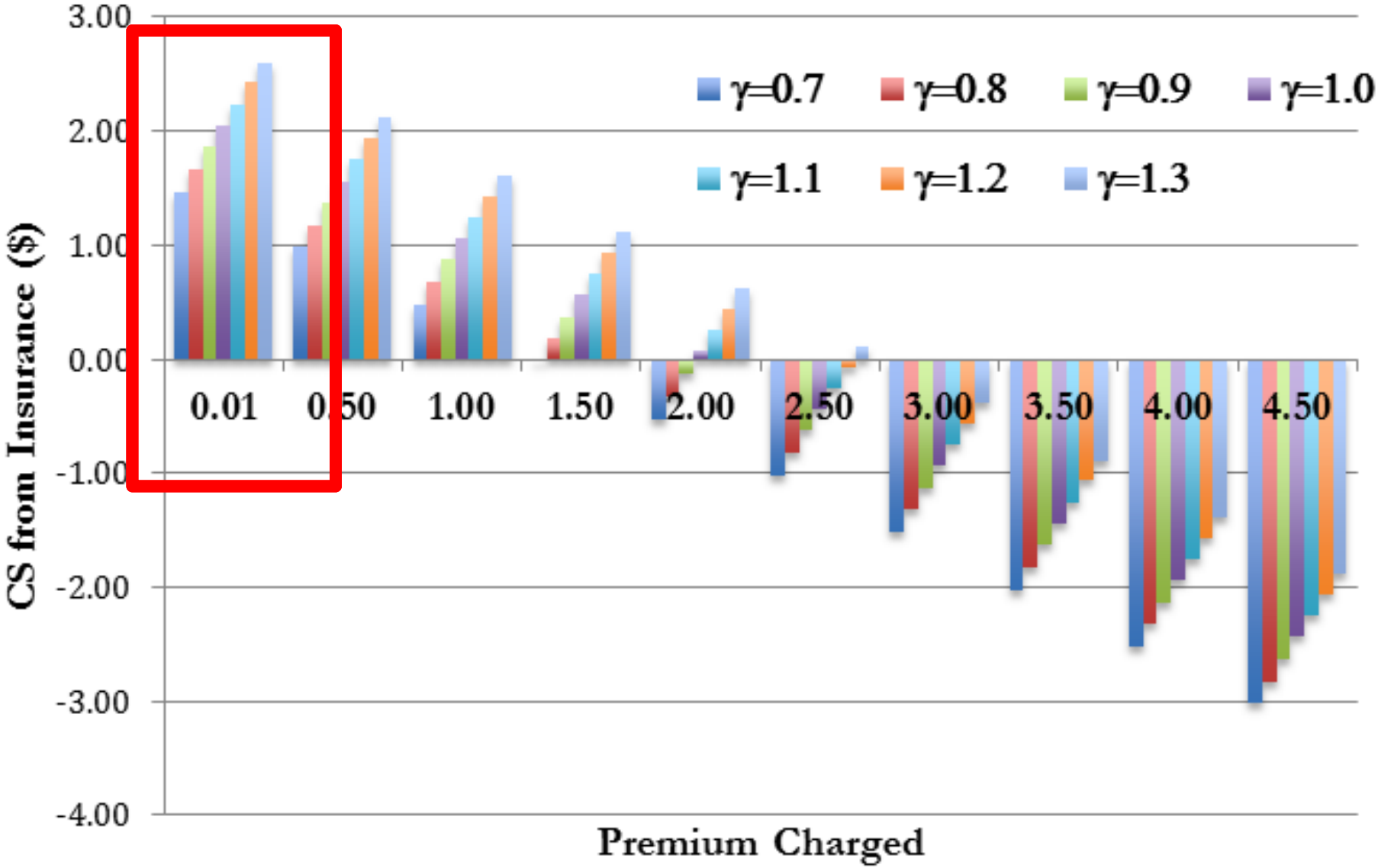

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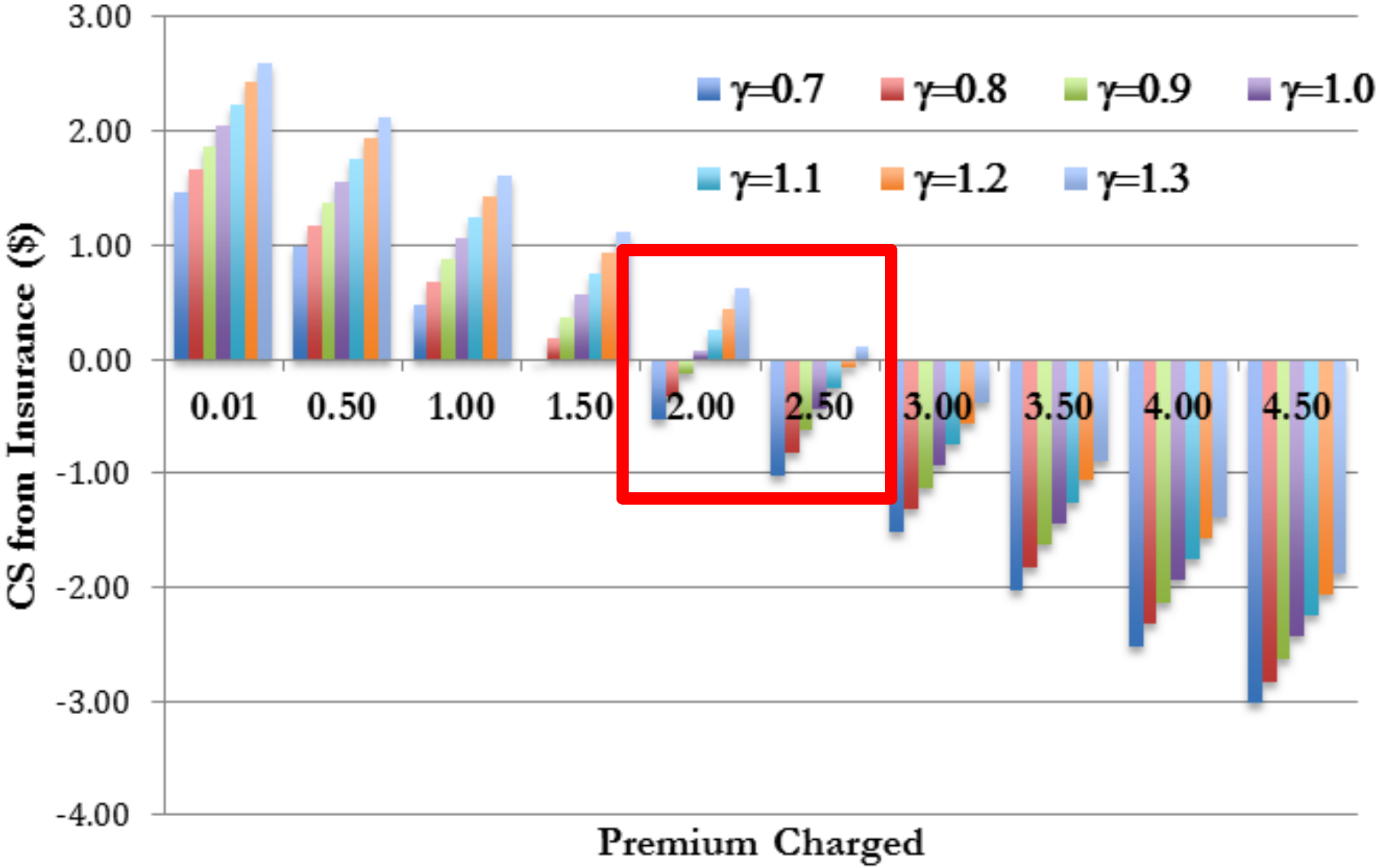


Figure 2. Consumer Surplus Across Inverse-S Probability Weighting Parameter (r = 0.6)

