

**UC Berkeley
Haas School of Business
Berkeley MBA for Executives Program**

**Game Theory
(XMBA 296)**

**Block 3
Risk preferences and social preferences
Jun 12-14, 2014**

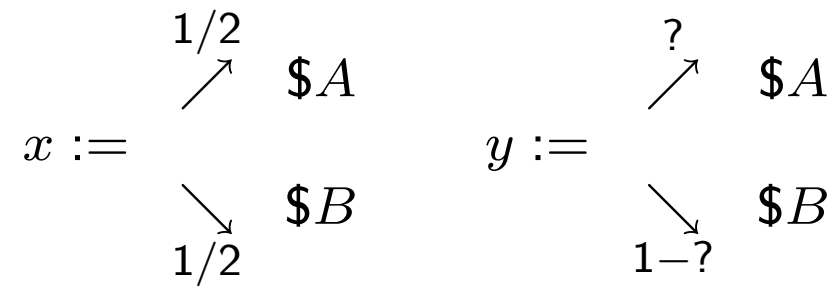
Risk preferences

Life is full of lotteries :-)

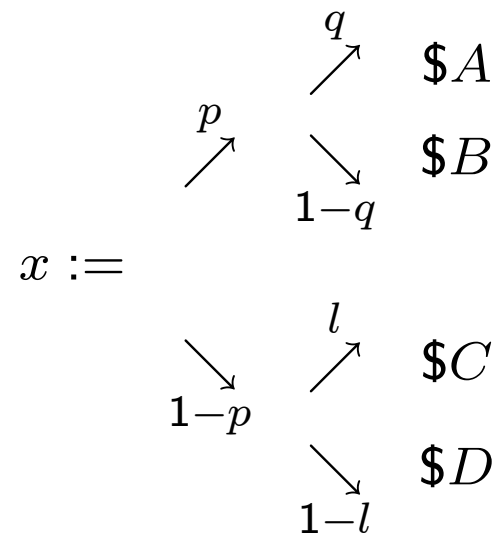
$$x := \begin{array}{l} \nearrow^p \quad \$A \\ \searrow \quad \$B \\ 1-p \end{array}$$

$$y := \begin{array}{l} \nearrow^p \quad \$A \\ \xrightarrow{q} \quad \$B \\ \searrow \quad \$C \\ 1-p-q \end{array}$$

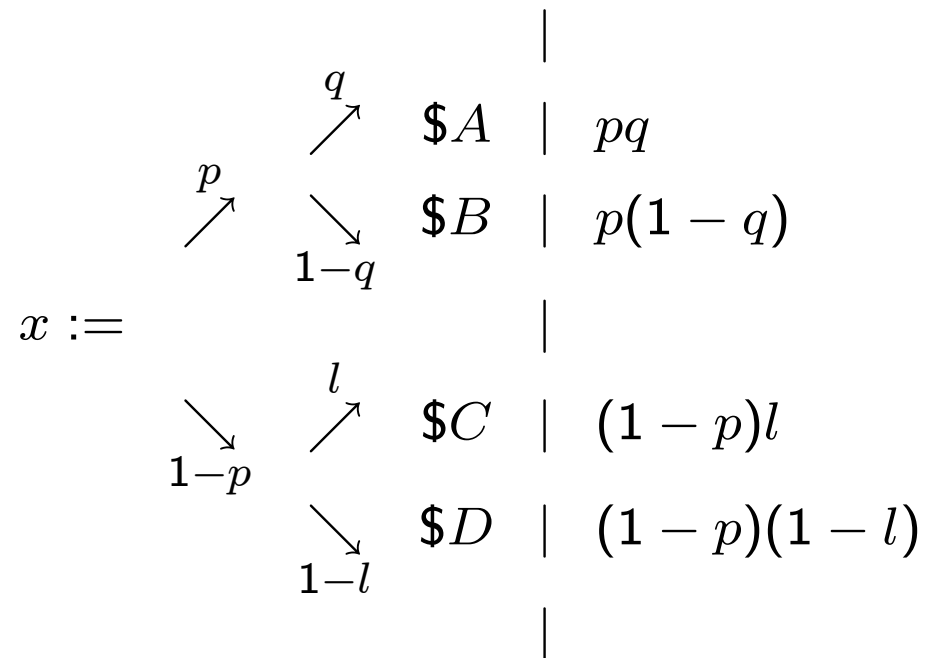
A risky lottery (left) and an ambiguous lottery (right)



