

Glenn Harrison

Evaluating Insurance Contract Non-Performance & Extensions

ETH zürich

ETH Risk Center

ETH Risk Center Course in
Behavioral Economics and Insurance,
May 12 2017, Zürich

Center for the Economic Analysis of Risk





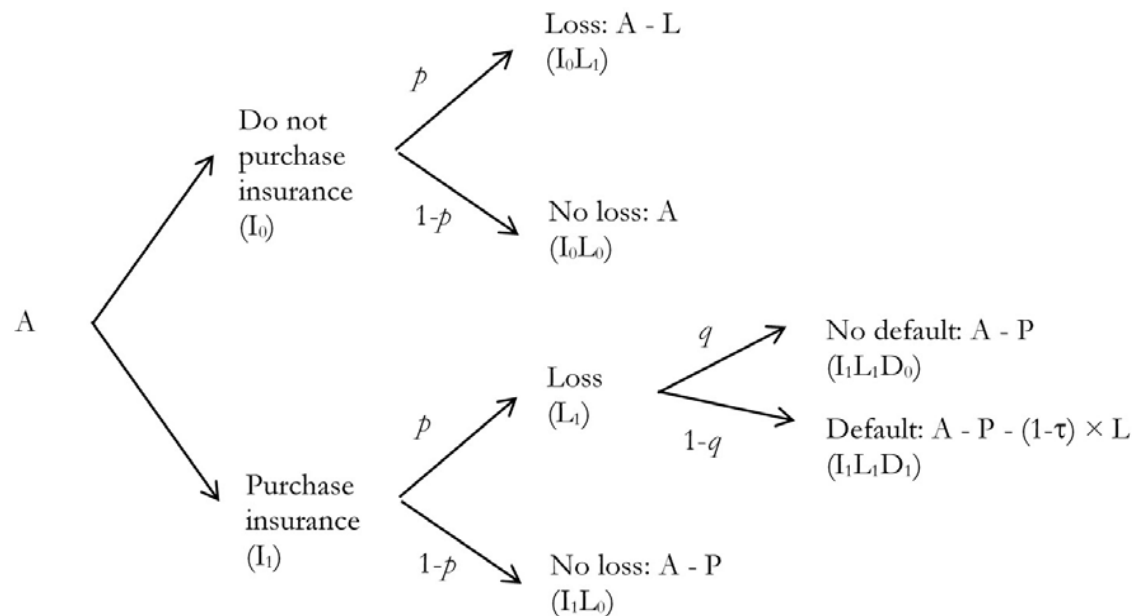
Contract non-performance

- > Non-performance a major issue in developing countries
 - Very hard to get reliable measures in public of *ex ante* NP risk
- > What is the effect of NP risk on the welfare of insurance?
- > Basic theory
 - Compound risk
 - Downside risk (in contrast to Index Insurance)
 - Confidence of belief about the risk
- > Behavior
 - ROCL again
 - Subjective beliefs

Theory, I

> Doherty and Schlesinger *QJE*, 1990

- Introducing default risk could result in demand varying non-monotonically with risk aversion, price and wealth
- Risk averse individuals might not necessarily purchase insurance with default risk





Theory, II

> Compound risk

Journal of Economic Behavior & Organization 119 (2015) 32–55



Contents lists available at [ScienceDirect](#)

Journal of Economic Behavior & Organization

journal homepage: www.elsevier.com/locate/jebo



Reduction of compound lotteries with objective probabilities:
Theory and evidence[☆]



Glenn W. Harrison^{a,d}, Jimmy Martínez-Correa^{b,*}, J. Todd Swarthout^c



Theory, III

> Eliciting subjective beliefs

Journal of Economic Behavior & Organization 134 (2017) 430–448



Contents lists available at [ScienceDirect](#)

Journal of Economic Behavior & Organization

journal homepage: www.elsevier.com/locate/jebo



Scoring rules for subjective probability distributions[☆]

Glenn W. Harrison^{a,*}, Jimmy Martínez-Correa^b, J. Todd Swarthout^c,
Eric R. Ulm^d





Lab experiment

> Control Treatment

- Risk task
 - Test for EUT (30 choices)
 - Test for ROCL (30 choices)
- Insurance task - 16 choices varying by:
 - loss probability (10%, 20%) is told to subjects
 - premium (from \$0.50 to \$4.70)



Lab experiment, I

> Control Treatment

- Risk task
 - Test for EUT (30 choices)
 - Test for ROCL (30 choices)
- Insurance task - 16 choices varying by:
 - loss probability (10%, 20%) is told to subjects
 - premium (from \$0.50 to \$4.70)

> NP Treatment

- Risk task - same as Control
- Insurance task – 32 choices varying by:
 - loss probability (10%, 20%) is told to subjects
 - premium (\$0.50, \$1.20, \$1.80, \$3.50)
 - solvency probability (50%, 80%) is told to subjects
 - repayment percentage (0%, 40%)

Figure 3.2 Impact of Non-Performing Risk on Consumer Surplus Assuming EUT

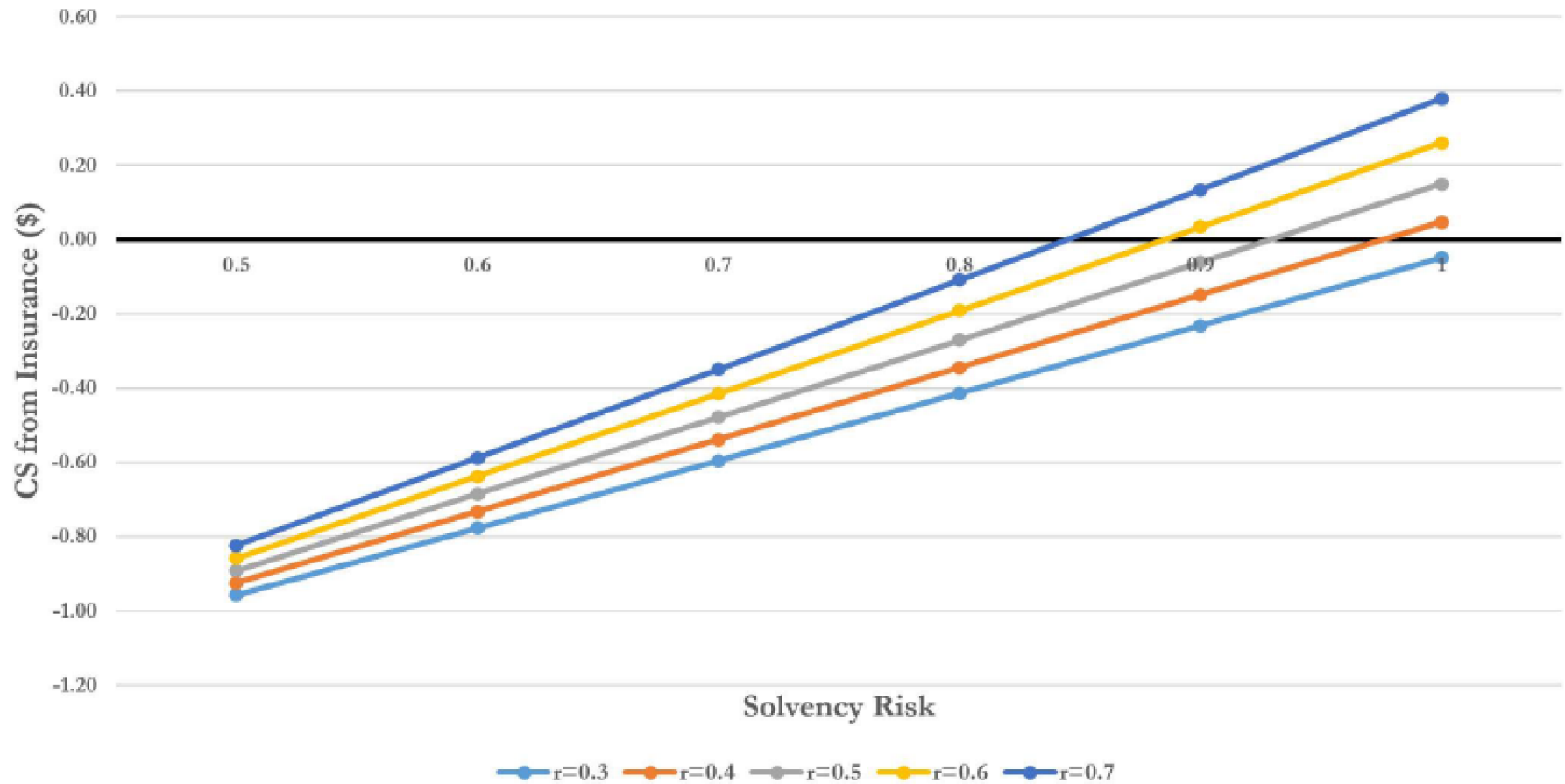


Figure 3.3 Impact of Non-Performing Risk on Consumer Surplus Assuming RDU with a Power Probability Weighting Function