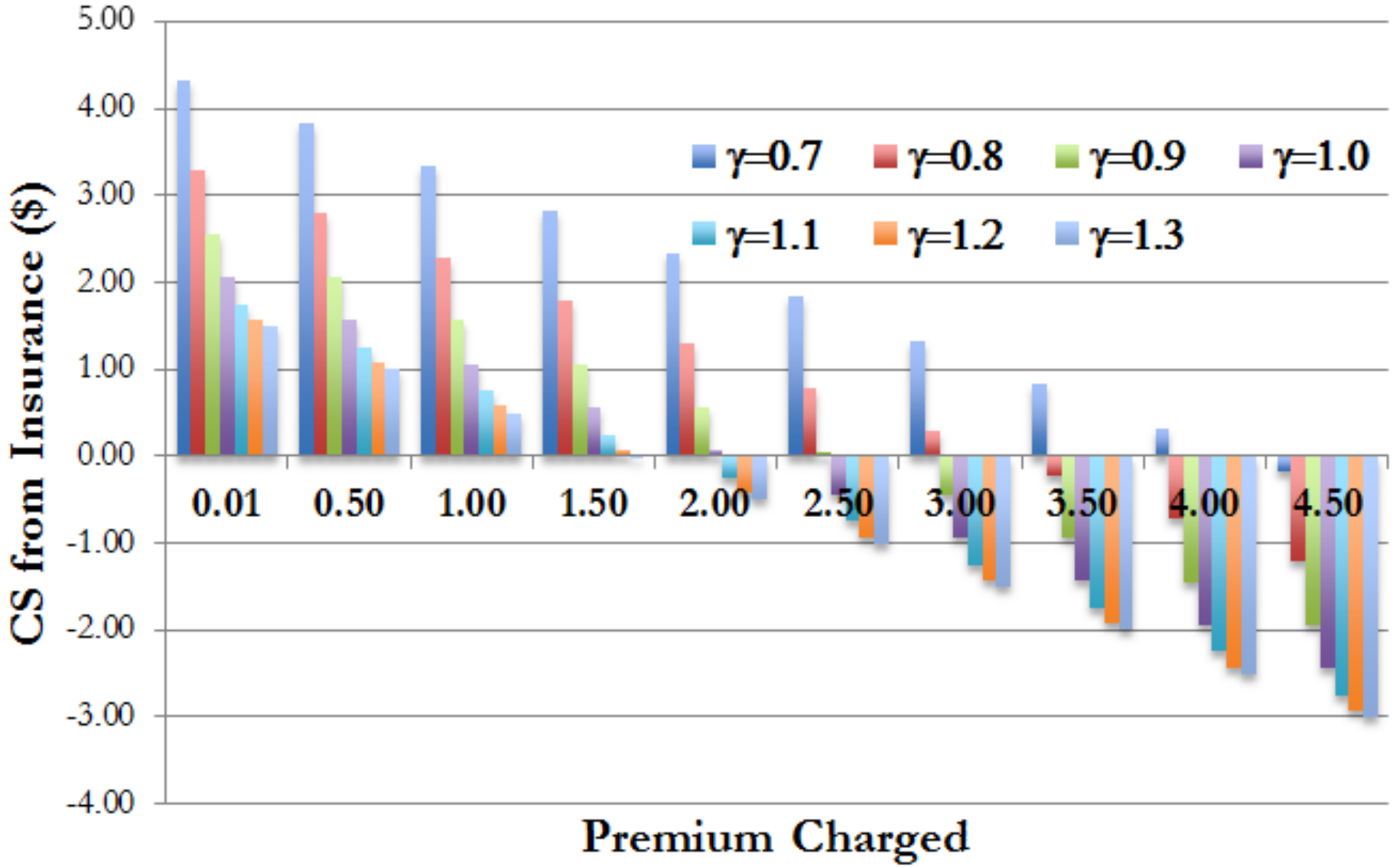


Figure 2. Consumer Surplus Across Inverse-S Probability Weighting Parameter (r = 0.6)

General experimental design

- Battery of lottery choices to decide on the best descriptive model of risk preferences for each subject

- Battery of insurance choices for that subject

- Use risk preferences estimated from the first task to estimate consumer surplus gain or loss from choices in the second task
  - Return to two methodological issues here in moment

This specific experiment

- 103 students over 3 sessions at GSU

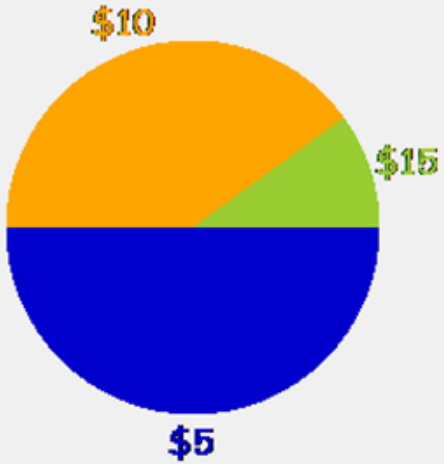
- Risk task
  - 80 binary choices between lotteries with objective probabilities

Left

Chance of winning $5 is 40%
Chance of winning $15 is 60%

Select Left

Right



Chance of winning $5 is 50%
Chance of winning $10 is 40%
Chance of winning $15 is 10%

Select Right

Figure 5: Classifying Subjects as EUT or RDU

N=103, one *p*-value per individual
Estimates for each individual of EUT and RDU specifications

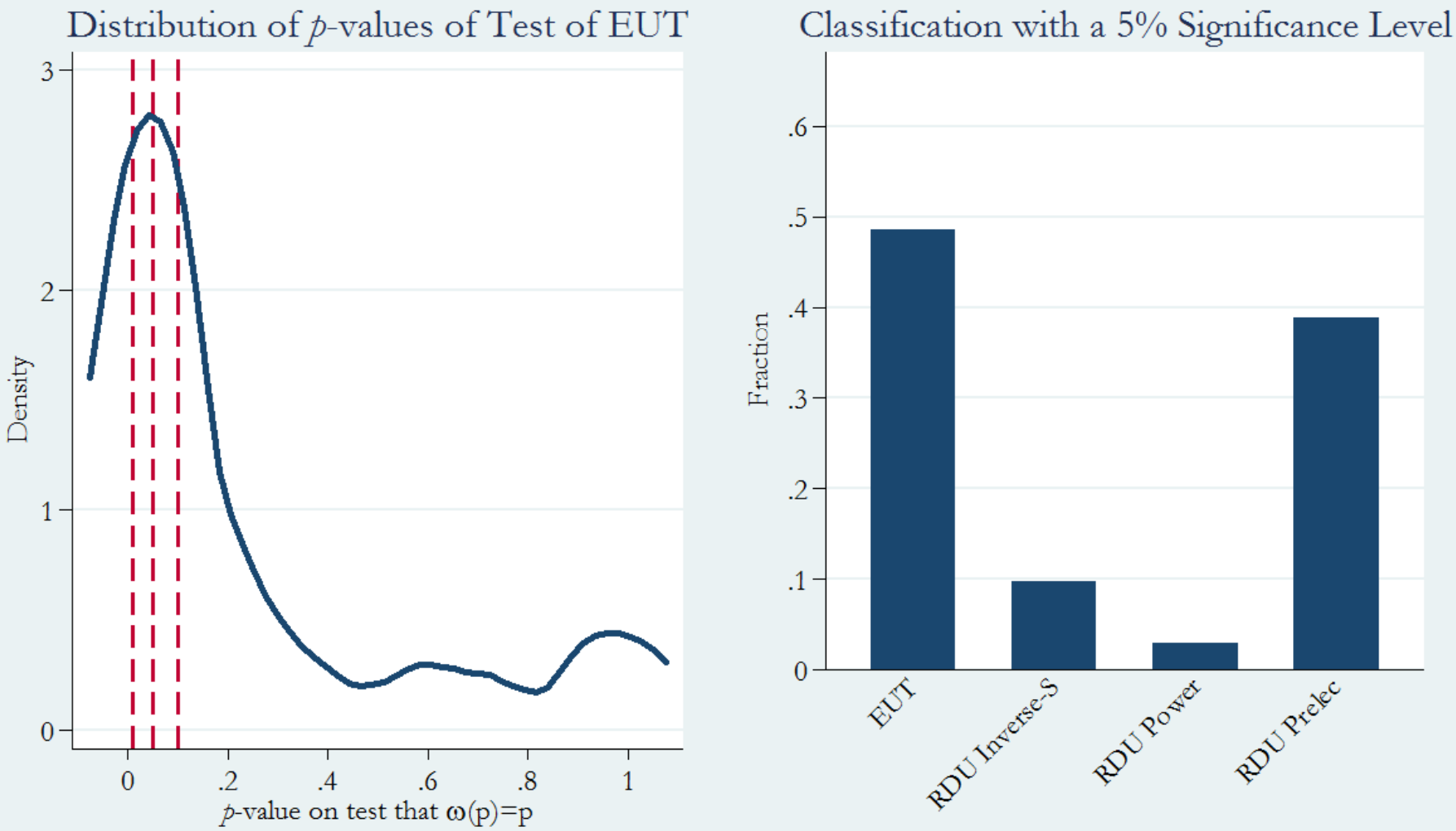


Figure 6: Estimated Risk Parameters for Subject #8

Subject #8 is classifed EUT with EUT *p*-value = 0.520 (≥ 0.05)