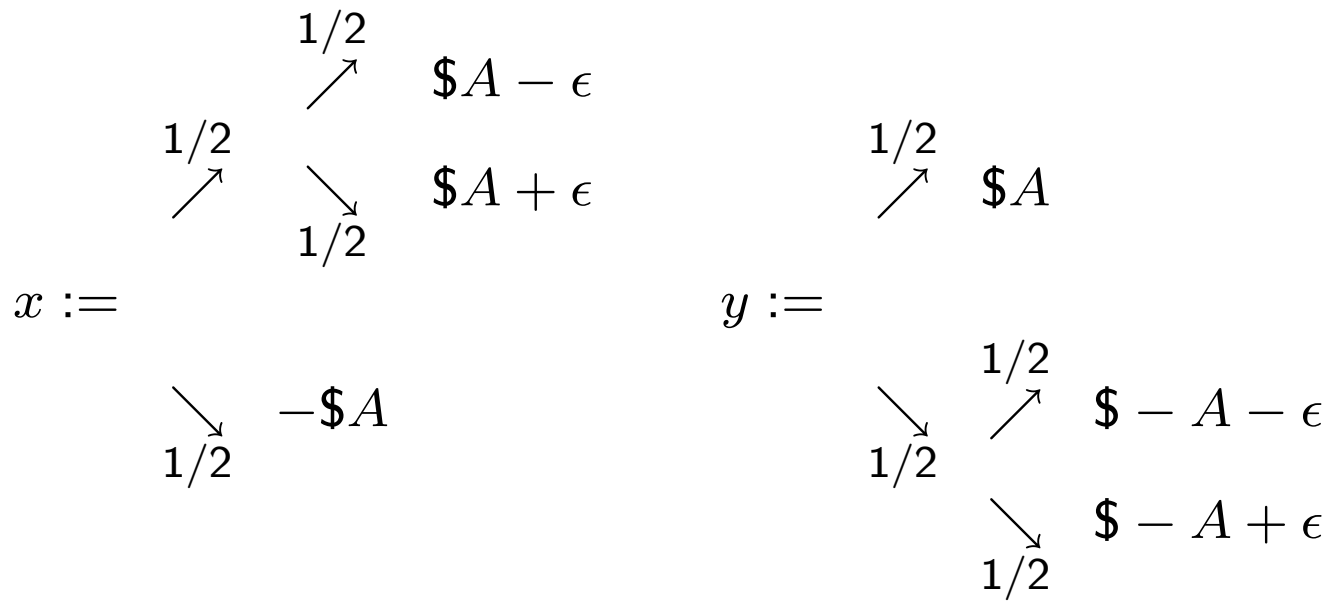
A compounded lottery



The reduction of a compounded lottery



Prudence

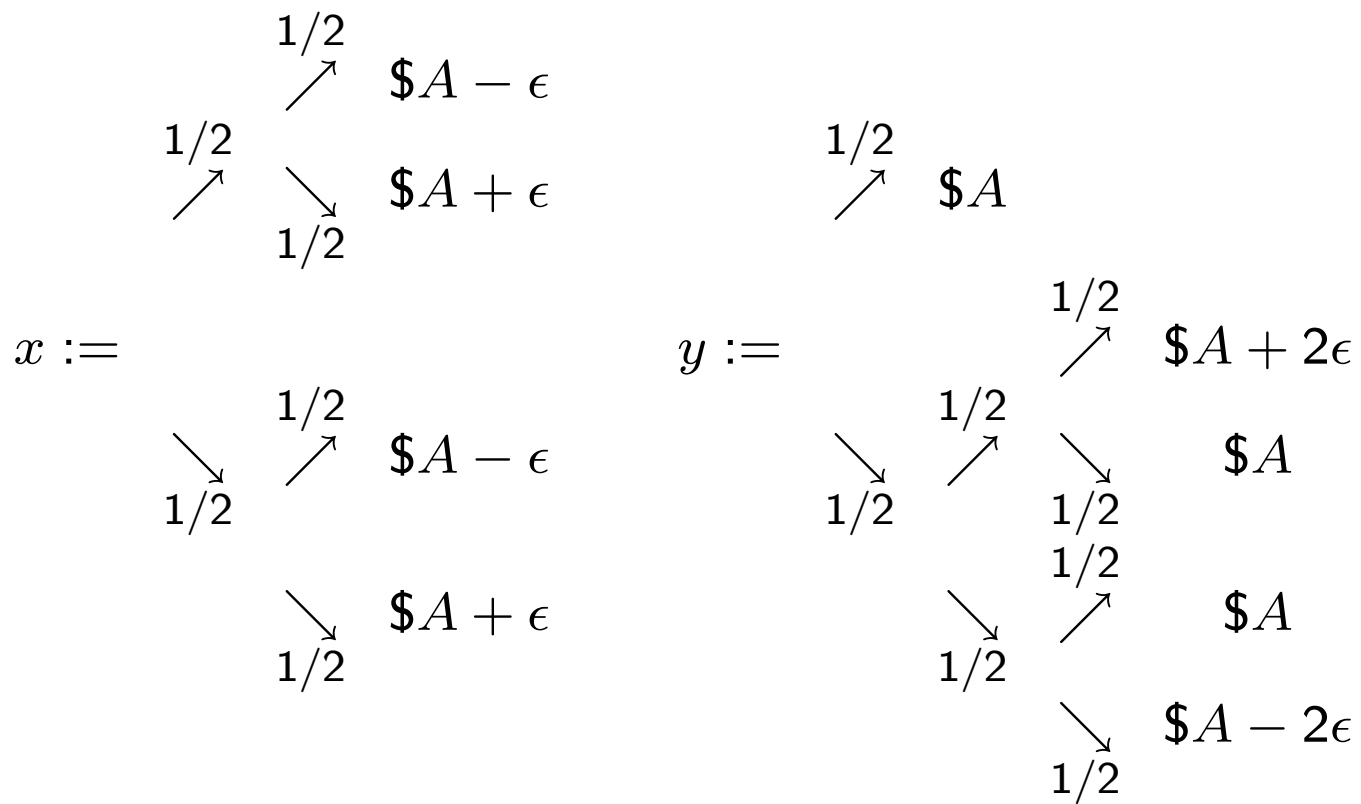


What is prudence ?

Careful good judgment (caution or circumspection) that allows someone to avoid danger or risks. One of the four cardinal virtues or core values (the others are justice, courage and temperance).

An individual who is prudent prefers lottery x over lottery y .

Temperance



What is temperance?

Moderation in action, thought, or feeling, studied by religious thinkers, philosophers, and psychologists. It is considered a virtue, a core value that can be seen consistently across time and cultures.

A temperate individual prefers lottery x over lottery y .

Rationality

For any pair of lotteries x and y ,

if the decision maker says that x is at least as good as y , we write

$$x \succsim y$$

and say that x is weakly preferred to y .

Foundations of Economic Analysis (1947)



Paul A. Samuelson (1915-2009) – the first American Nobel laureate in economics and the foremost (academic) economist of the 20th century (and the uncle of Larry Summers...).

The basic assumptions about preferences

The theory begins with three assumptions. These assumptions are so fundamental that we can refer to them as the “axioms” of decision theory.

[1] Completeness

$$x \succsim y \text{ or } y \succsim x$$

for any pair of lotteries x and y .

The second axiom is called transitivity:

[2] Transitivity

if $x \succ y$ and $y \succ z$ then $x \succ z$

for any three lotteries x , y and z .

Together, completeness and transitivity constitute the formal definition of *rationality* as the term is used in economics. Rational decision makers are ones who

- have the ability to make choices [1],
- and whose choices display a logical consistency [2].

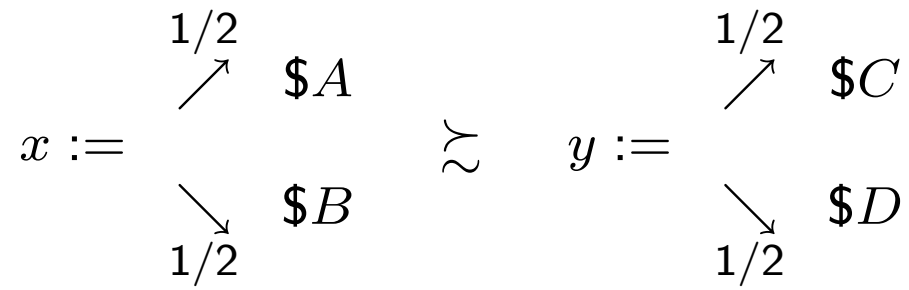
[3] The third axiom is called independence:

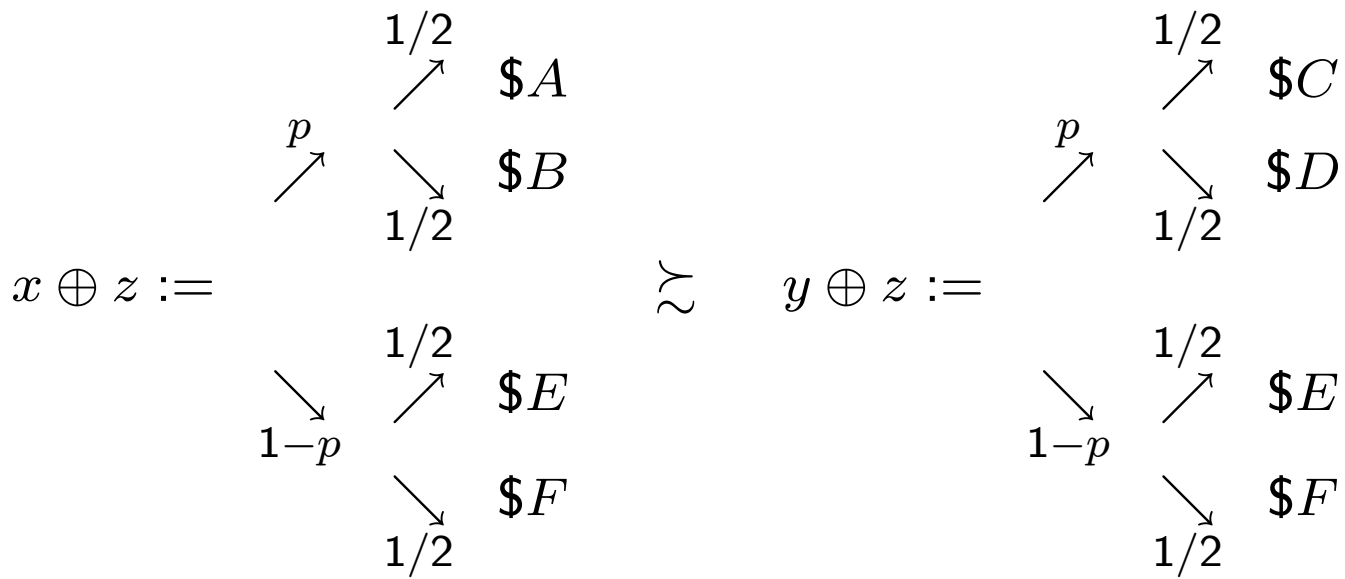
Independence

For any lotteries x, y, z and $0 < p < 1$

if $x \succ y$ then $px + (1 - p)z \succ py + (1 - p)z$.

Independence





Allais (1953) I

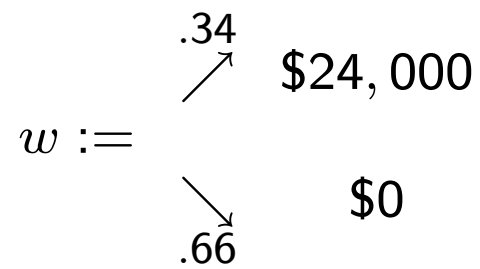
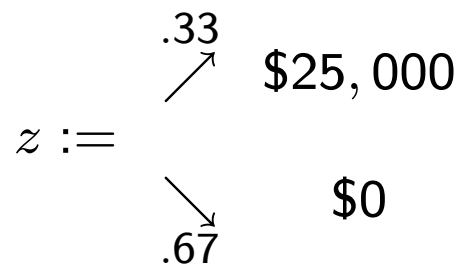
Choose between the two lotteries:

$$x := \begin{array}{l} \nearrow .33 \\ \longrightarrow .66 \\ \searrow .01 \end{array} \begin{array}{l} \$25,000 \\ \$24,000 \\ \$0 \end{array}$$