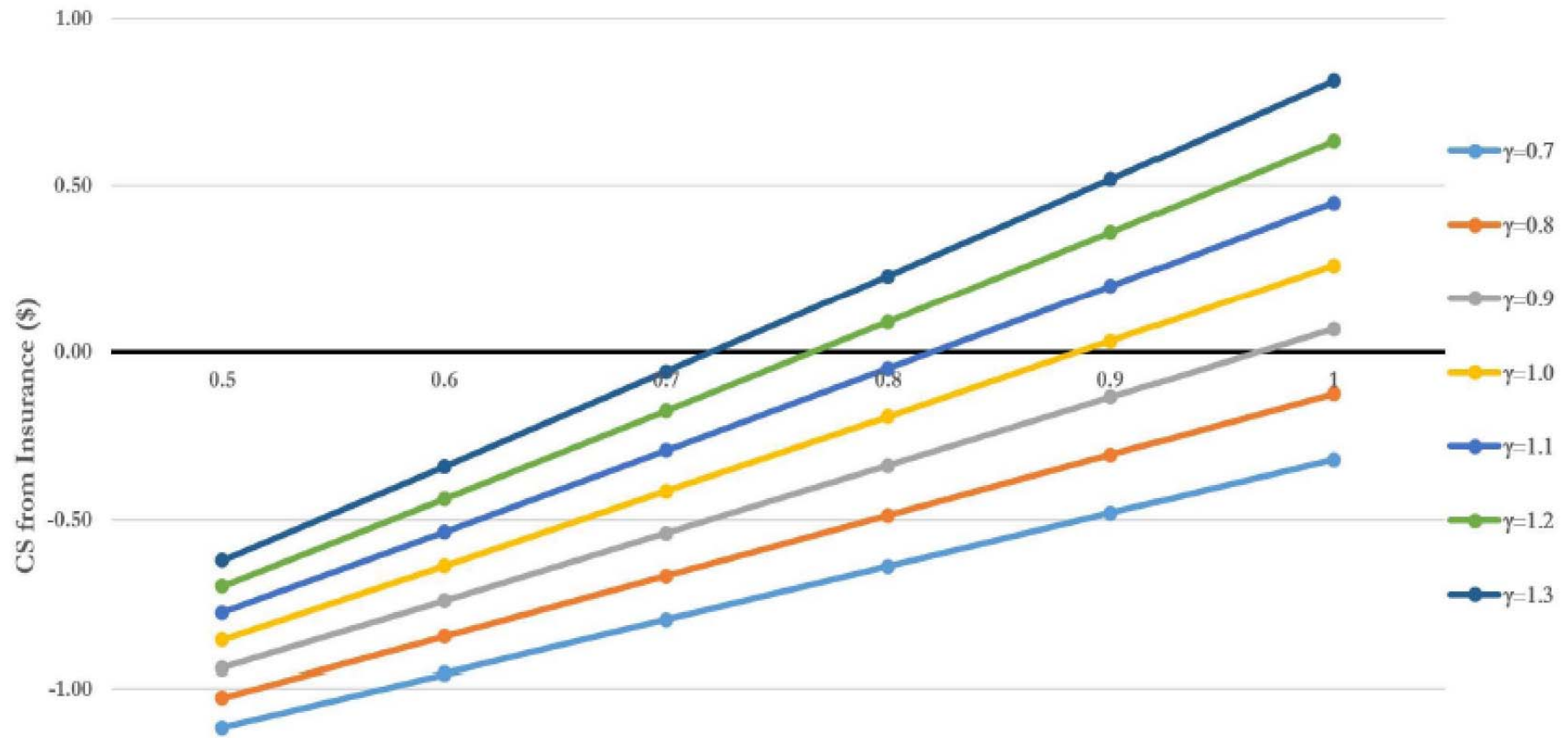


Figure 3.4 Impact of Non-Performance Risk on Consumer Surplus Assuming RDU and an Inverse-S Probability Weighing Function

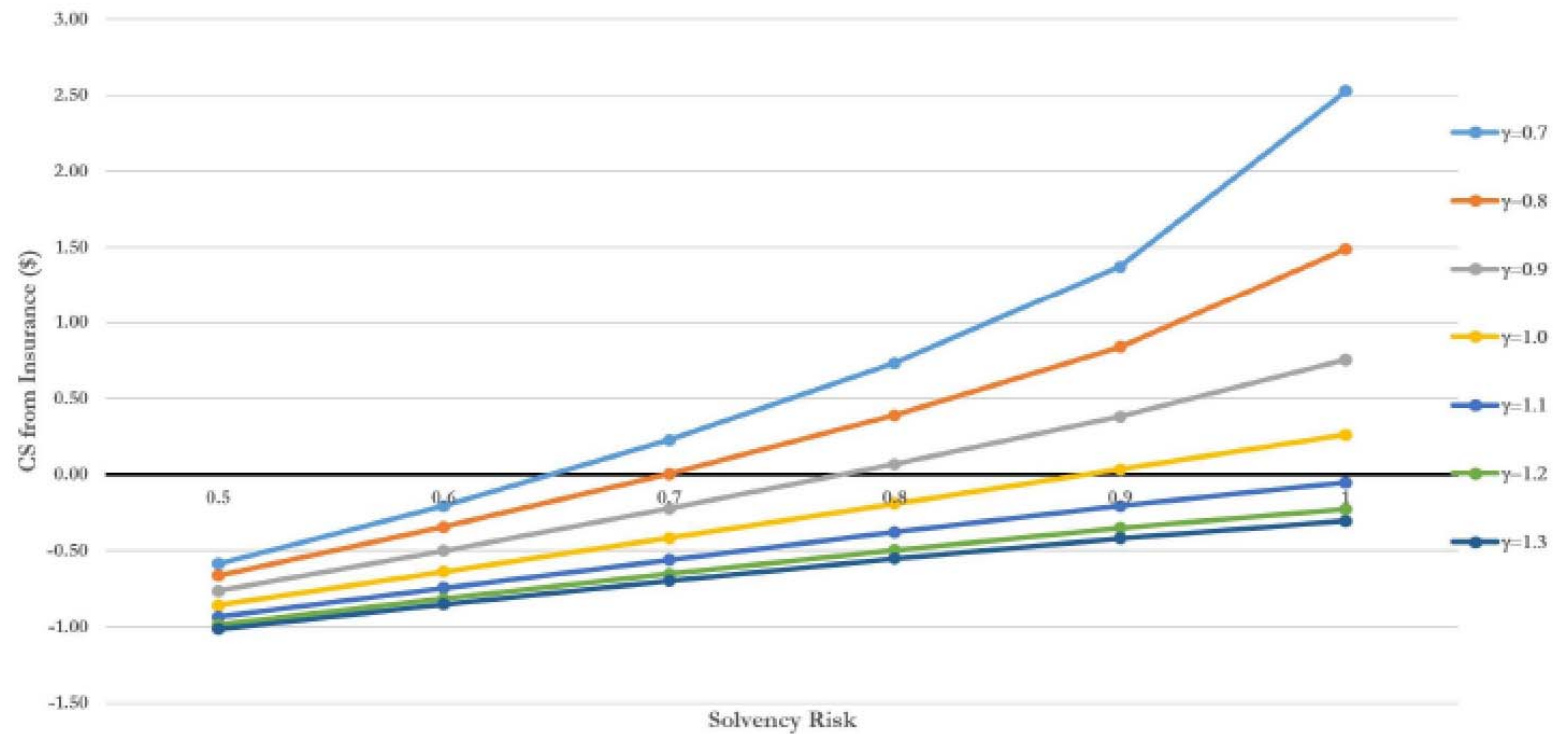


Figure 3.6 Interface for Insurance Choice Without Non-Performance Risk



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 **\$1.80**.

If you choose to insure against the loss, your final earnings will be **\$18.20**.

Would you like to purchase insurance against the loss of \$15.00 for \$1.80?

DO NOT BUY INSURANCE

BUY INSURANCE

Table 3.1 Insurance Contracts and Parameters in the Control Treatment

Choice	Premium (\$)	Initial		
		Loss Probability	Endowment (\$)	Loss (\$)
1	0.50	0.1	20	15
2	1.20	0.1	20	15
3	1.80	0.1	20	15
4	2.30	0.1	20	15
5	2.90	0.1	20	15
6	3.50	0.1	20	15
7	4.10	0.1	20	15
8	4.70	0.1	20	15
9	0.50	0.2	20	15
10	1.20	0.2	20	15
11	1.80	0.2	20	15
12	2.30	0.2	20	15
13	2.90	0.2	20	15
14	3.50	0.2	20	15
15	4.10	0.2	20	15
16	4.70	0.2	20	15

Figure 3.7 Interface for Insurance Choice With Non-Performance Risk

Your initial stakes are \$20.00. If a loss occurs, you will lose \$15.00.

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

There is a chance that the insurance company declares bankruptcy. If so, the company will only pay back 40% of the losses.

This insurance will cost you \$1.80.

Probability of Loss



10% chance
you experience
loss.

90% chance
you experience
no loss.

Possible Outcomes WITHOUT Insurance

LOSS occurs: \$5

NO LOSS occurs: \$20

DO NOT BUY INSURANCE

Probability of Bankruptcy



20% chance
insurance
company is
bankrupt.

80% chance
insurance
company is not
bankrupt.

Possible Outcomes WITH Insurance

LOSS occurs and company goes BANKRUPT: \$9.20

LOSS occurs and company does NOT go BANKRUPT: \$18.20

NO LOSS occurs: \$18.20

BUY INSURANCE

Table 3.2 Insurance Contracts and Parameters in the Non-Performance Treatment

Choice	Solvency Probability	Repayment Proportion	Premium (\$)	Loss Probability	Initial Endowment (\$)	Loss (\$)	Actuarially Fair Premium (\$)
1	0.8	0	0.50	0.1	20	15	1.20
2	0.5	0	0.50	0.1	20	15	0.75
3	0.8	0.4	0.50	0.1	20	15	1.32
4	0.5	0.4	0.50	0.1	20	15	1.05
5	0.8	0	0.50	0.2	20	15	2.40
6	0.5	0	0.50	0.2	20	15	1.50
7	0.8	0.4	0.50	0.2	20	15	2.64
8	0.5	0.4	0.50	0.2	20	15	2.10
9	0.8	0	1.20	0.1	20	15	1.20
10	0.5	0	1.20	0.1	20	15	0.75
11	0.8	0.4	1.20	0.1	20	15	1.32
12	0.5	0.4	1.20	0.1	20	15	1.05
13	0.8	0	1.20	0.2	20	15	2.40
14	0.5	0	1.20	0.2	20	15	1.50
15	0.8	0.4	1.20	0.2	20	15	2.64
16	0.5	0.4	1.20	0.2	20	15	2.10
17	0.8	0	1.80	0.1	20	15	1.20
18	0.5	0	1.80	0.1	20	15	0.75
19	0.8	0.4	1.80	0.1	20	15	1.32
20	0.5	0.4	1.80	0.1	20	15	1.05
21	0.8	0	1.80	0.2	20	15	2.40
22	0.5	0	1.80	0.2	20	15	1.50
23	0.8	0.4	1.80	0.2	20	15	2.64
24	0.5	0.4	1.80	0.2	20	15	2.10
25	0.8	0	3.50	0.1	20	15	1.20
26	0.5	0	3.50	0.1	20	15	0.75
27	0.8	0.4	3.50	0.1	20	15	1.32
28	0.5	0.4	3.50	0.1	20	15	1.05
29	0.8	0	3.50	0.2	20	15	2.40
30	0.5	0	3.50	0.2	20	15	1.50
31	0.8	0.4	3.50	0.2	20	15	2.64
32	0.5	0.4	3.50	0.2	20	15	2.10



Lab experiment, II



> SB Treatment

- Risk task - same as Control
- Insurance task – 32 choices varying by:
 - loss probability (10%, 20%) is told to subjects
 - premium (from \$0.50 to \$4.70)
 - solvency probability (urn A, urn B)
- Beliefs task
 - Introduce uncertainty in solvency probability
 - Urn A – 80% solvency, Urn B – 50% solvency (match NP)
 - Solvency probability determined by distribution of colored balls in sample drawn from urn
 - Subjective beliefs elicited on number of red balls drawn

Figure 3.8 Interface for Insurance Choice With Subjective Beliefs on Non-Performance


Your initial stakes are \$20.00. If a loss occurs, you will lose \$15.00.