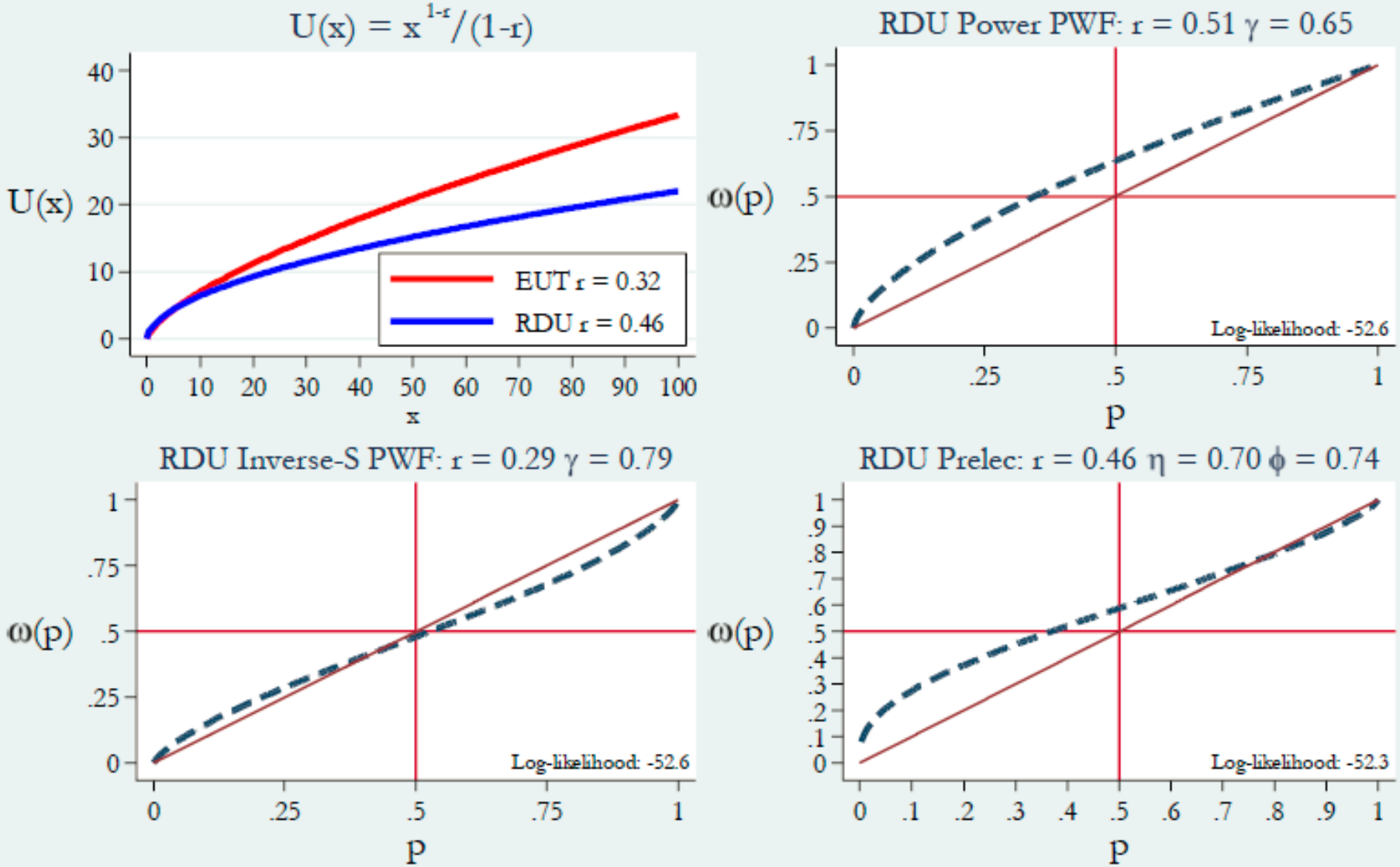
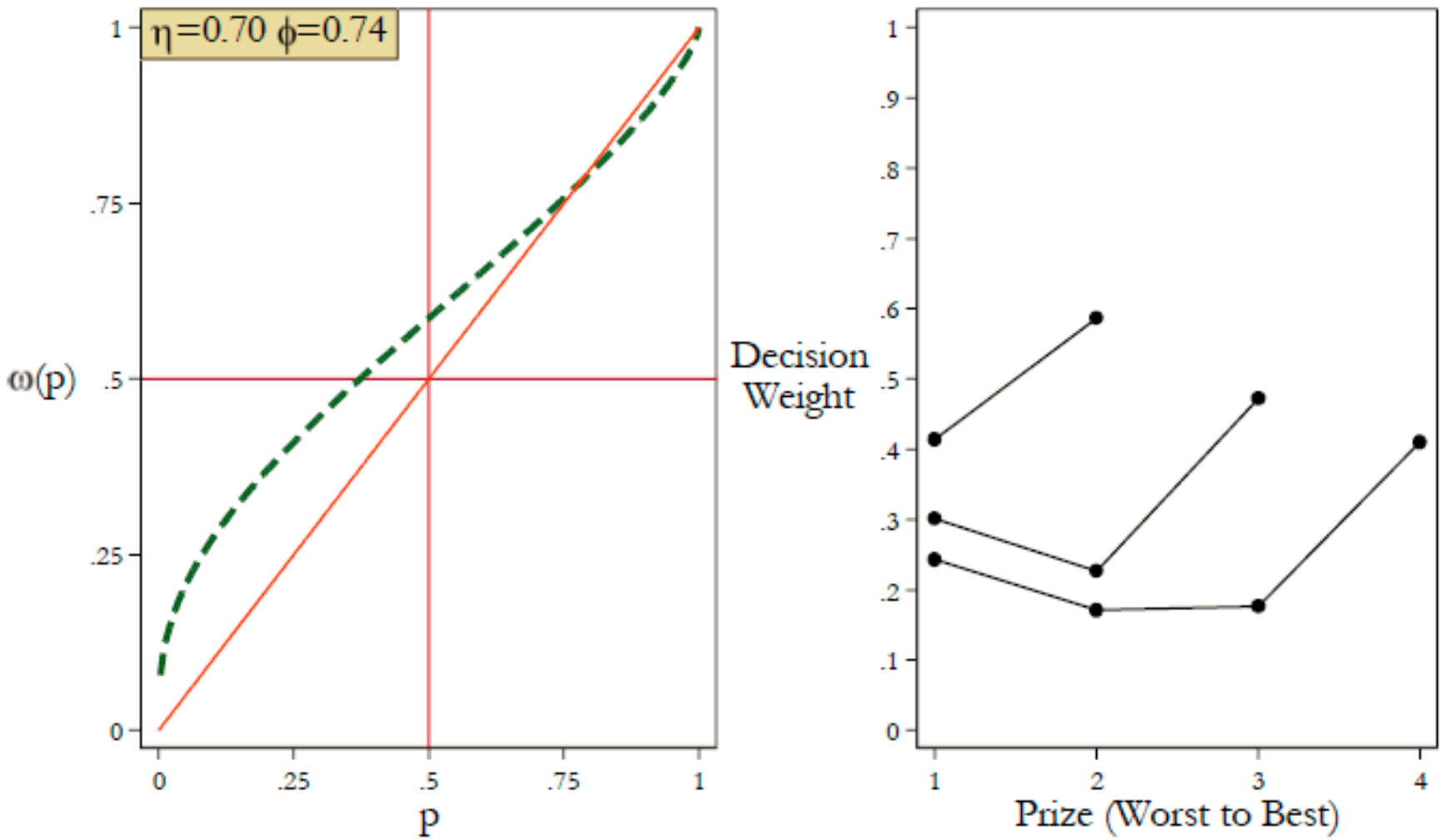


Figure 7: Prelec Probability Weighting and Implied Decision Weights

Based on equi-probable reference lotteries



This specific experiment

- 103 students over 3 sessions at GSU

- Risk task
  - 80 binary choices between lotteries with objective probabilities

- Insurance task
  - Initial endowment = $20, loss amount = $15, loss probability = 10%
  - 24 insurance choices, with premia ranging from $0.20 to $4.80

Probability of **LOSS**

Your initial earnings are **$20.00**.

When the lottery is played out, there is a **10%** chance you will **lose $15.00**. However, there is a **90%** chance you will **not lose any money**.

If a loss occurs, you will be **left with $5.00**, else your earnings will **remain at $20**.

You have the option to purchase insurance, which would help avoid that potential loss completely.

You can buy the insurance at a price of **$2.20**.

If you choose to insure against the loss, your final earnings will be **$17.80**.

Would you like to purchase insurance against the loss of $15.00 for $2.20?