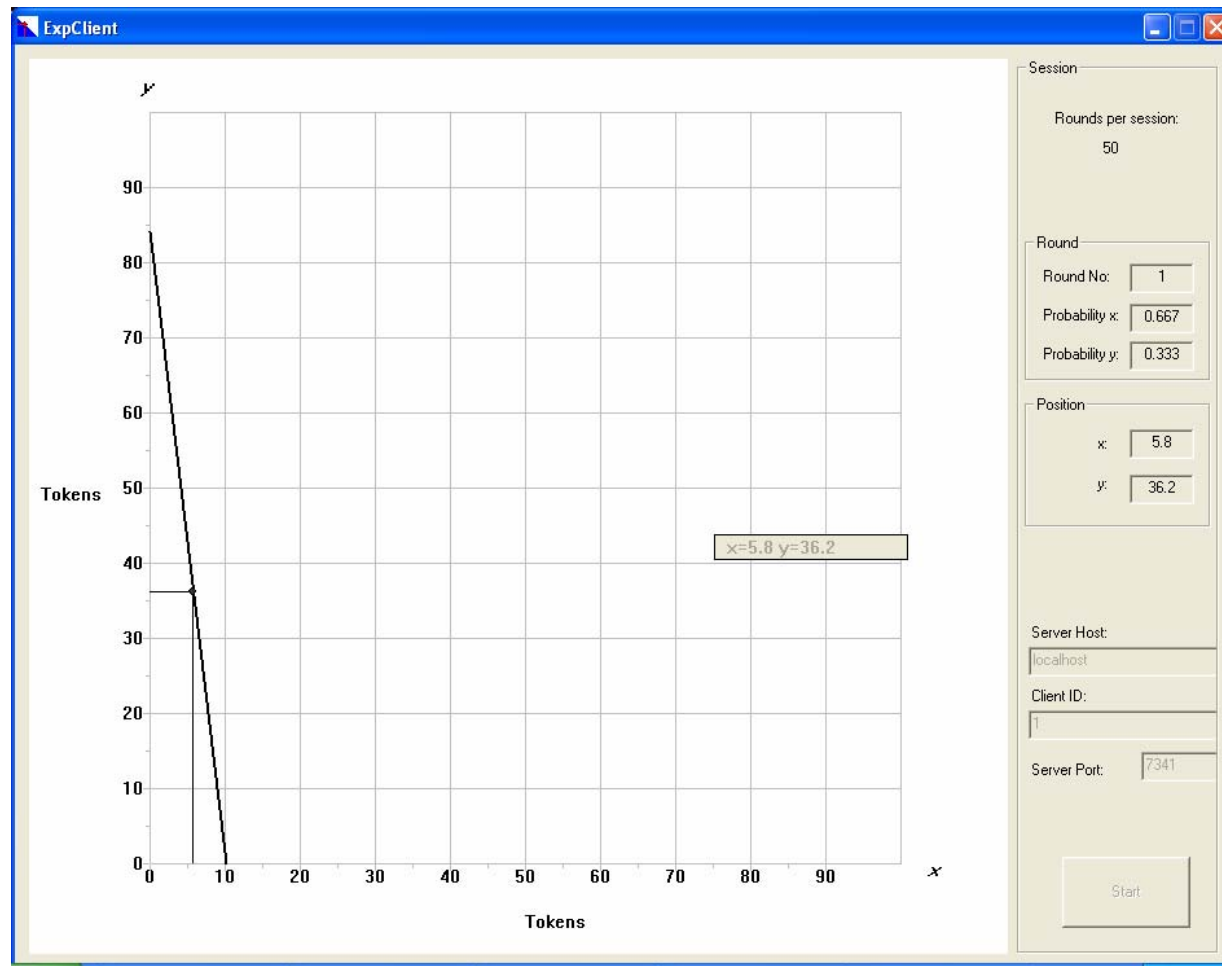
$$y := \xrightarrow{1} \$24,000$$

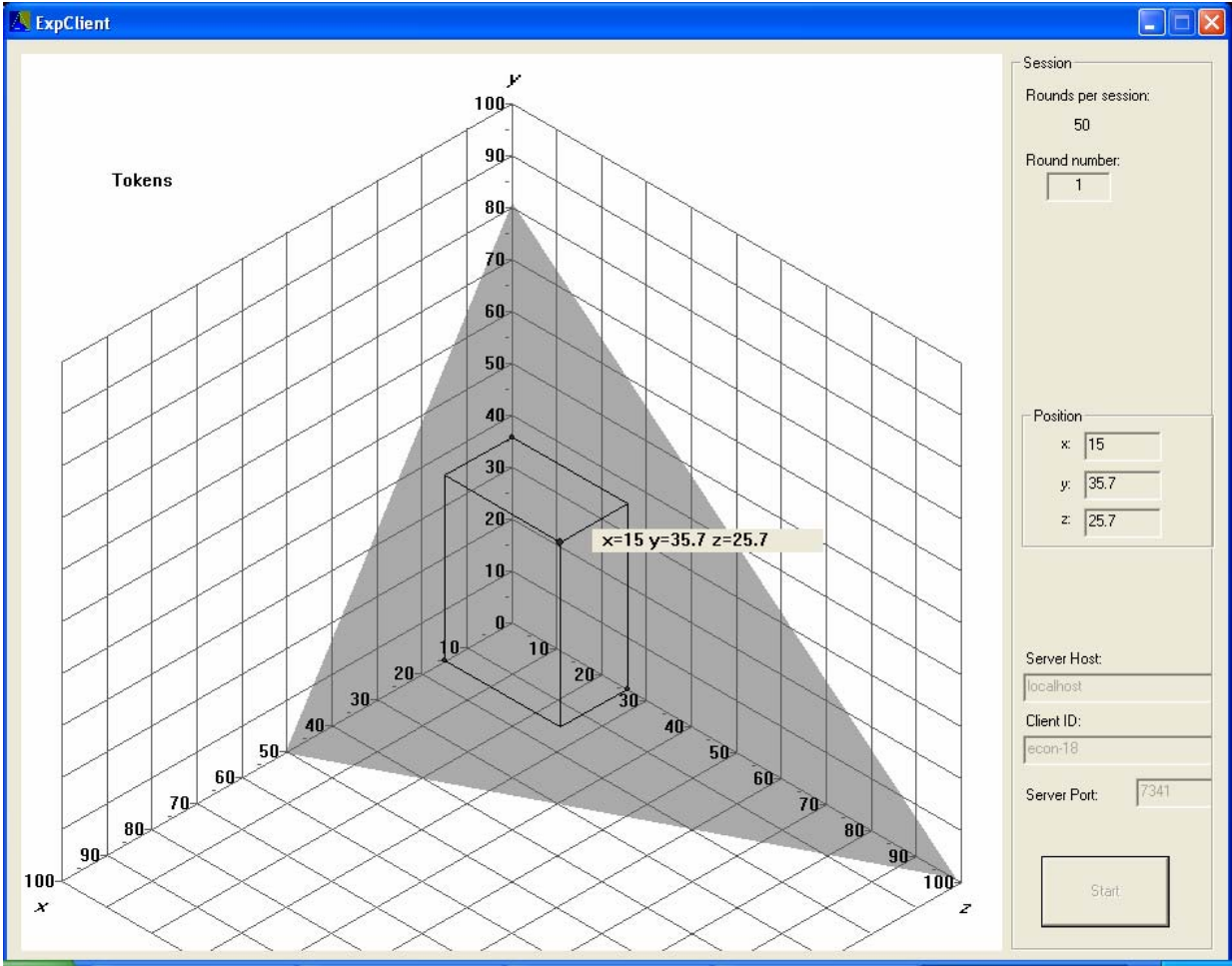
Allais (1953) II

Choose between the two lotteries:



The experimental computer program dialog windows

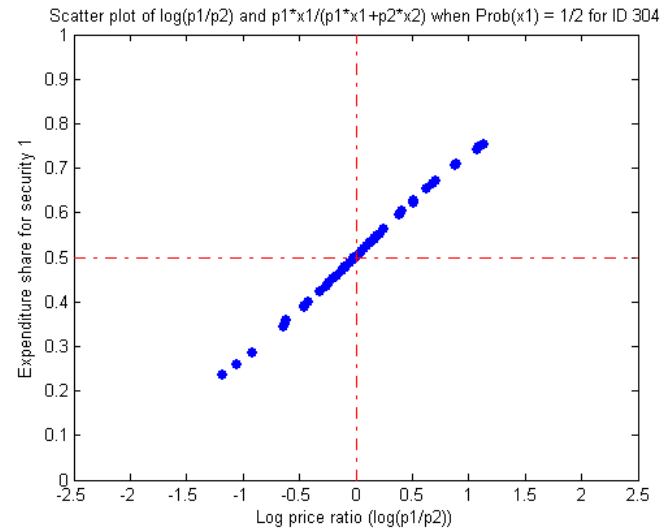
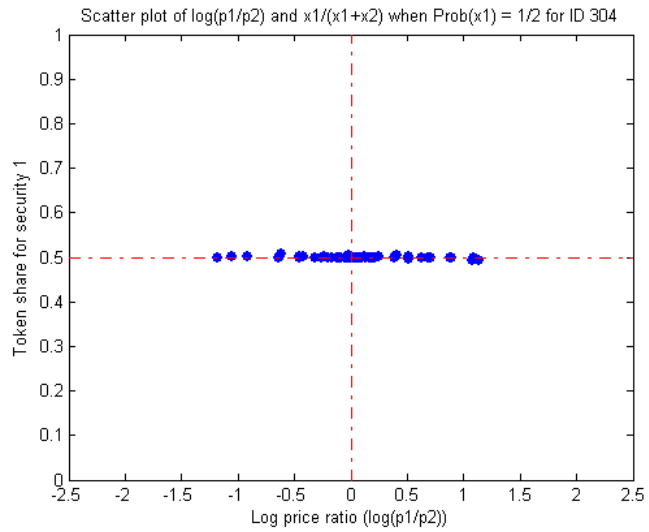
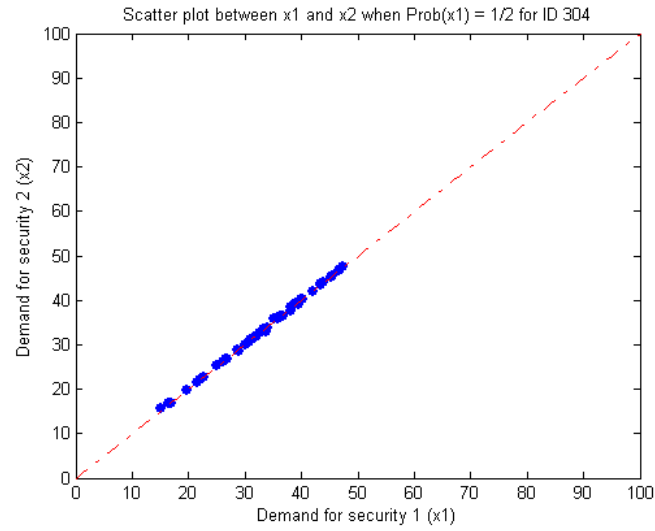