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

There is a chance that the insurance company declares bankruptcy. If so, the company will pay no losses at all.

This insurance will cost you \$1.80.

Probability of Loss



10% chance you experience loss.

90% chance you experience no loss.

Possible Outcomes WITHOUT Insurance

LOSS occurs: \$5

NO LOSS occurs: \$20

DO NOT BUY INSURANCE

Probability of Bankruptcy

Urn A

Chance of going **BANKRUPT** depends on the number of **RED** balls.

Chance of **not** going **BANKRUPT** depends on number of **WHITE** balls.

Possible Outcomes WITH Insurance

LOSS occurs and company **goes BANKRUPT**: \$3.20

LOSS occurs and company **does NOT** go **BANKRUPT**: \$18.20

NO LOSS occurs: \$18.20

BUY INSURANCE

Table 3.3 Insurance Contracts and Parameters in the Subjective Beliefs Treatment

Choice	Um for Solvency Probability	Repayment Proportion	Premium (\$)	Loss Probability	Initial Endowment (\$)	Loss (\$)	Actuarially Fair Premium (\$)
1	A	0	0.50	0.1	20	15	1.20
2	B	0	0.50	0.1	20	15	0.75
3	A	0	0.50	0.2	20	15	2.40
4	B	0	0.50	0.2	20	15	1.50
5	A	0	1.80	0.1	20	15	1.20
6	B	0	1.80	0.1	20	15	0.75
7	A	0	1.80	0.2	20	15	2.40
8	B	0	1.80	0.2	20	15	1.50
9	A	0	2.90	0.1	20	15	1.20
10	B	0	2.90	0.1	20	15	0.75
11	A	0	2.90	0.2	20	15	2.40
12	B	0	2.90	0.2	20	15	1.50
13	A	0	4.10	0.1	20	15	1.20
14	B	0	4.10	0.1	20	15	0.75
15	A	0	4.10	0.2	20	15	2.40
16	B	0	4.10	0.2	20	15	1.50
17	A	0	1.20	0.1	20	15	1.20
18	B	0	1.20	0.1	20	15	0.75
19	A	0	1.20	0.2	20	15	2.40
20	B	0	1.20	0.2	20	15	1.50
21	A	0	2.30	0.1	20	15	1.20
22	B	0	2.30	0.1	20	15	0.75
23	A	0	2.30	0.2	20	15	2.40
24	B	0	2.30	0.2	20	15	1.50
25	A	0	3.50	0.1	20	15	1.20
26	B	0	3.50	0.1	20	15	0.75
27	A	0	3.50	0.2	20	15	2.40
28	B	0	3.50	0.2	20	15	1.50
29	A	0	4.70	0.1	20	15	1.20
30	B	0	4.70	0.1	20	15	0.75
31	A	0	4.70	0.2	20	15	2.40
32	B	0	4.70	0.2	20	15	1.50

Figure 3.9 Interface of Subjective Beliefs

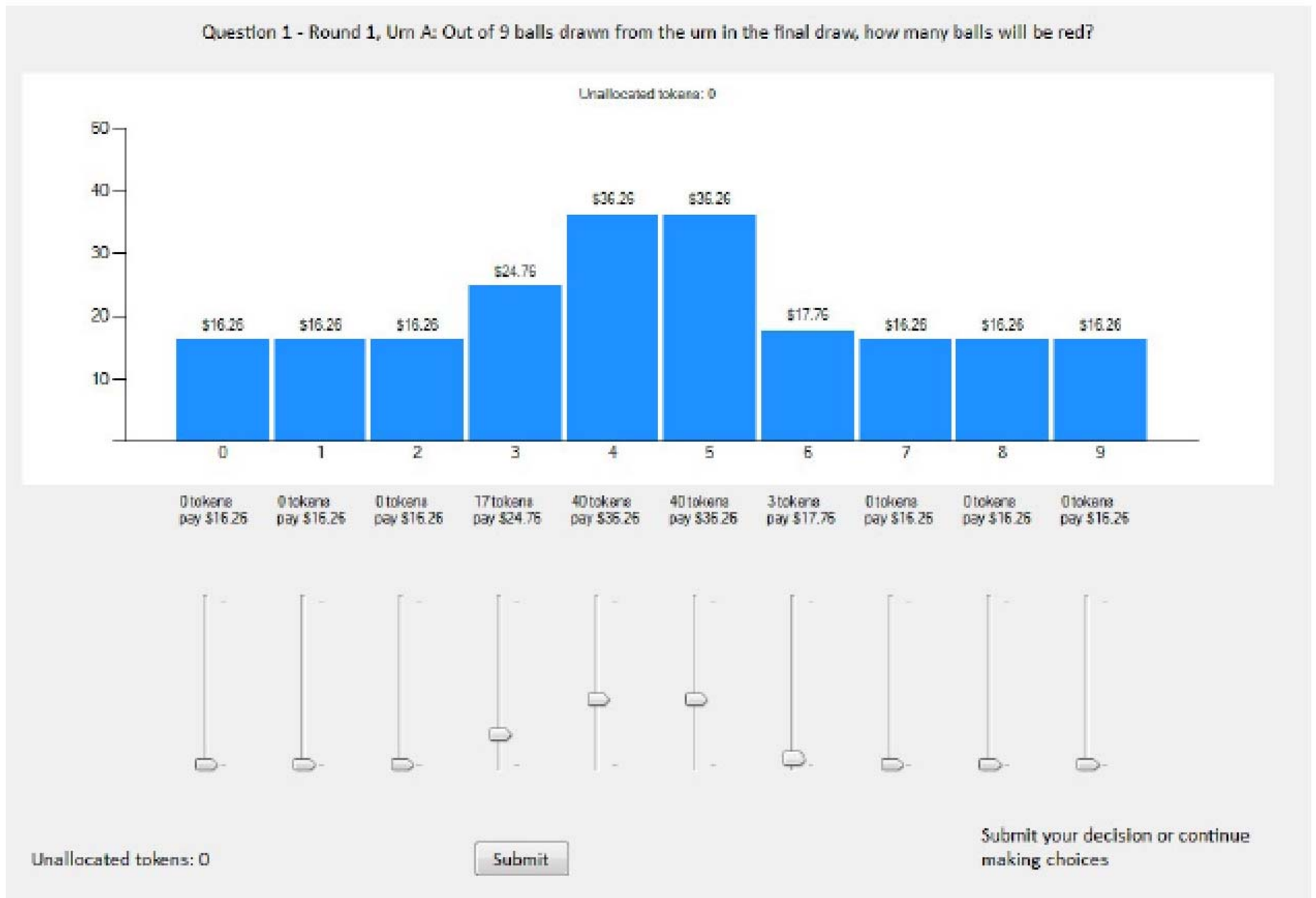


Figure 3.10 Classifying Subjects as EUT or RDU

N=77, one p -value per individual
Estimates for each individual of EUT and RDU specifications