- ○ No
- ○ Yes

Table 1. *Ex ante* Consumer Surplus across Classifications for Subject 8

No.	Premium ($)	Choice	EUT ($)	RDU Power ($)	RDU Inverse-S ($)	RDU Prelec ($)
1	.2	1	1.57	1.11	2.72	2.13
2	.4	1	1.37	.91	2.52	1.93
3	.6	1	1.17	.71	2.32	1.73
4	.8	0	.97	.51	2.12	1.53
5	1	1	.77	.31	1.92	1.33
6	1.2	1	.57	.11	1.72	1.13
7	1.4	1	.38	-.08	1.53	.94
8	1.6	1	.17	-.29	1.32	.73
9	1.8	1	-.02	-.48	1.13	.54
10	2	1	-.23	-.69	.92	.33
11	2.2	1	-.43	-.89	.72	.13
12	2.4	1	-.63	-1.09	.52	-.07
13	2.6	0	-.82	-1.28	.33	-.26
14	2.8	1	-1.02	-1.48	.13	-.46
15	3	0	-1.22	-1.68	-.07	-.66
16	3.2	0	-1.43	-1.89	-.28	-.87
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20	4	1	-2.22	-2.68	-1.07	-1.66
21	4.2	0	-2.42	-2.88	-1.27	-1.86
22	4.4	0	-2.63	-3.09	-1.48	-2.07
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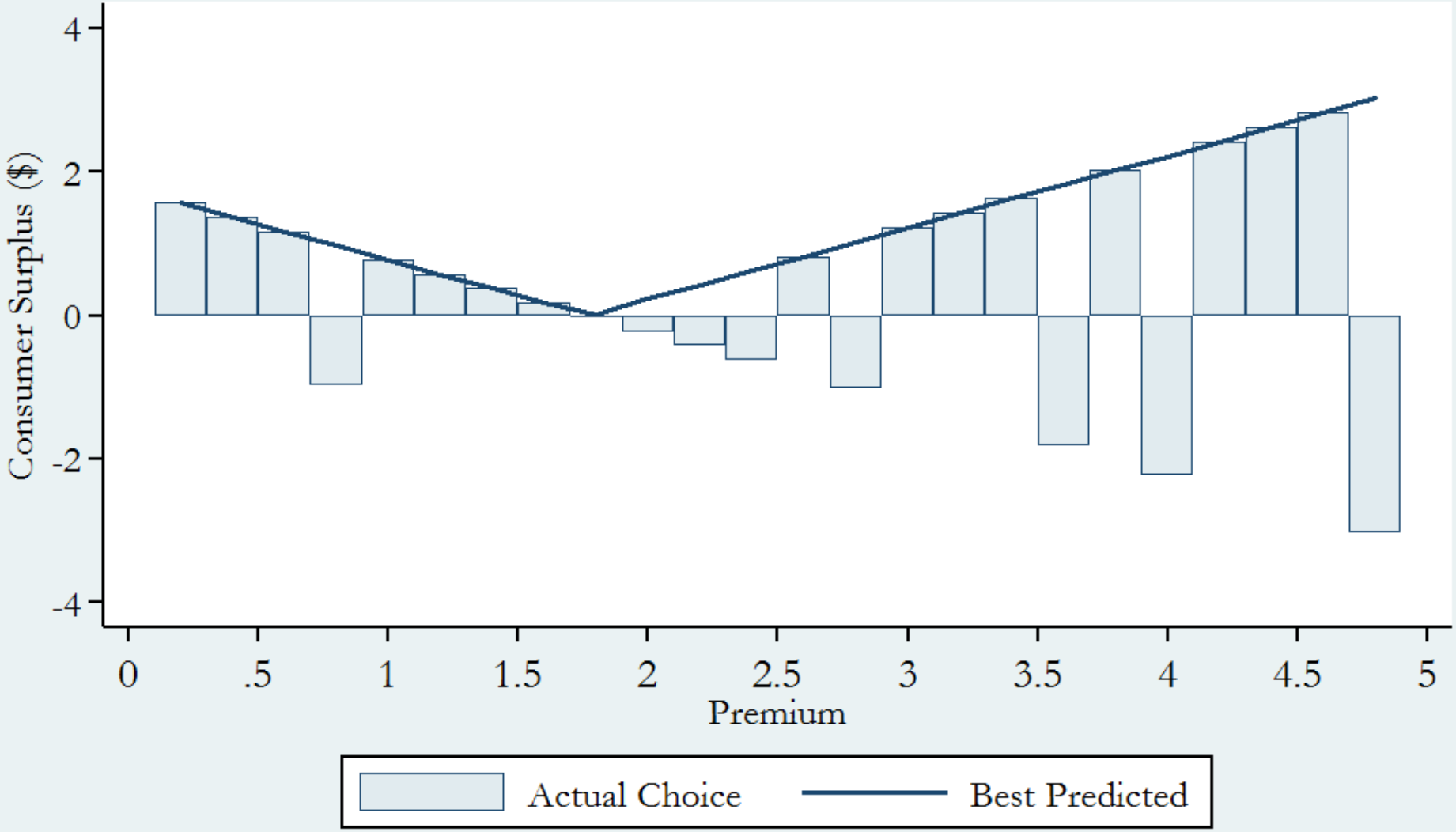
Figure 8: Consumer Surplus Based on Subject 8's Choices

Across Premiums, EUT Classification



Left arm on 'V' should purchase. Right arm of 'V' should not purchase

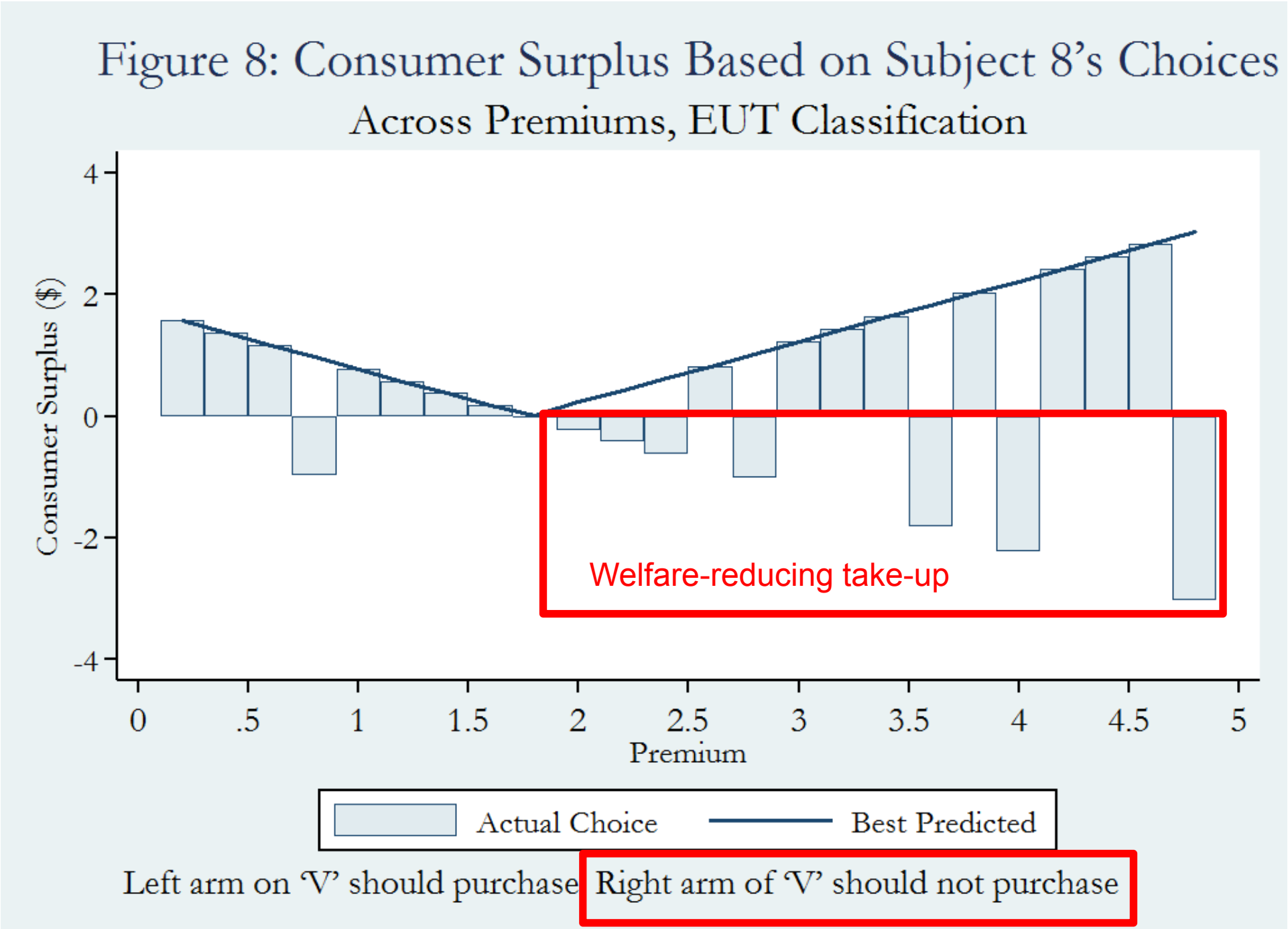


Figure 8: Consumer Surplus Based on Subject 8's Choices
Across Premiums, EUT Classification
Consumer Surplus ($)
4
2
0
-2
-4
0
.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Premium
Welfare-reducing take-up
Actual Choice
Best Predicted
Left arm on 'V' should purchase
Right arm of 'V' should not purchase