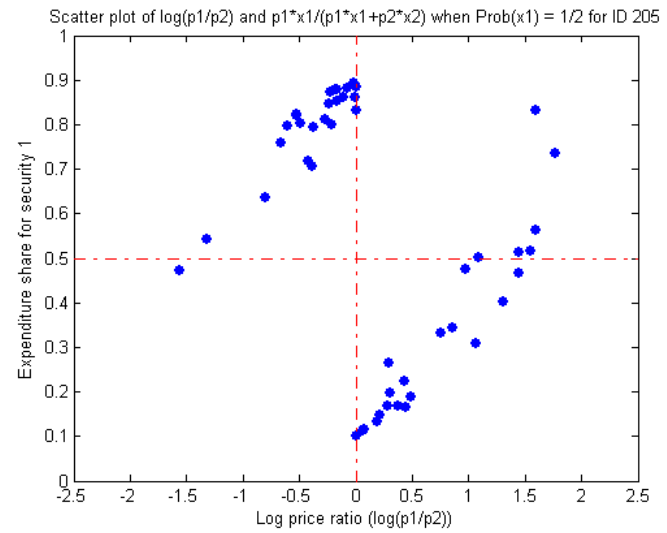
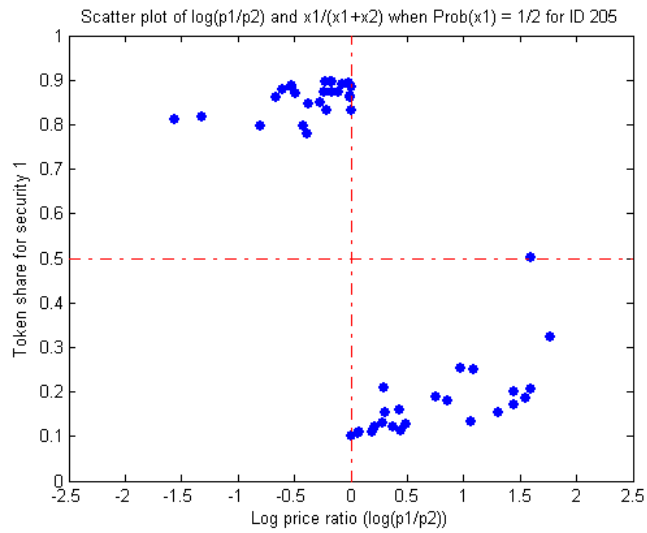
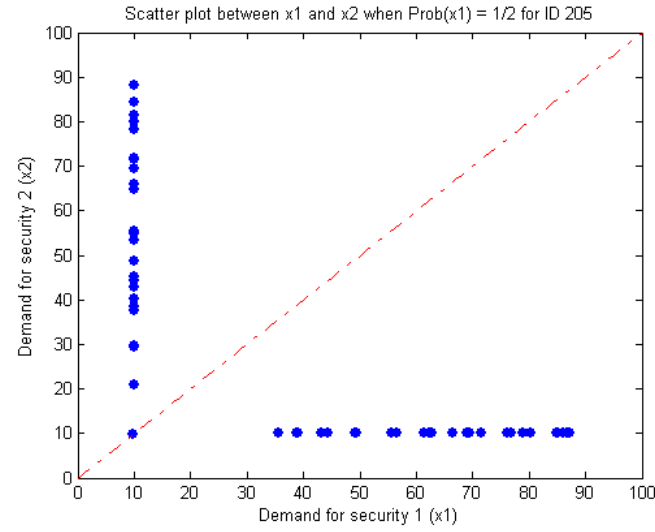


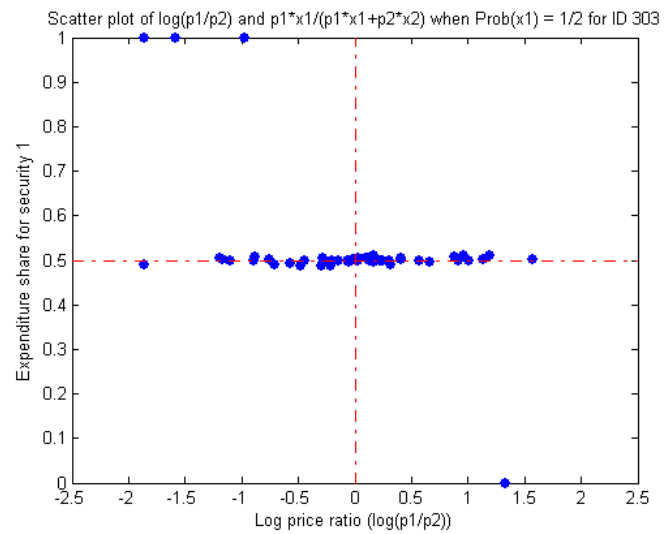
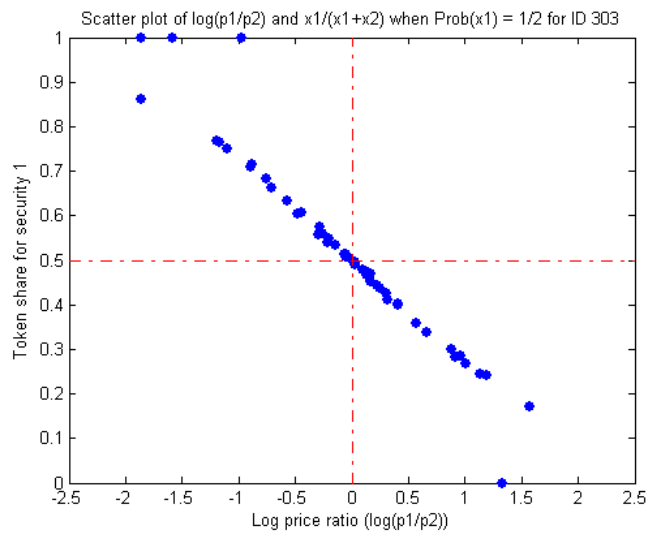
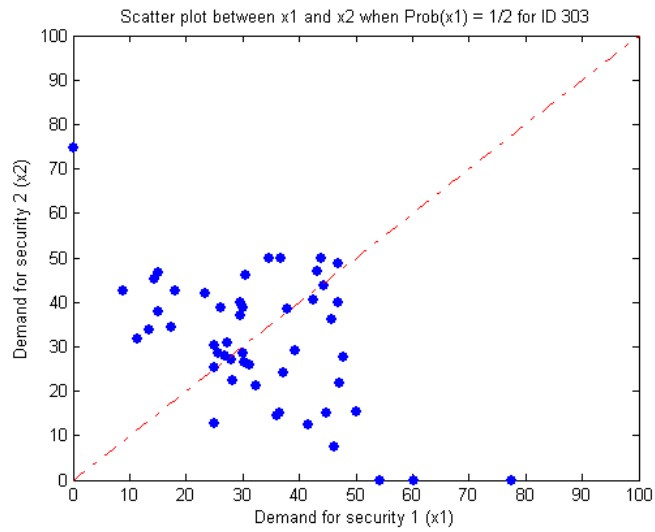
The CentERpanel