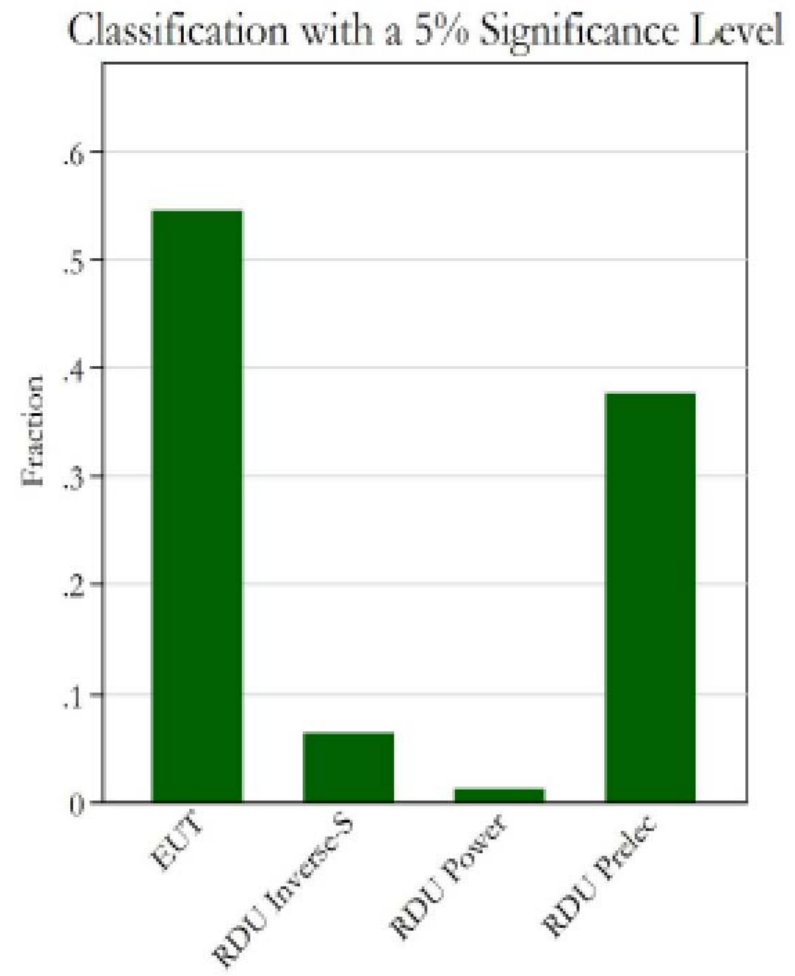
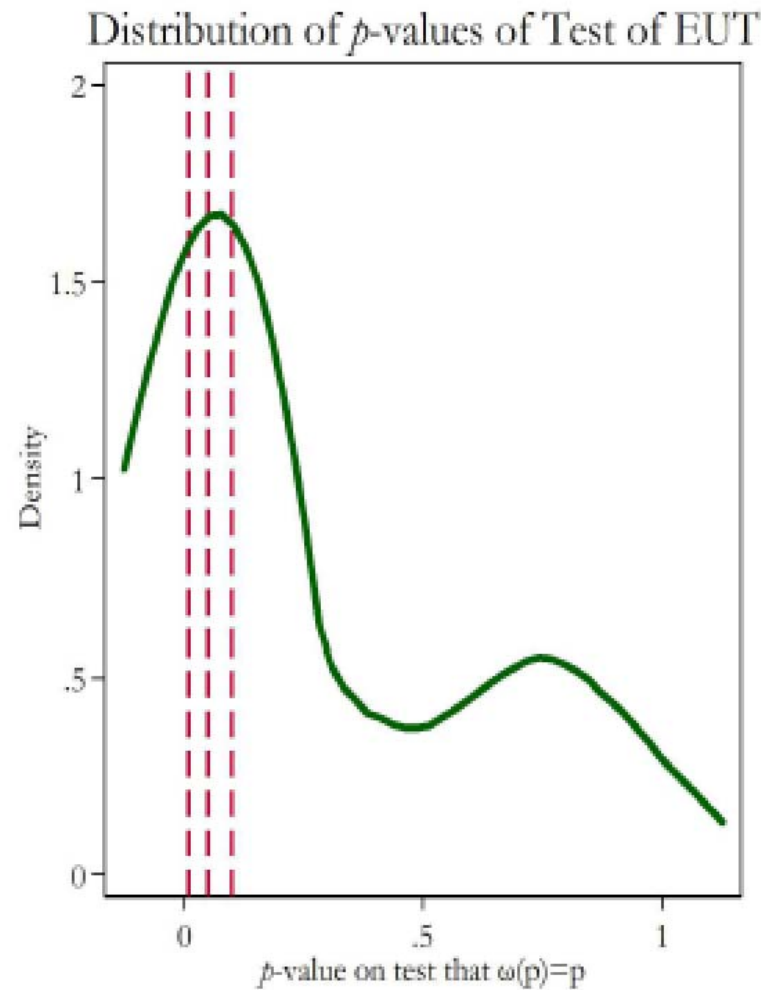
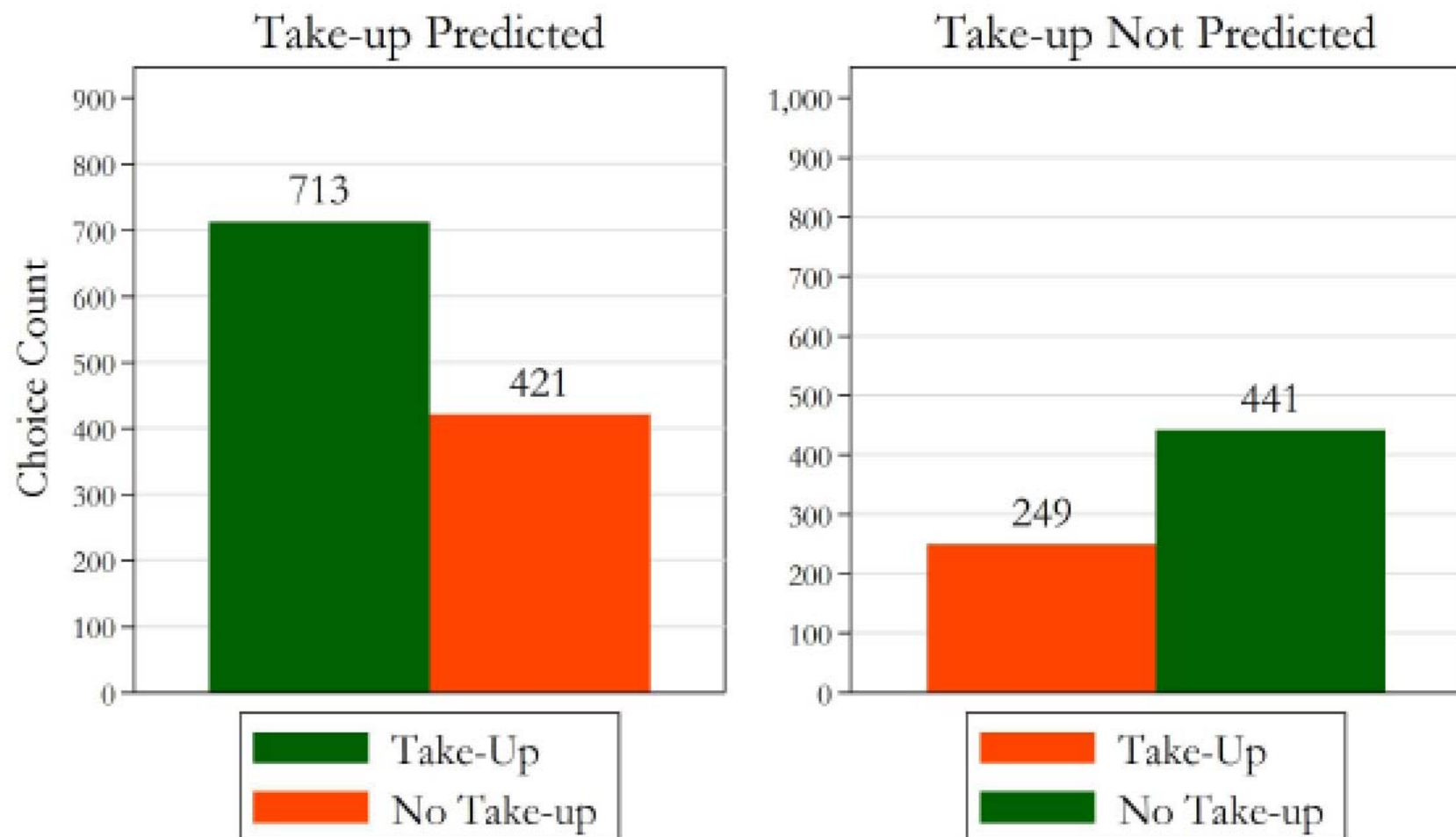


Figure 3.14 Proportion of Actual Take-Up to Predicted Choices for All Subjects

Fisher Exact Test 2-sided p -value < 0.001





Choice of welfare measure

- > Consumer surplus or efficiency?
- > CS has problems with NP risk
 - Δ NP risk is an “inferior product”
 - So expected CS is always smaller
- > Efficiency offers a natural normalization, and is preferred

Figure 14: Comparison of Efficiency Distributions

Control (N=40) against Non-Performance Risk treatment (N=37)