Figure 9: Consumer Surplus Based on Subject 71's Choices

Across Premiums, RDU Prelec Classification

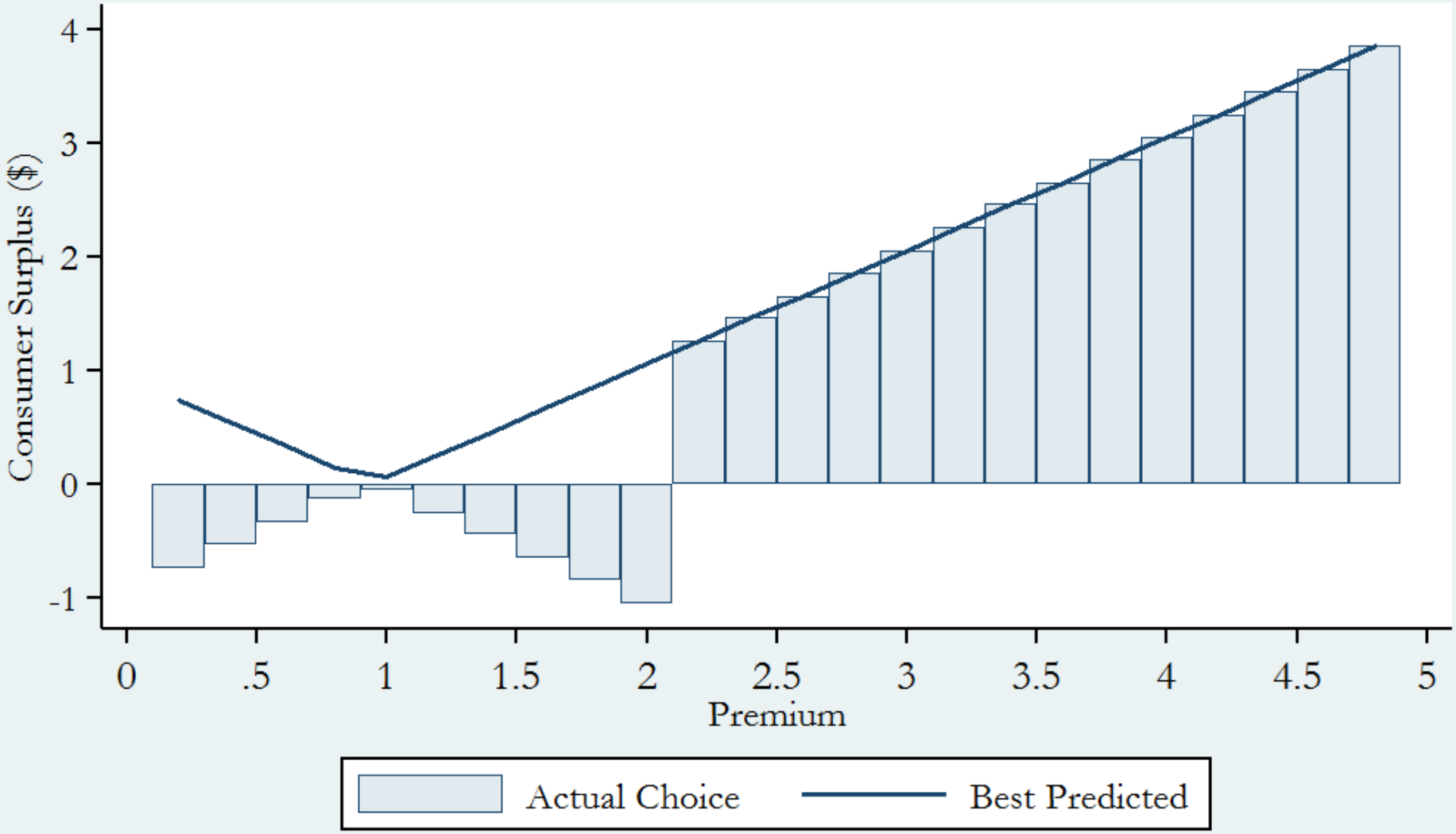


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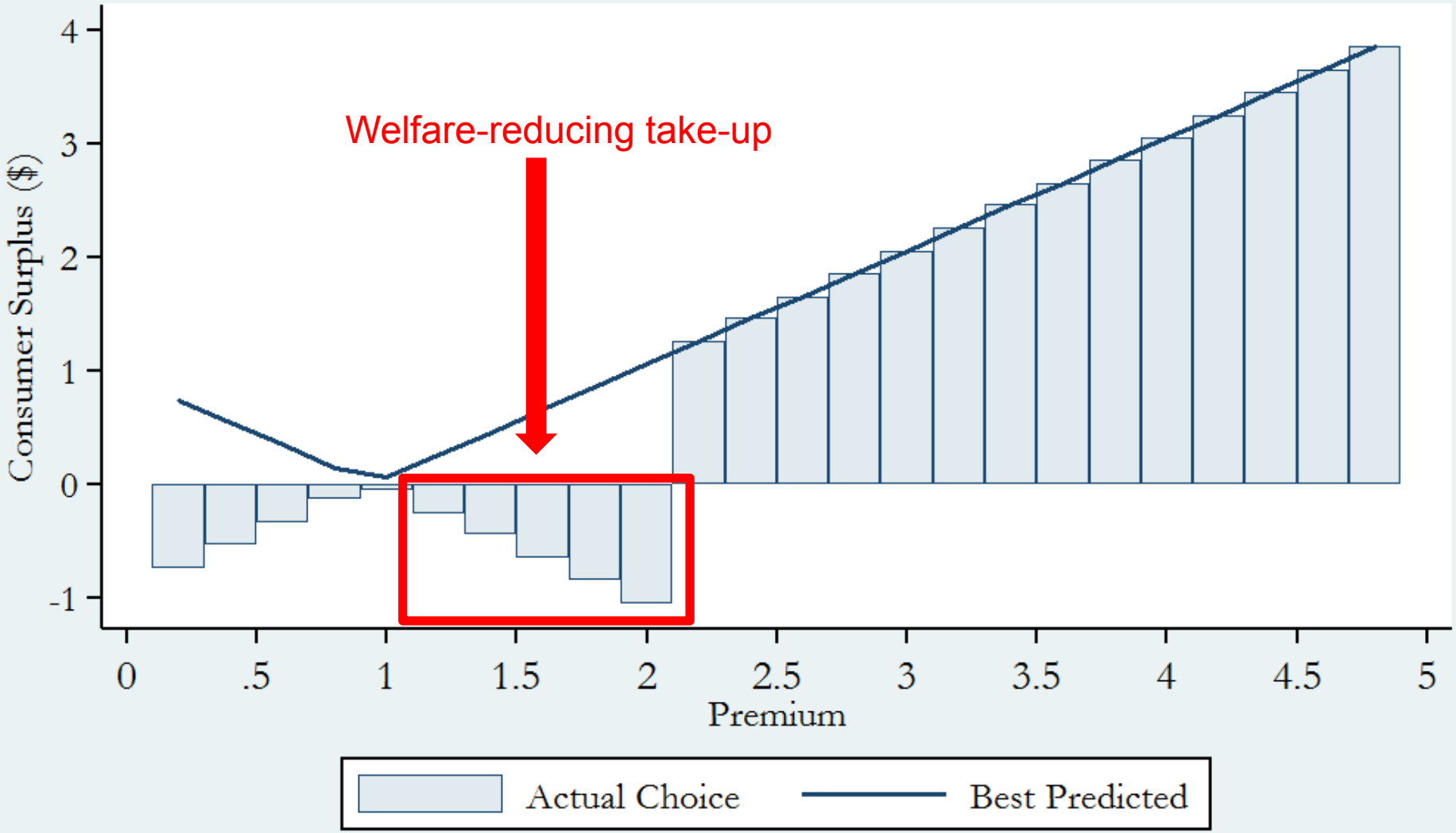
Figure 9: Consumer Surplus Based on Subject 71's Choices

Across Premiums, RDU Prelec Classification



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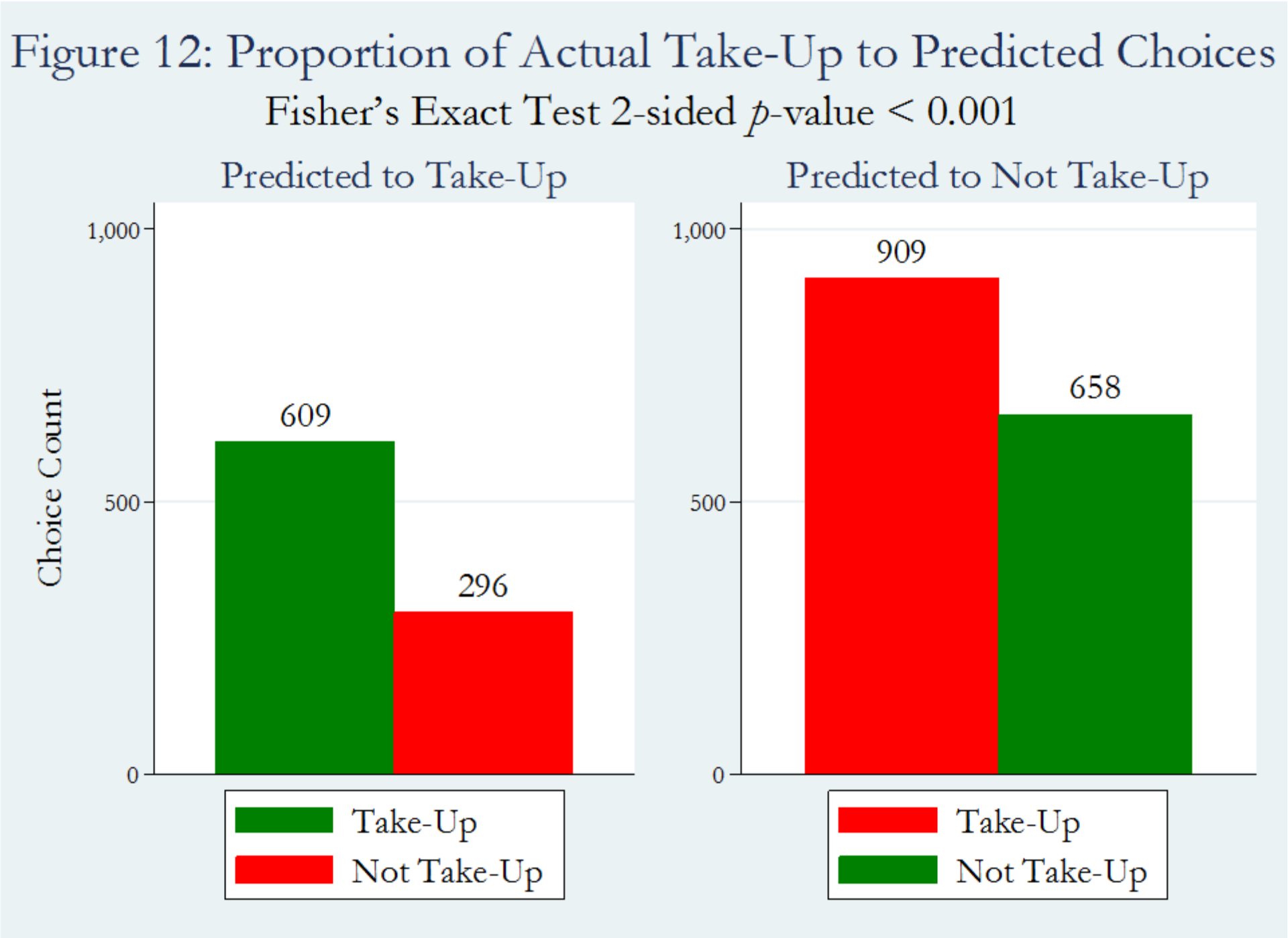