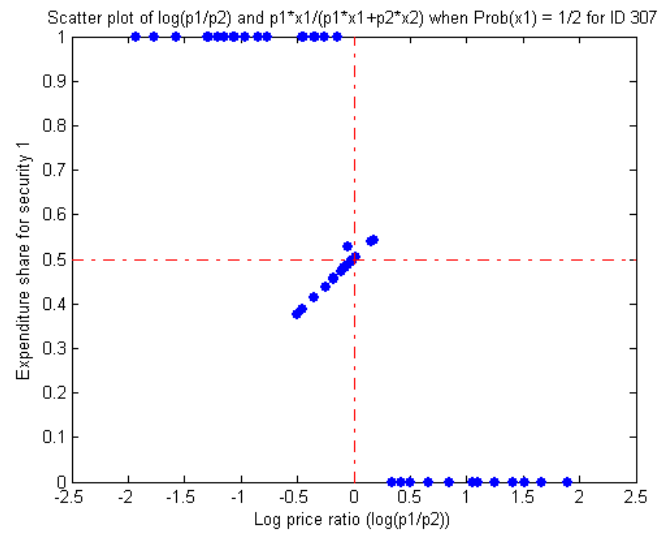
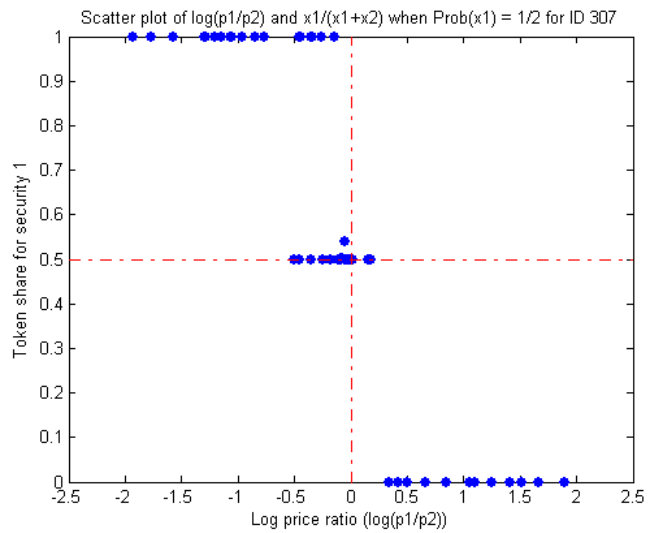
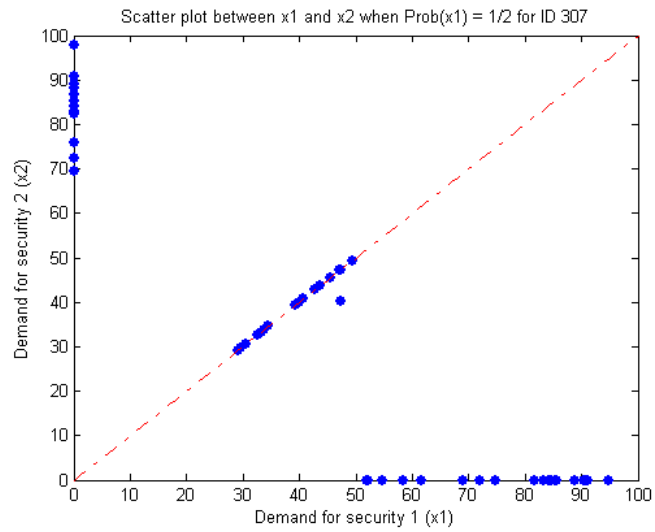
- A representative sample of over 2,000 Dutch-speaking households (5,000 individual members) in the Netherlands.
- A wide range of individual socio-demographic and economic information for the panel members.
- The subjects in the experiment were randomly recruited from the entire CentERpanel body.