p -values test hypothesis that Non-Performance Risk treatment impacts efficiency

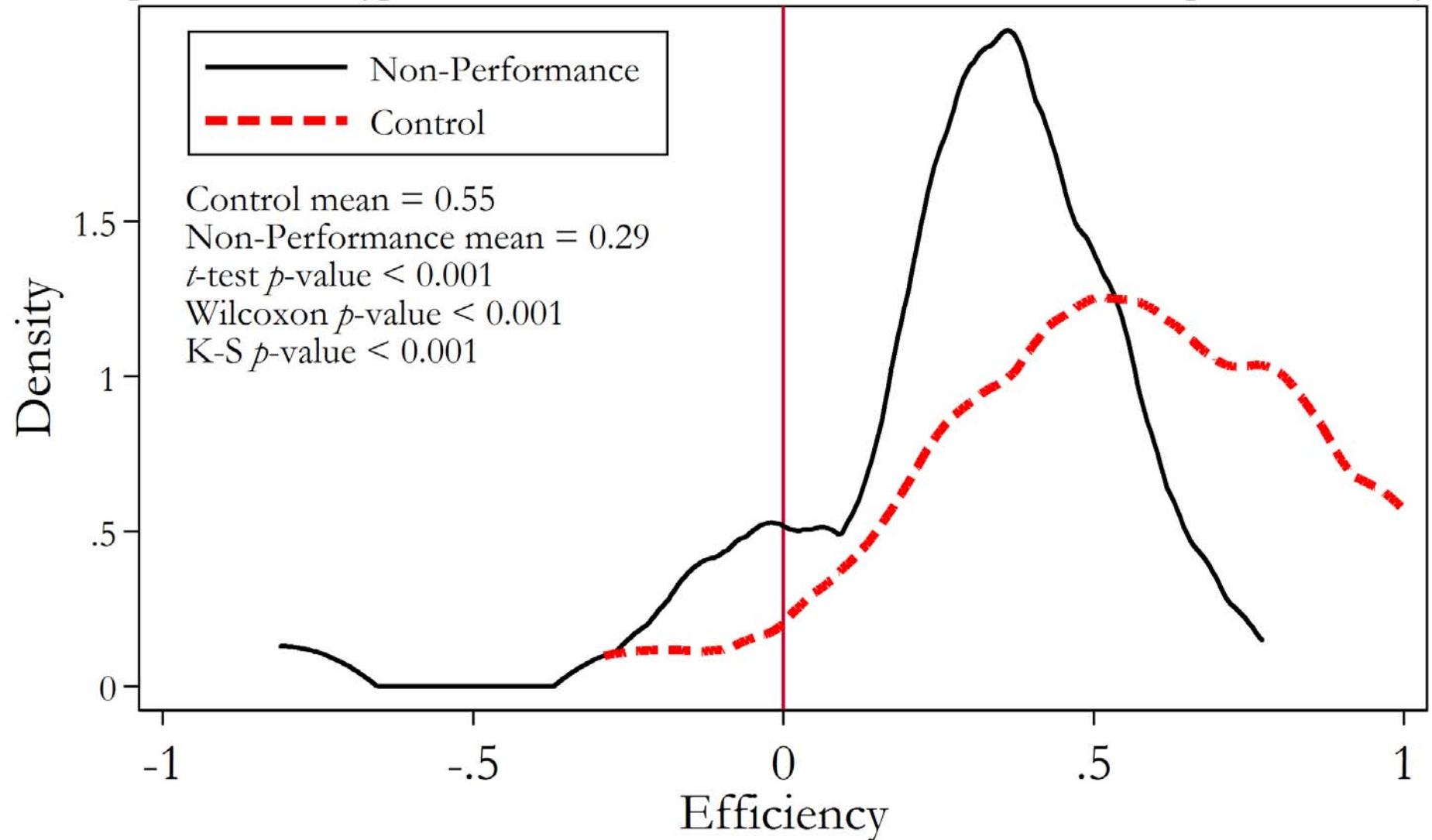


Figure 29: Comparison of Efficiency Distribution for NP and SB Treatments

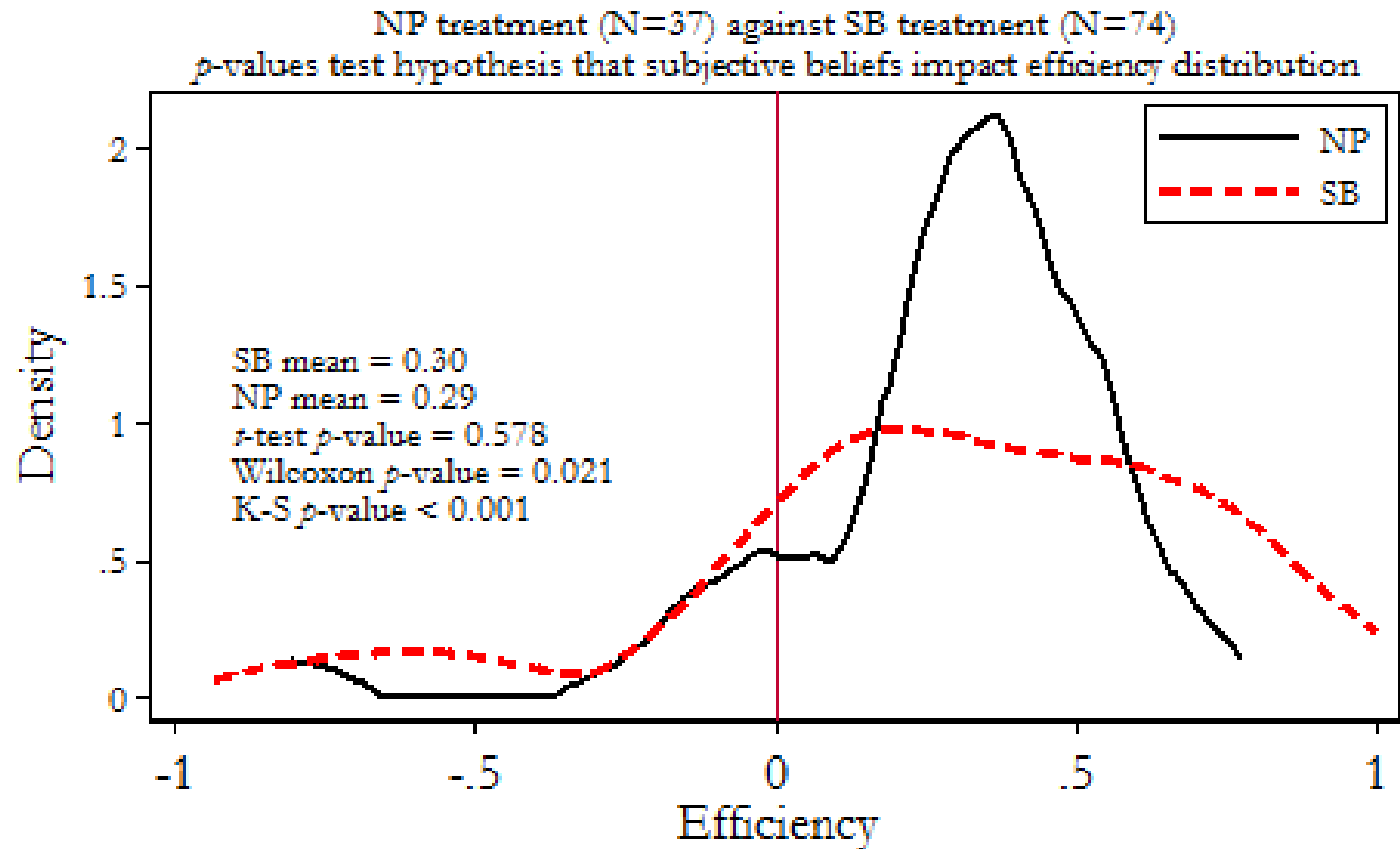


Figure 3.17 Classifying Subjects as Source-Dependent EUT or Recursive RDU Without Assuming ROCL