Figure 12: Proportion of Actual Take-Up to Predicted Choices
Fisher's Exact Test 2-sided p-value < 0.001
Predicted to Take-Up
Predicted to Not Take-Up
Choice Count
1,000
500
0
609
296
909
658
Take-Up
Not Take-Up
Take-Up
Not Take-Up

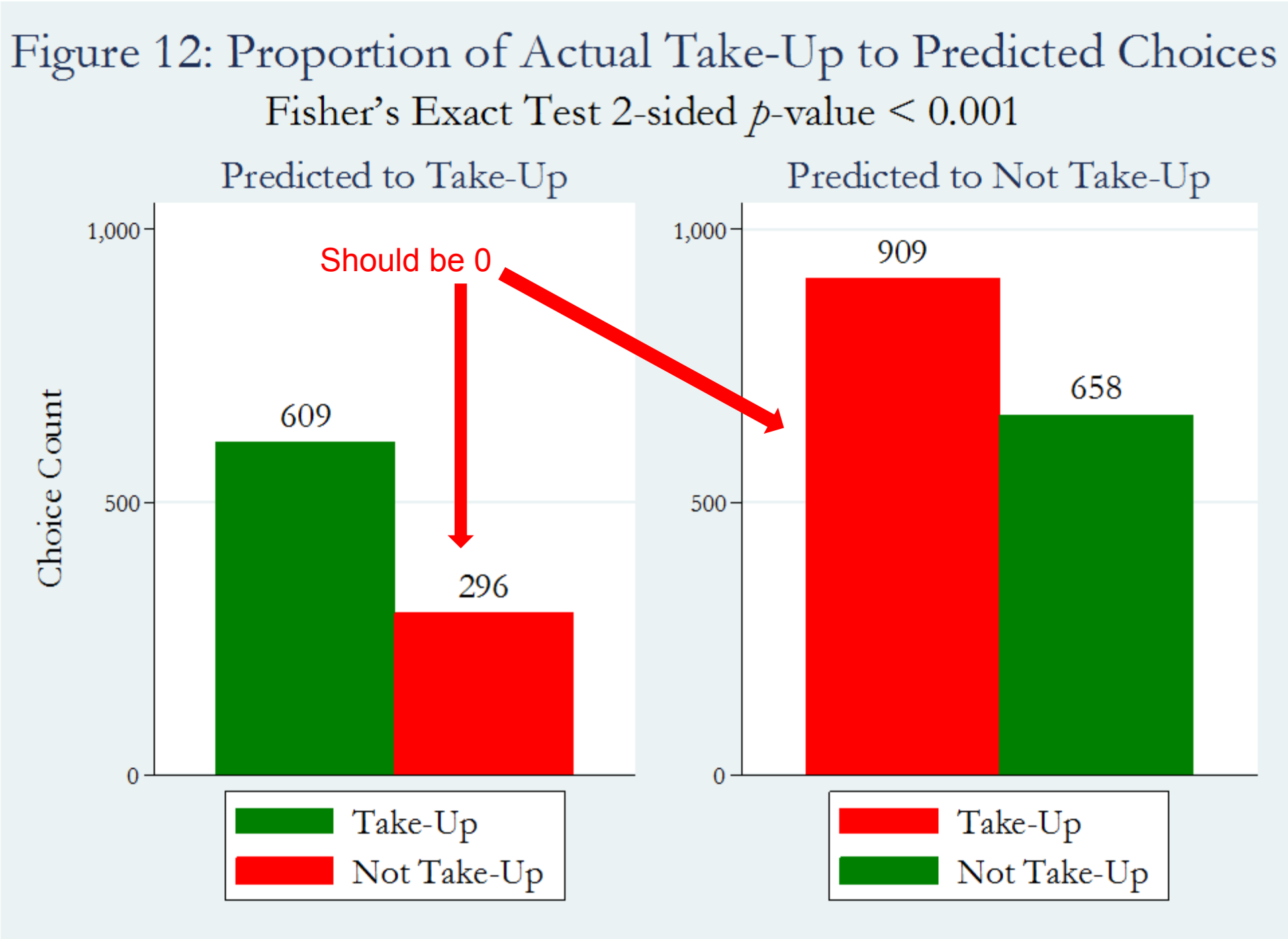
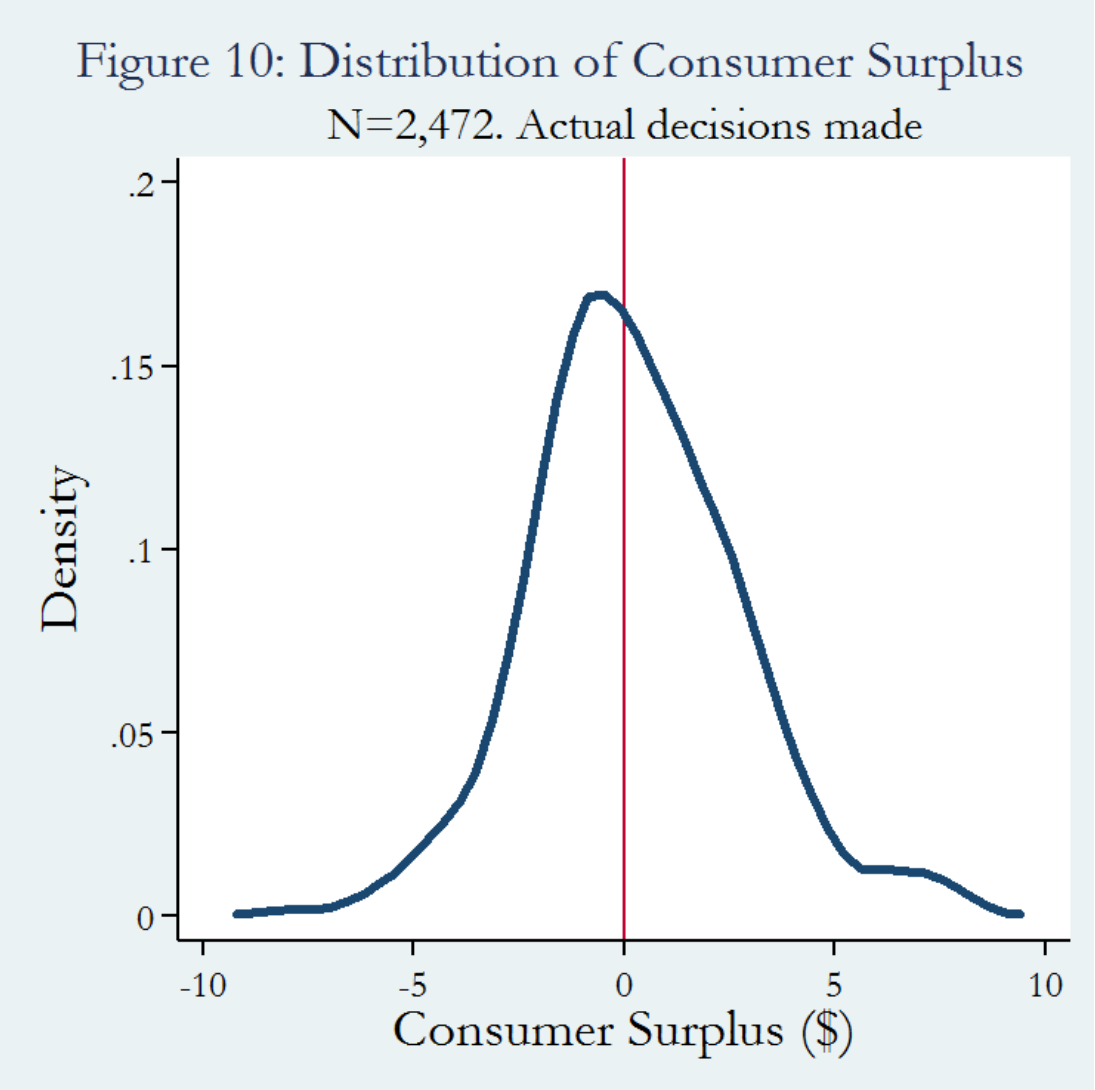