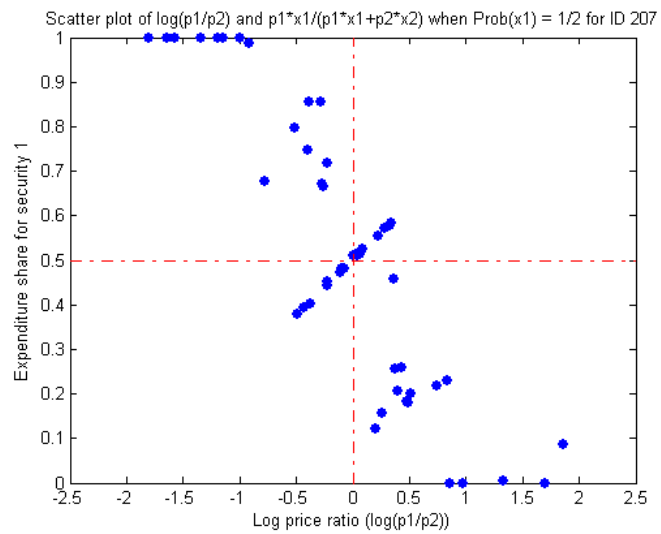
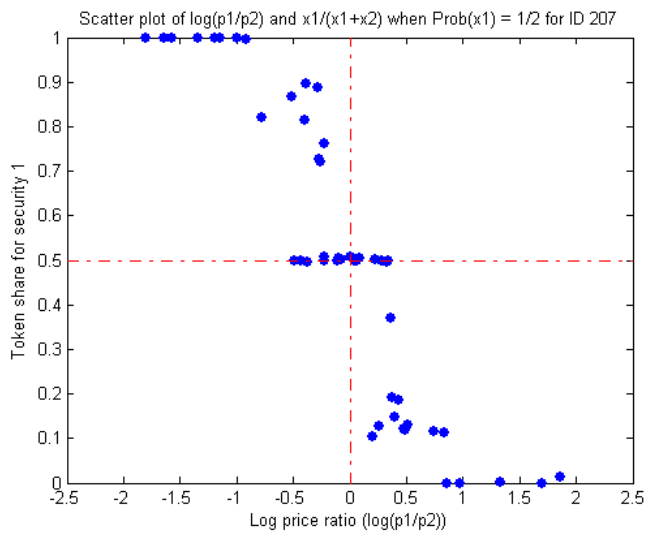
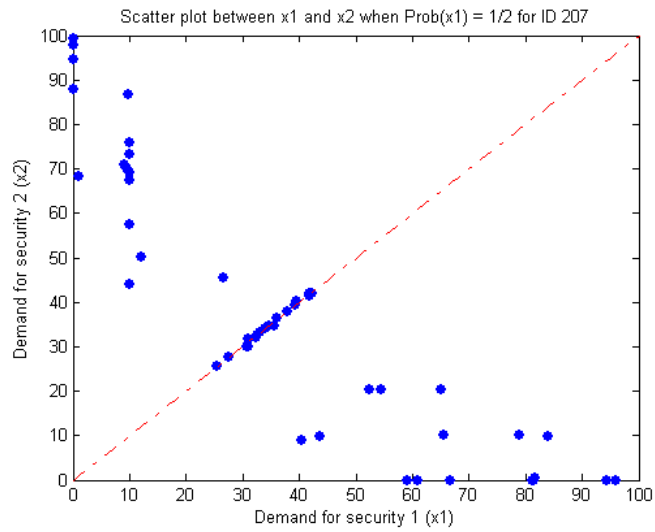
Individual-level data

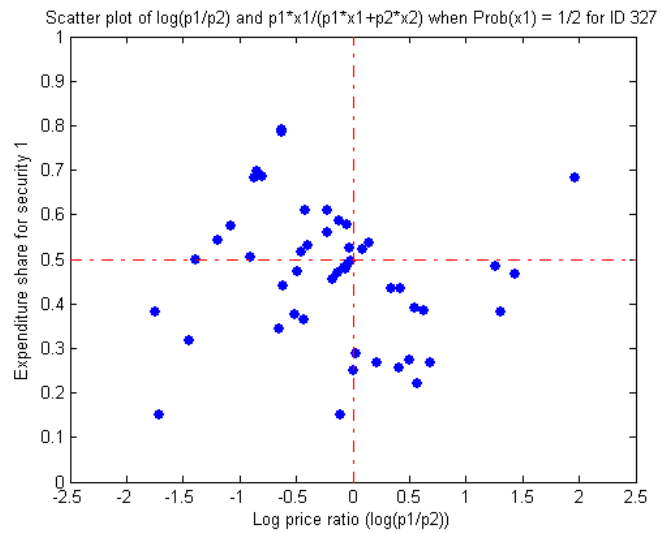
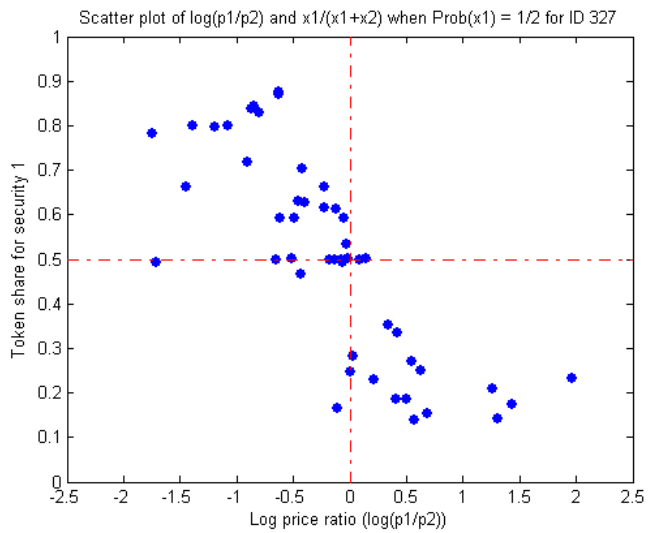
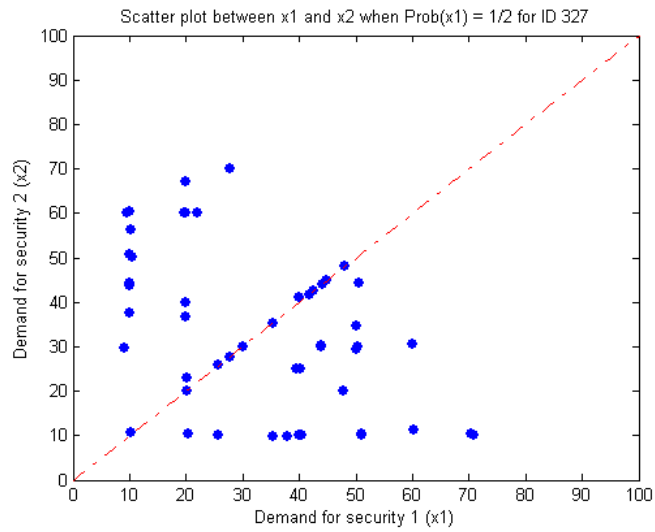