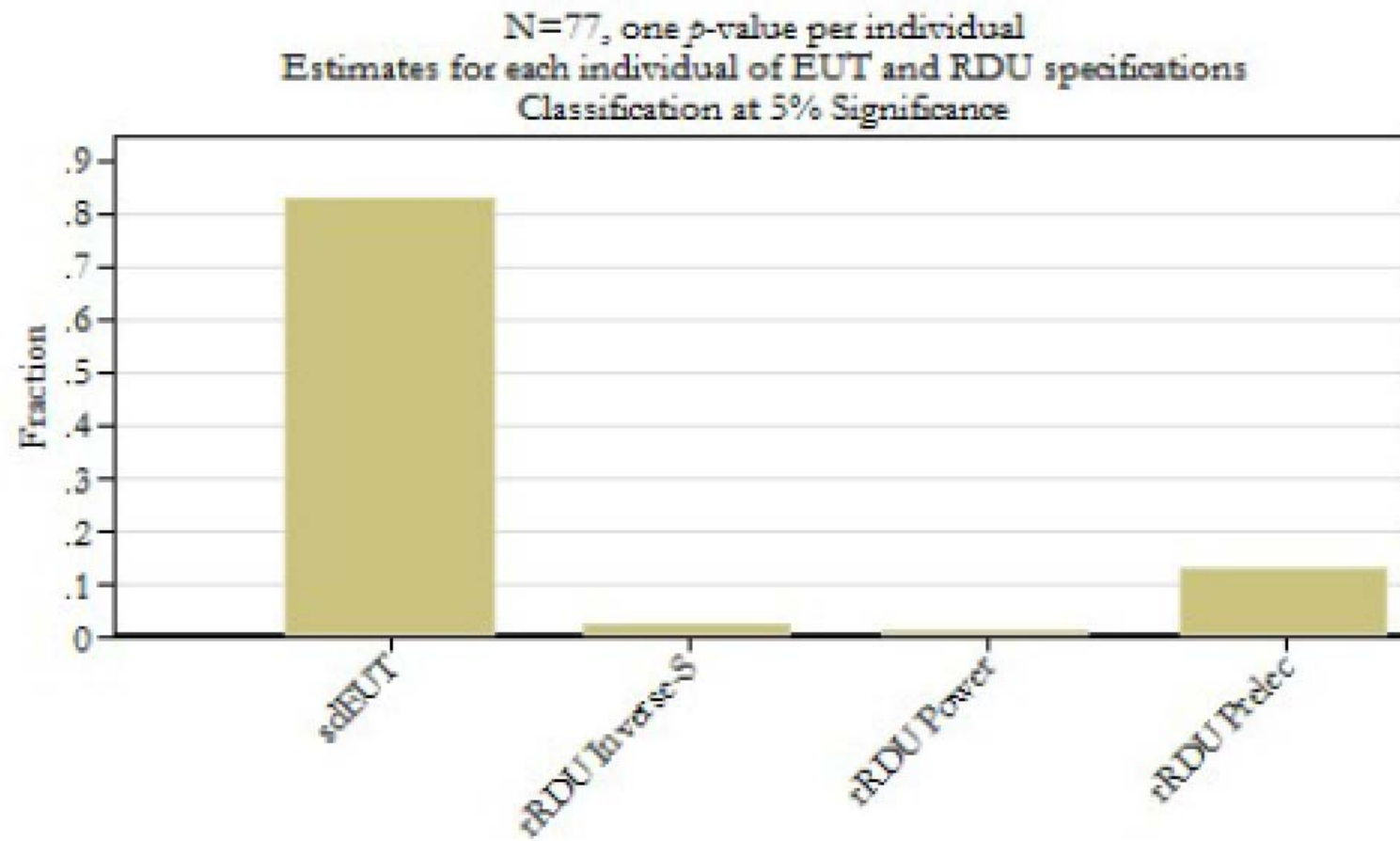


Figure 3.21 Comparison of Efficiency Distribution, Without Assuming ROCL

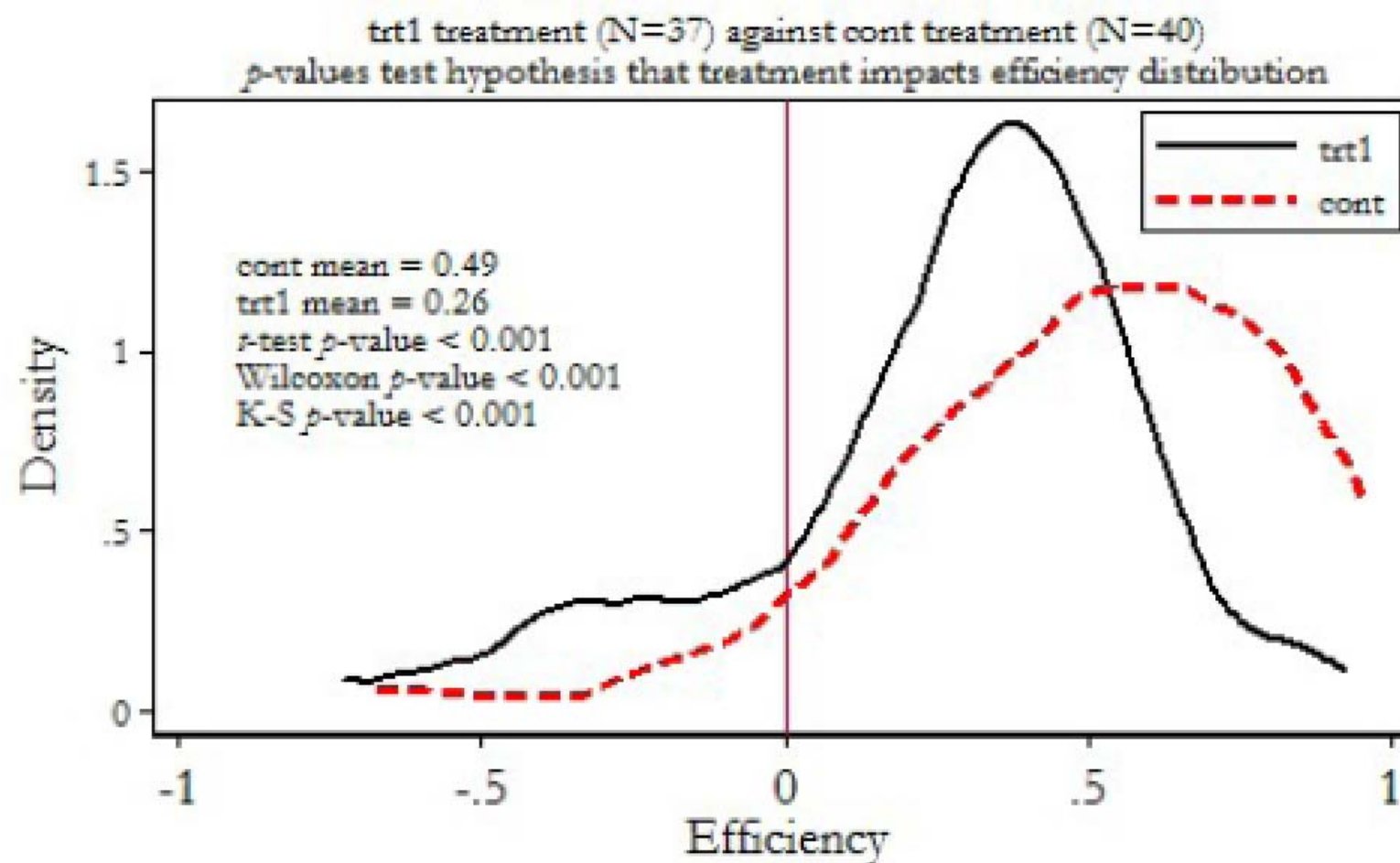


Figure 3.26 Classifying SB Subjects as EUT or RDU

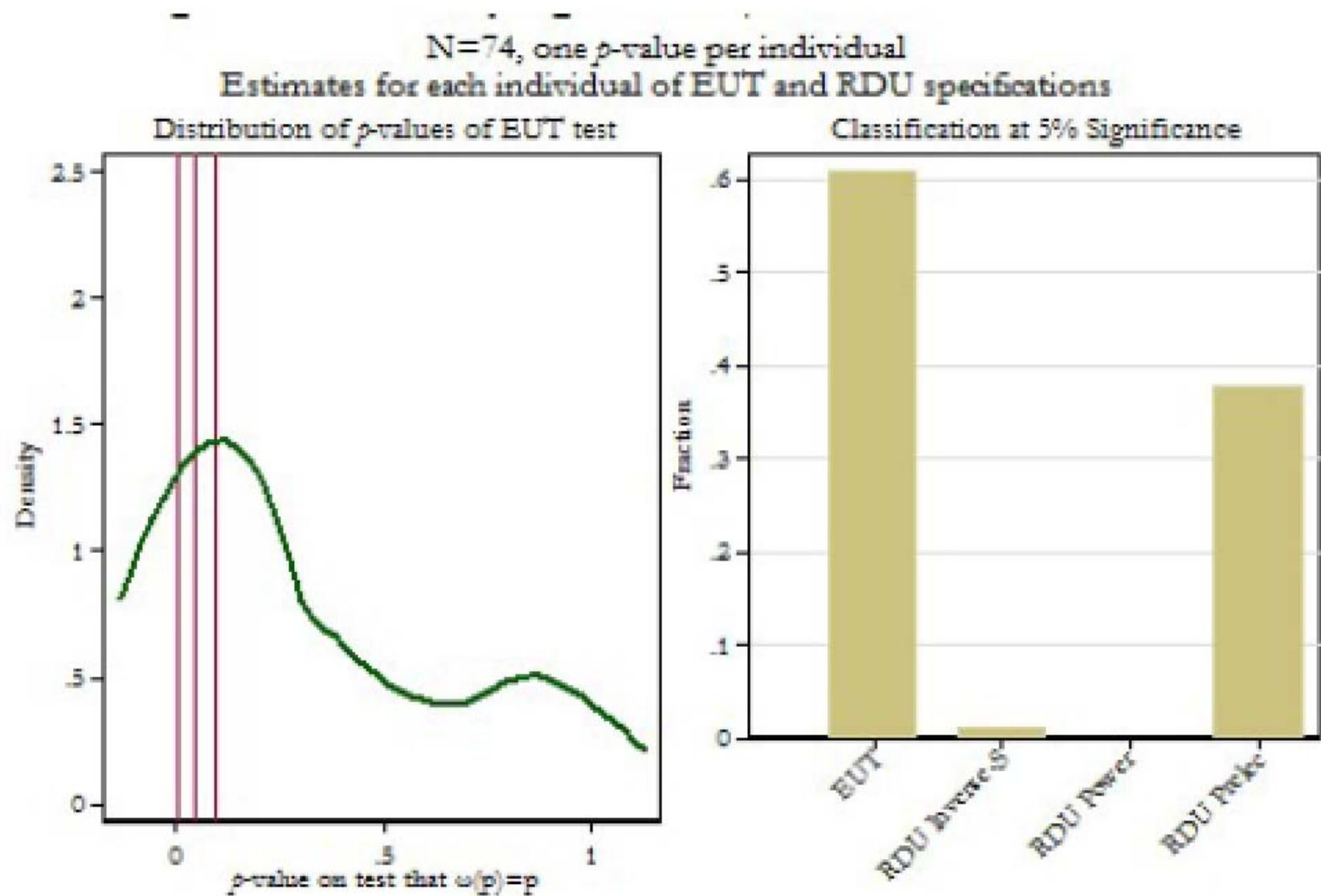
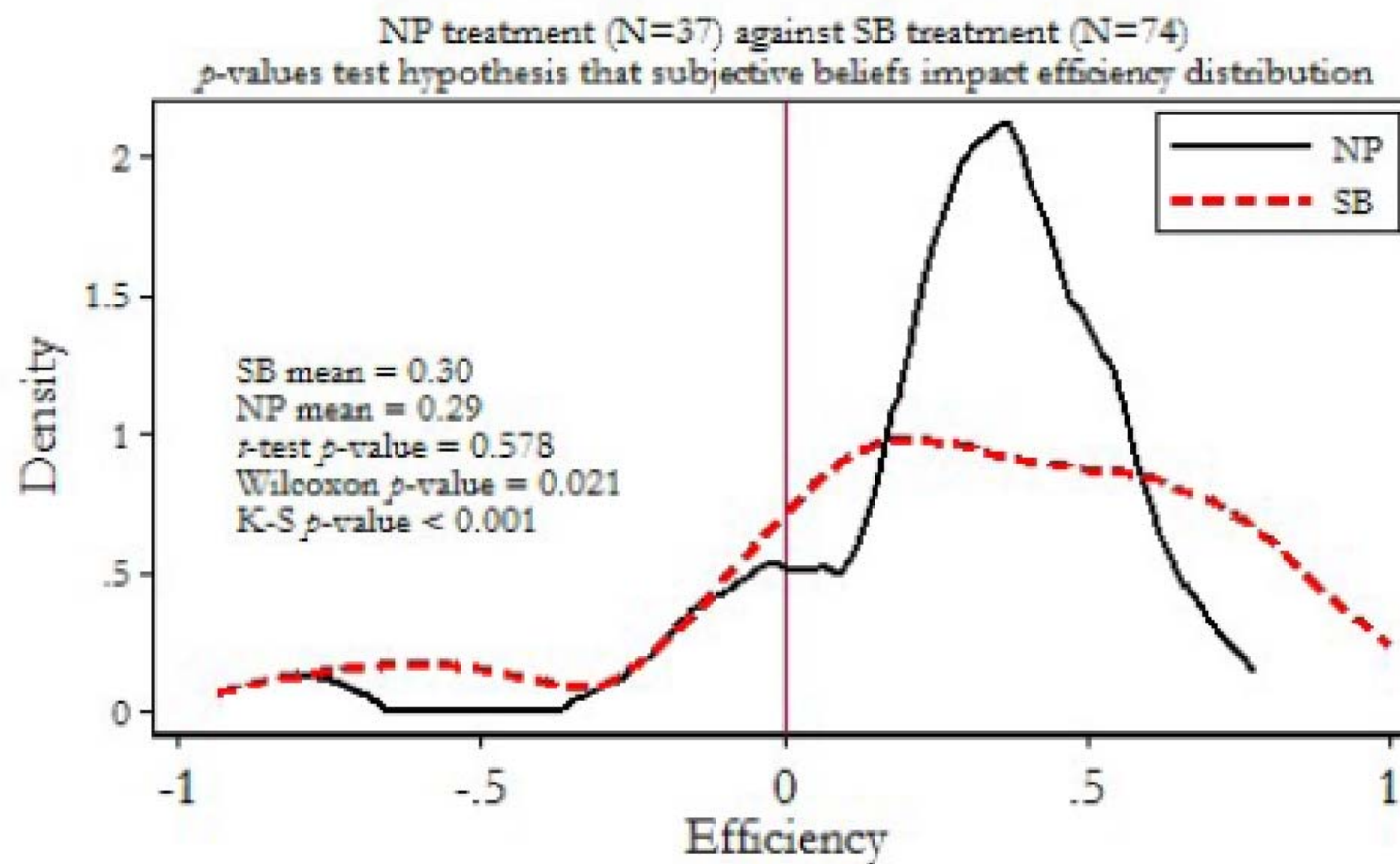


Figure 3.27 Proportion of Actual Take-Up to Predicted Choices (SB)



Figure 3.29 Comparison of Efficiency Distribution for NP and SB Treatments





Conclusion on NP risk

- > Contract non-performance decreases welfare of individual's insurance choices
 - Critical to use the efficiency measure here
- > Allowing for subjective beliefs does not impact average welfare
 - Hypothesis: subjective risk makes people more wary of NP risk
 - Encouraging more careful decision-making
 - Mitigating the reduction in precision about the NP risk



Extensions

- > Theories for behavioral welfare economics
- > Theoretical extensions: risk measures
- > Lab and field extensions
- > Field extensions
- > Methods
 - Nudging
 - Randomized evaluations