Figure 12: Proportion of Actual Take-Up to Predicted Choices
Fisher's Exact Test 2-sided p-value < 0.001
Predicted to Take-Up
Predicted to Not Take-Up
Choice Count
1,000
500
0
Should be 0
609
296
909
658
Take-Up
Not Take-Up
Take-Up
Not Take-Up

The welfare metric



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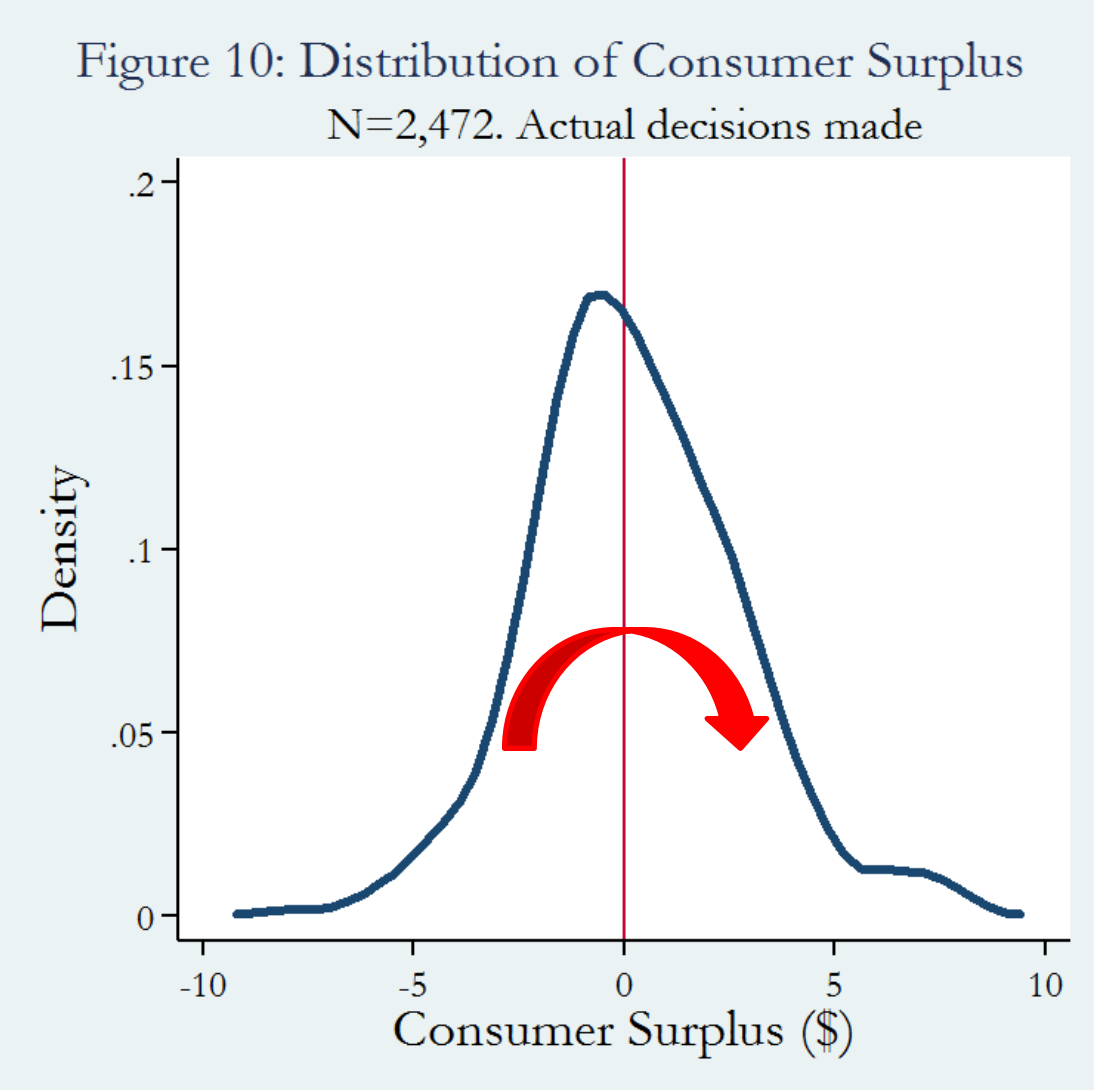
The behavioral challenge, I



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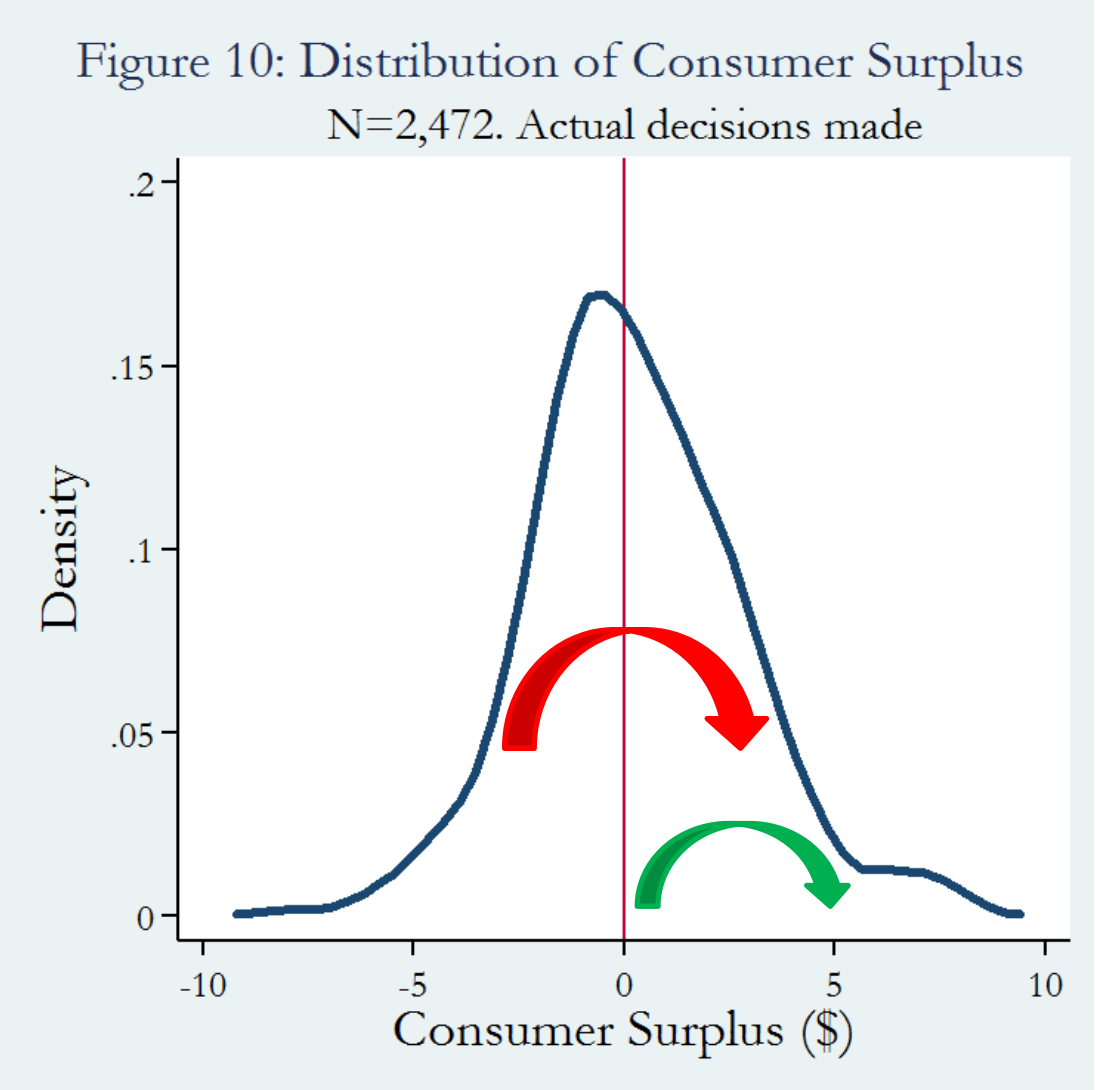
The behavioral challenge, II



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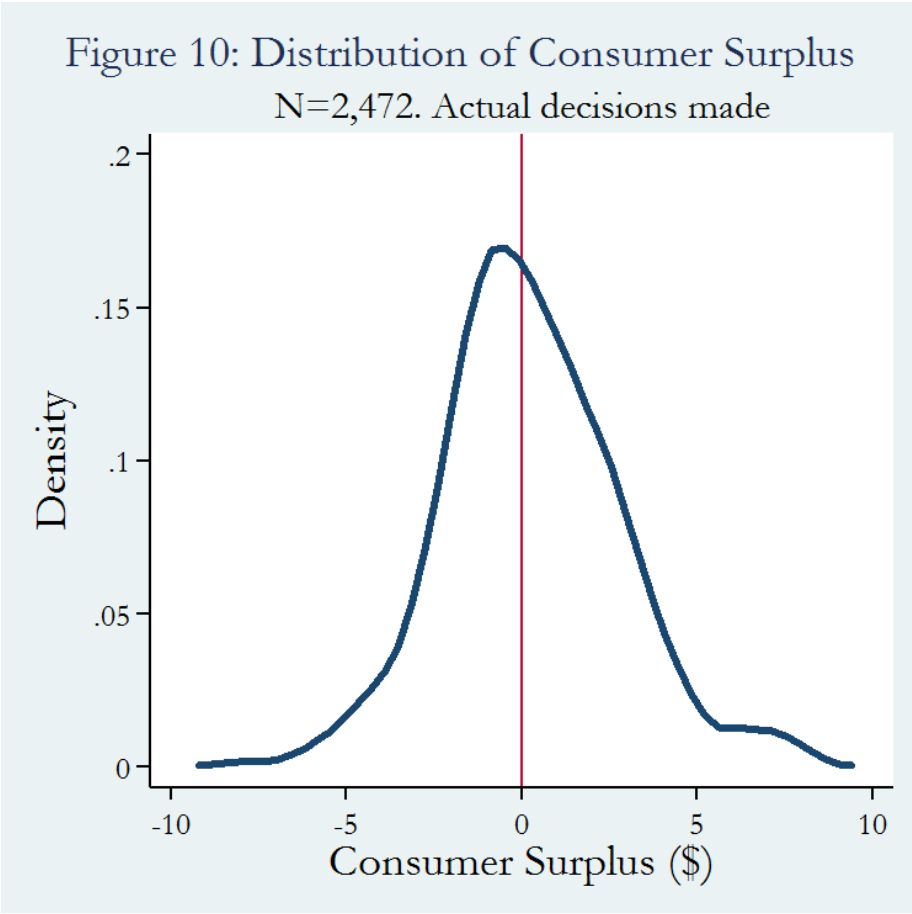
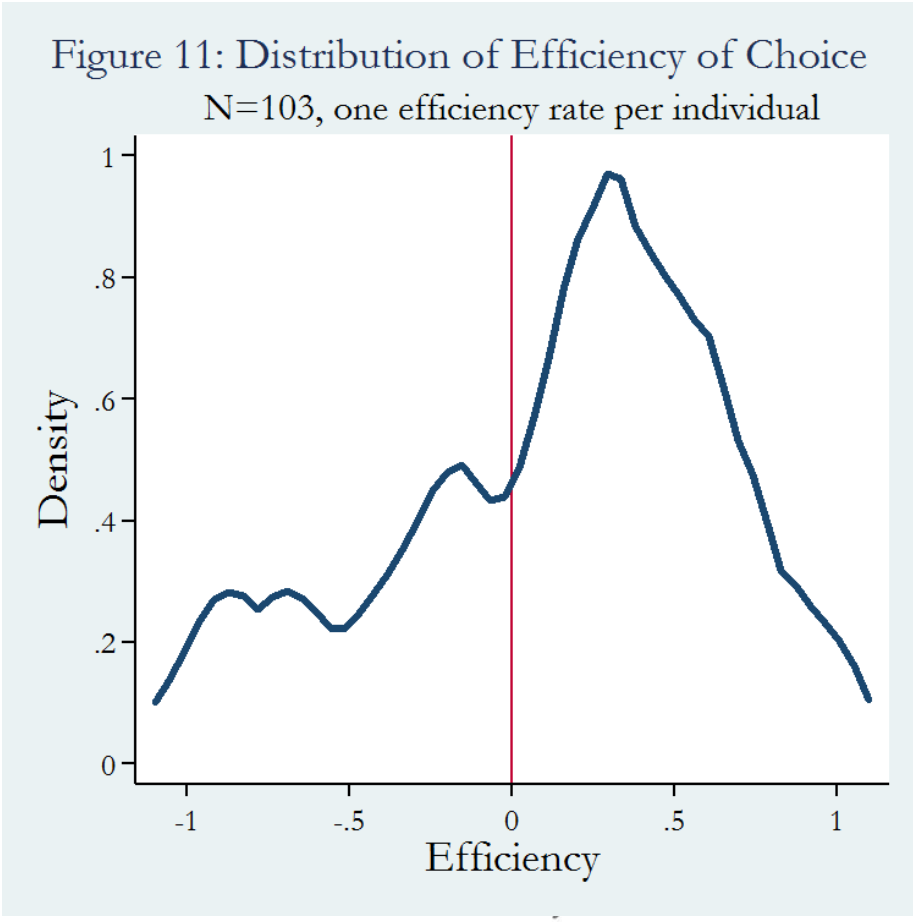
Another normalization: “efficiency”

> Fraction of theoretically expected surplus actually extracted





An important subtlety, I

- Core methodological challenges
  - Revealed preference: if we infer risk preferences from the choice to take up insurance, how can expected consumer surplus ever be negative?
  - Revealed beliefs: if we infer risk perceptions from the choice to take up insurance, how can expected consumer surplus ever be negative?

wwSs?
what would Savage say?

WWSS?

what would Savage say?

An important subtlety, I

- Core methodological challenges
  - Revealed preference: if we infer risk preferences from the choice to take up insurance, how can expected consumer surplus ever be negative?
  - Revealed beliefs: if we infer risk perceptions from the choice to take up insurance, how can expected consumer surplus ever be negative?
- Implication for normative evaluation:
  - Must assume away behavioral "source dependence" of risk preferences and risk perceptions

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An important subtlety, II

- The welfare metric here is the “best descriptive” model of risk preferences
  - *Periculum habitus non est disputandum*

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- But what if the best descriptive model is not attractive normatively?
  - Main people claim EUT is normatively attractive, and RDU is not
  - Easy to come up with axioms s.t. RDU is normatively attractive
- Ongoing work with John Quiggin
  - If EUT (RDU) is the welfare metric, use the best-fitting EUT (RDU) model, even if RDU (EUT) is the best descriptive model
  - How to select the welfare metric?

Relevant literature? Not so sure

THE REVIEW OF ECONOMIC STUDIES

Review of Economic Studies (2008) **75**, 1287–1296 0034-6527/08/00511287$02.00
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(A, f): Choice with Frames[1]

YUVAL SALANT
Stanford University

and

ARIEL RUBINSTEIN
University of Tel Aviv Cafés and New York University

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Relevant literature? Not so sure

BEYOND REVEALED PREFERENCE: CHOICE-THEORETIC FOUNDATIONS FOR BEHAVIORAL WELFARE ECONOMICS*

B. DOUGLAS BERNHEIM AND ANTONIO RANGEL

The Quarterly Journal of Economics, February 2009

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Relevant literature? Not so sure

BEHAVIORAL WELFARE ECONOMICS

B. Douglas Bernheim
Stanford University

Journal of the European Economic Association April–May 2009 7(2–3):267–319

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Relevant literature? Not so sure

Journal of Economic Methodology, 2014
Vol. 21, No. 4, 343–360, http://dx.doi.org/10.1080/1350178X.2014.965909

Routledge
Taylor & Francis Group

Welfare economics and bounded rationality: the case for model-based approaches

Paola Manzini[a]* and Marco Mariotti[b]

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Implications, Extensions, Limitations

- Take-up is used widely to evaluate insurance products
  - Does not reliably reflect welfare gain: it gets the “sign” wrong
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  - Self-protection, self insurance
- Even higher-order risk preferences
  - Insurance often provides large payouts for extreme events
  - Account for prudence and temperance

Implications, Extensions, Limitations

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  - Trivial to extend to CPT
  - Or models of uncertainty aversion
    - Especially with subjective belief distributions over loss risk

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  - Would affect the present value of expected welfare gain
- Field experiments
  - Subjective or unknown loss probabilities
  - Non-performance – significant default risk in the field

Conclusions, I

- Behavior plays a key role describing insurance decisions
  - Gives us a structural understanding of insurance purchases
- Behavior underlies the evaluation of insurance decisions
  - Normative welfare evaluation: the expected consumer surplus
  - Normative welfare evaluation: are observed decisions “rational”?
  - Long-term profitability, and profitability of new products
- Three key components of behavior
  - Risk attitudes, time preferences, and subjective beliefs
- Central role of experiments
  - Lab <u>and</u> field experiments as complements

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Conclusions, II

- Methodological challenge #1
  - What if the descriptive evidence supports “source dependence” of risk preferences or perception?
  - It does not, as it happens, but could
  - No obvious solution (to me): this may be an assumption, in one form or another, we must make to do interesting welfare evaluation

- Methodological challenge #2
  - What if best descriptive model of risk preference or perception is not one we find normatively attractive?
  - Suggested solutions in work with John Quiggin