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 Frames¹

YUVAL SALANT

Stanford University

and

ARIEL RUBINSTEIN

University of Tel Aviv Cafés and New York University



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



Relevant literature? Not so sure

BEHAVIORAL WELFARE ECONOMICS

B. Douglas Bernheim
Stanford University

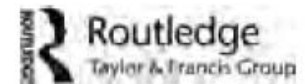
Journal of the European Economic Association April–May 2009 7(2–3):267–319



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>



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

Paola Manzini^{a*} and Marco Mariotti^b



Relevant literature? Not so sure

- > Core methodological challenge: how can we rely on revealed preference?
- > Various suggestions
 - Don't, since it is obvious what is better – the **Nudgers**
 - Don't, just do cost-effectiveness analysis – the **Randomistas**
 - Theoretical proposals
 - Model the deviations and recover the inner, rational preferences
 - Find choice settings where preferences are not needed, or only minimal preference axioms are needed (e.g., non-satiation)
 - Just focus on the opportunity set
 - Sophisticated revealed preference – **Case study**



Theory extensions

> Risk measures and (coherent) economics

B.A.J. 9, IV, 959-991 (2003)

RISK MEASURES AND THEORIES OF CHOICE

BY A. TSANAKAS AND E. DESLI

ABSTRACT

We discuss classes of risk measures in terms both of their axiomatic definitions and of the economic theories of choice that they can be derived from. More specifically, expected utility theory gives rise to the exponential premium principle, proposed by Gerber (1974), Dhaene *et al.* (2003), whereas Yaari's (1987) dual theory of choice under risk can be viewed as the source of the distortion premium principle (Denneberg, 1990; Wang, 1996). We argue that the properties of the exponential and distortion premium principles are complementary, without either of the two performing completely satisfactorily as a risk measure. Using generalised expected utility theory (Quiggin, 1993), we derive a new risk measure, which we call the distortion-exponential principle. This risk measure satisfies the axioms of convex measures of risk, proposed by Föllmer & Shied (2002a,b), and its properties lie between those of the exponential and distortion principles, which can be obtained as special cases.



Lab and field extensions, I

> Smart subsidies

- Can we use information on demographics to design targeted subsidies to encourage Δ welfare?
- Use existing experiments to design policy, and undertake an out-of-sample test

> Literacy interventions

- Back to Solomon Huebner and “the insurance product”
- Cheap talk
- Lab experiments as “practice runs with consequences”
- Explanation of compound risks
- Information on NP risk metrics



Lab and field extensions, II

> Higher-order risk preferences

- Not quite right, but think of these as skewness risk preferences and kurtosis risk preferences
- Critical for cat risk
 - Low probability, and high consequence

> Downside risk preferences

- Asymmetric risk preferences
- Risk measures that reflect actual risk preferences

> Reference points and loss aversion

- All sorts of questions about validity of CPT



Field extensions, I

> Subjective beliefs

- Loss probabilities
- Compound risk probabilities
 - Index insurance contracts
 - NP risk

> Time preferences

- Recall the basic insurance contract: pay premium now, get possible benefits over the next year
- Present bias could significantly affect PV of CE of insurance
- Time consistency?
 - Related to perception of insurance product as risk management or an investment



Field extensions, II

> Self-protection and self-insurance

- Insurance as just one of the possible risk management options
- Are these competitive or complementary?

> Informal risk management and insurance

- Myriad informal mechanisms evolved over time
 - Households
 - Kinship, villages and burial transfers
 - Delayed enforcement by utility companies
- Crowding-out effect of short-term subsidies on formal insurance

> Non-performance risk

- Trust and “betrayal aversion”



Field extensions, III

> Application #1: Portfolios of the Atlanta Poor

- Extension of Portfolios of the Poor methods to the urban poor
- High-frequency diaries to understand risk management context
- Family matters
- Simple indemnity insurance
- Index insurance w.r.t. official unemployment rates

> Application #2: Index Insurance in South Africa

- Trust matters
- Family matters
- Indemnity insurance w.r.t. funeral costs
- Index insurance w.r.t. official unemployment rates



The Nudgers

- > Using behavioral economics to design “choice architectures” to mitigate biases
 - For example, picking default options
 - Often based on RCTs, but not always
- > Libertarian paternalism



The Nudgers

- > Using behavioral economics to design “choice architectures” to mitigate biases
 - For example, picking default options
 - Often based on RCTs, but not always
- > Libertarian paternalism
- > Issues
 - What direction is “up” for me, for you, for someone else?
 - Boosts *versus* nudges
 - Evil nudgers....

ADDICTION BY DESIGN

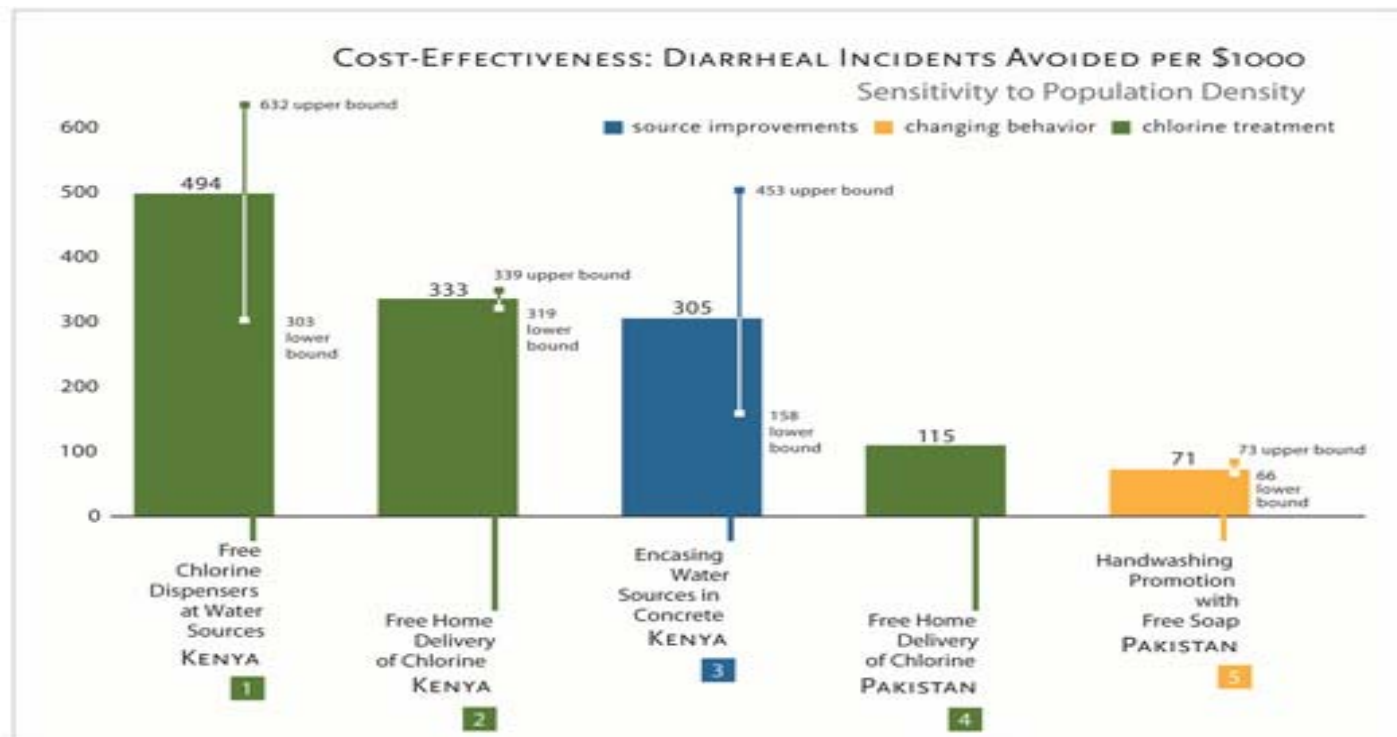
Machine Gambling in Las Vegas



NATASHA DOW SCHÜLL

The Randomistas

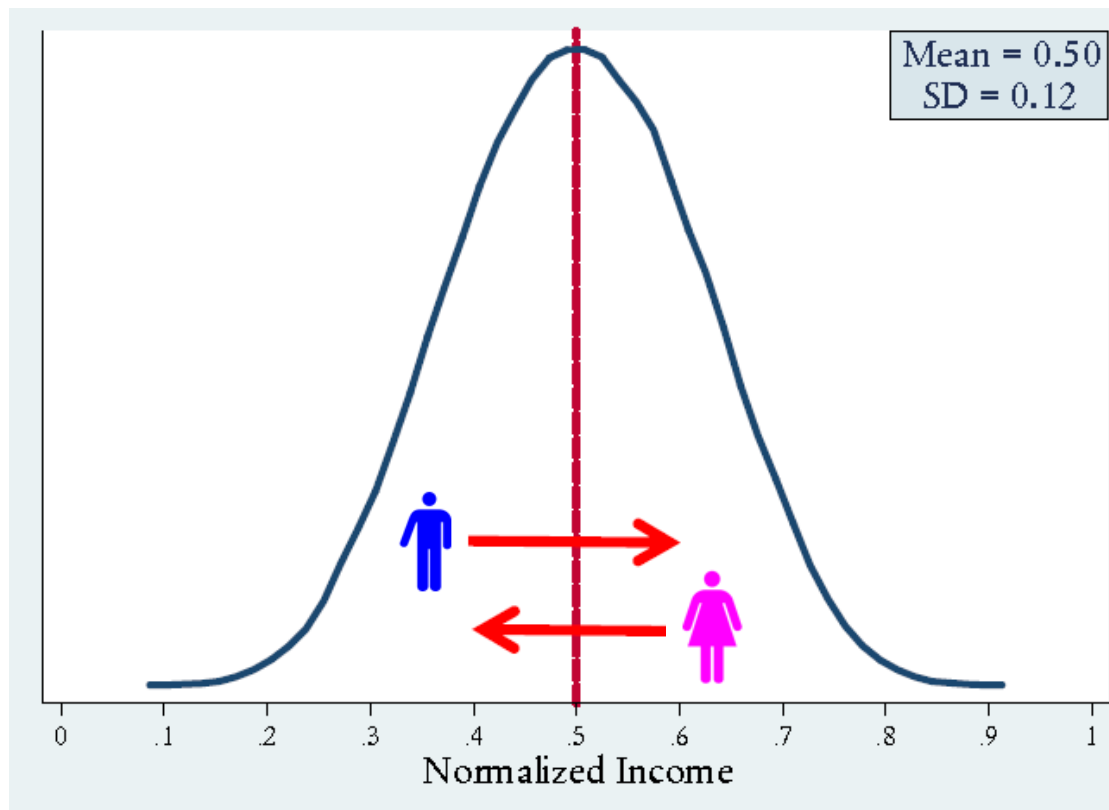
- > RCTs
- > Cost-effectiveness



Diarrhea Incidents Averted per \$1000 Spent

Issues

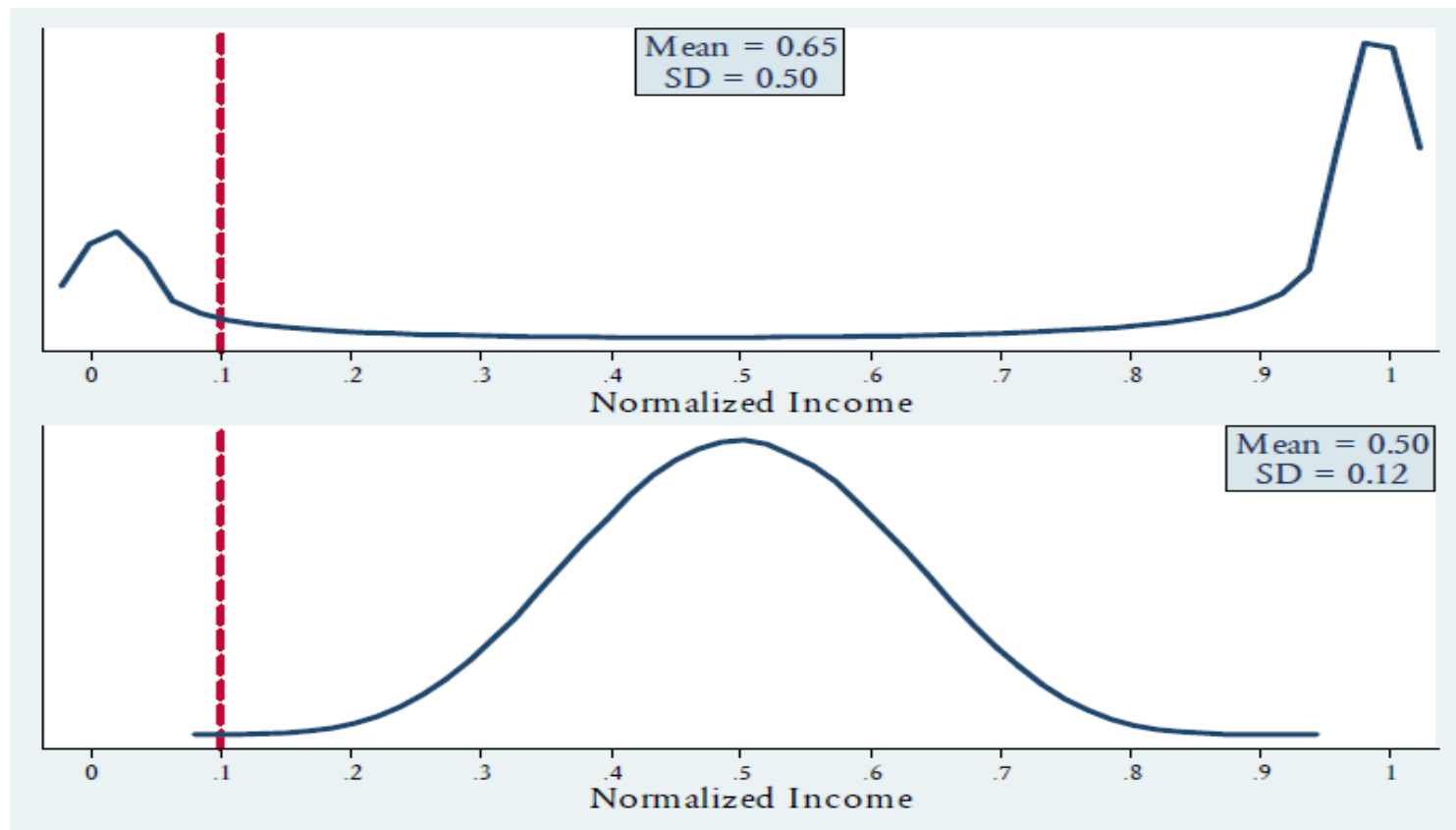
- > Exclusive focus on the average effect of the policy
 - Ignores equity concerns





Issues

- Exclusive focus on the average effect of the policy
 - Ignores equity concerns
 - What if the policy objective is not the average?





Issues

- > Exclusive focus on the average effect of the policy
 - Ignores equity concerns
 - What if the policy objective is not the average?
 - What if we care about identifying winners and losers?

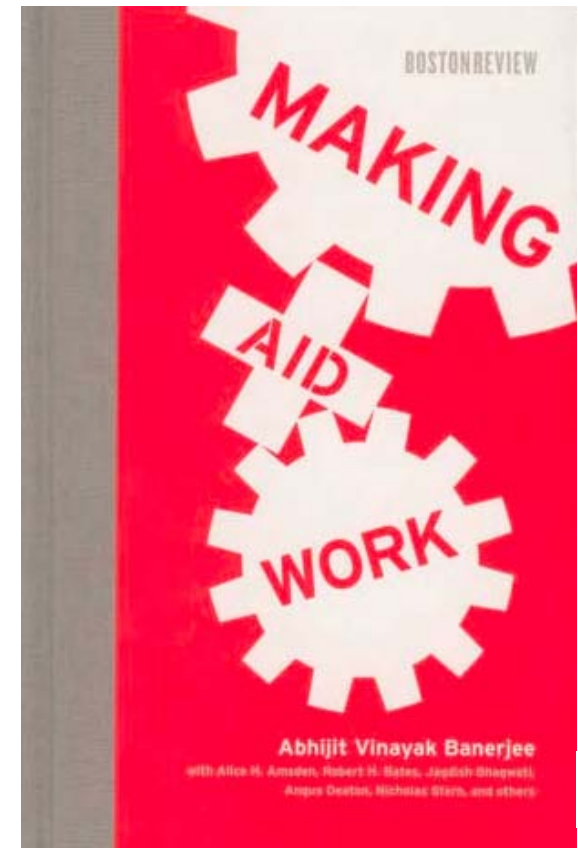
Policy reform without tears*

*Glenn W. Harrison, Jesper Jensen, Morten I. Lau
and Thomas F. Rutherford*



Issues

- > Exclusive focus on the average effect of the policy
- > Many policies cannot be randomized
 - Literally, or ethically



Issues

- > Exclusive focus on the average effect of the policy
- > Many policies cannot be randomized
- > How do we compare across policies in different areas?

J-PAL PROGRAMS	
	AGRICULTURE <i>over 43 projects in 17 countries</i>
	EDUCATION <i>over 118 projects in 29 countries</i>
	ENVIRONMENT & ENERGY <i>over 19 projects in 12 countries</i>
	FINANCE & MICROFINANCE <i>over 162 projects in 36 countries</i>
	HEALTH <i>over 114 projects in 32 countries</i>
	LABOR MARKETS <i>over 57 projects in 24 countries</i>
	POLITICAL ECONOMY & GOVERNANCE <i>over 98 projects in 26 countries</i>

\$1 million?



Issues

- > Exclusive focus on the average effect of the policy
- > Many policies cannot be randomized
- > How do we compare across policies in different areas?
- > What if we need to know why the policy works (or not)?



Issues

- > Exclusive focus on the average effect of the policy
- > Many policies cannot be randomized
- > How do we compare across policies in different areas?
- > What if we need to know why the policy works?
- > Clean-beaker science applied in a dirty-beaker world
 - FDA drug approval process using RCTs, contrast with the application of drugs in the field
 - Comorbidities in Phase III clinical trials?
 - Evaluation horizon in Phase III?
 - Rampant off-label approval by doctors?



Issues

- > Exclusive focus on the average effect of the policy
- > Many policies cannot be randomized
- > How do we compare across policies in different areas?
- > What if we need to know why the policy works?
- > Clean-beaker science applied in a dirty-beaker world
- > The only way to make causal statements?



Issues

- > Exclusive focus on the average effect of the policy
- > Many policies cannot be randomized
- > How do we compare across policies in different areas?
- > What if we need to know why the policy works?
- > Clean-beaker science applied in a dirty-beaker world
- > The only way to make causal statements?
- > Randomization bias?



Issues

- > Exclusive focus on the average effect of the policy
- > Many policies cannot be randomized
- > How do we compare across policies in different areas?
- > What if we need to know why the policy works?
- > Clean-beaker science applied in a dirty-beaker world
- > The only way to make causal statements?
- > Randomization bias?
- > Not methodologically new in economics...



Longer history in economics

Social Experimentation and Economic Policy: A Survey

By ROBERT FERBER

University of Illinois

and

WERNER Z. HIRSCH

University of California at Los Angeles

Journal of Economic Literature
Vol. XVI (December 1978), pp. 1379–1414





Types of experiments

> Types of experiments

- Thought experiments
- Lab experiments
- Artefactual, framed or natural field experiments
- Social experiments
- Natural experiments

Field Experiments

GLENN W. HARRISON *and* JOHN A. LIST¹

Journal of Economic Literature
Vol. XLII (December 2004) pp. 1009–1055



Types of experiments

> Types of experiments

- Thought experiments
- Lab experiments
- Artefactual, framed or natural field experiments
- Social experiments
- Natural experiments

All can and do
use some
randomization

Field Experiments

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Dangerous slogans and science

> “What works”

- By what, or whose, metric of “works”?
- At what benefit-cost ratio?

> “Evidence-based”

- What other kind of (operationally meaningful) economic science is there?

> “Only way to make causal statements”

- Not if you care about causal effects on welfare

> “OLS gives the same results, and is easier to interpret”

- Nonsense, and now rarely checked



Conclusion

- > Beware of behavioral economists bearing policies
 - Actually, often not economists
- > Beware of seductive slogans
- > Beware of avoiding theory or structural econometrics

- > But don't lose the valuable insights provided
- > Or the valuable insights that will be provided if we use all of the tools of behavioral economics together