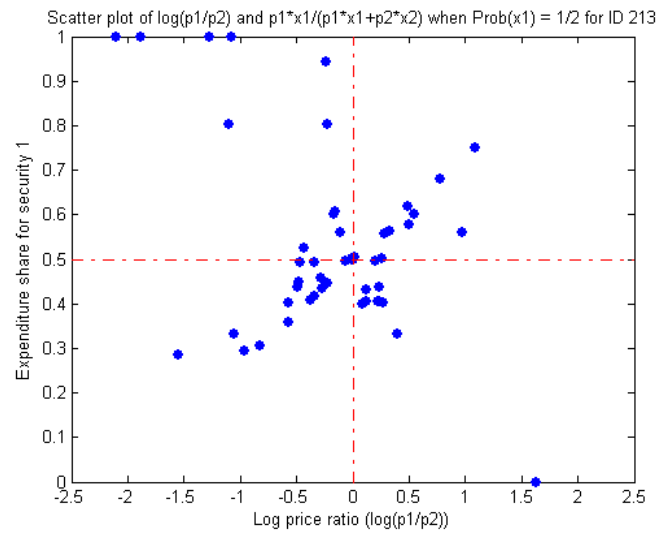
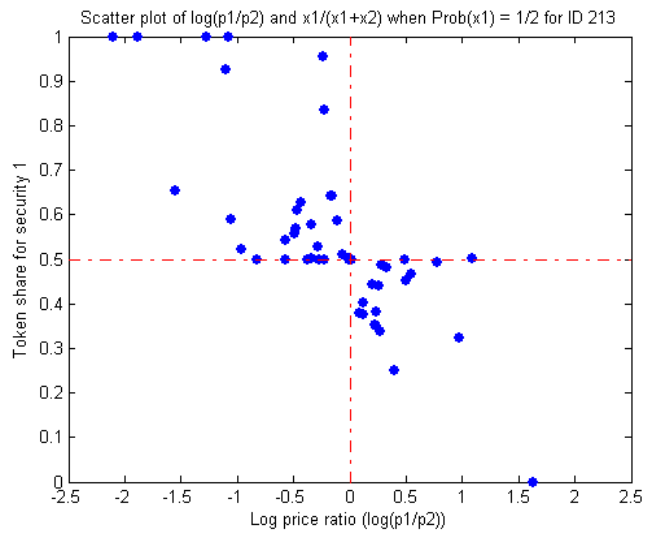
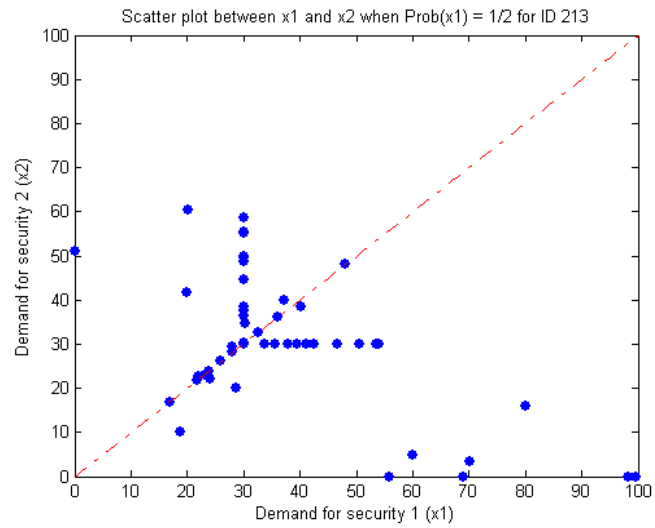








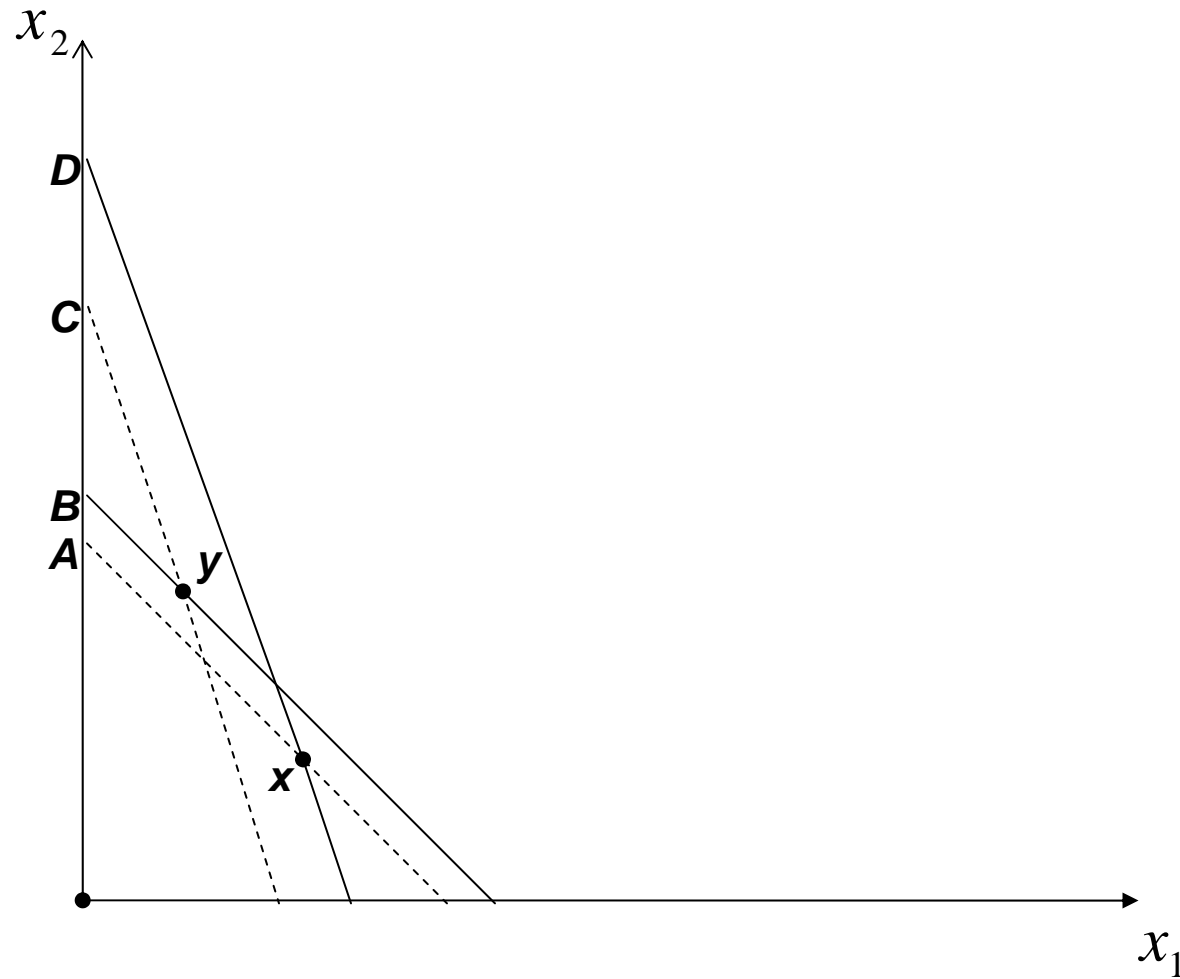




Afriat's critical cost efficiency index (CCEI) *The amount by which each budget constraint must be relaxed in order to remove all violations of GARP.*

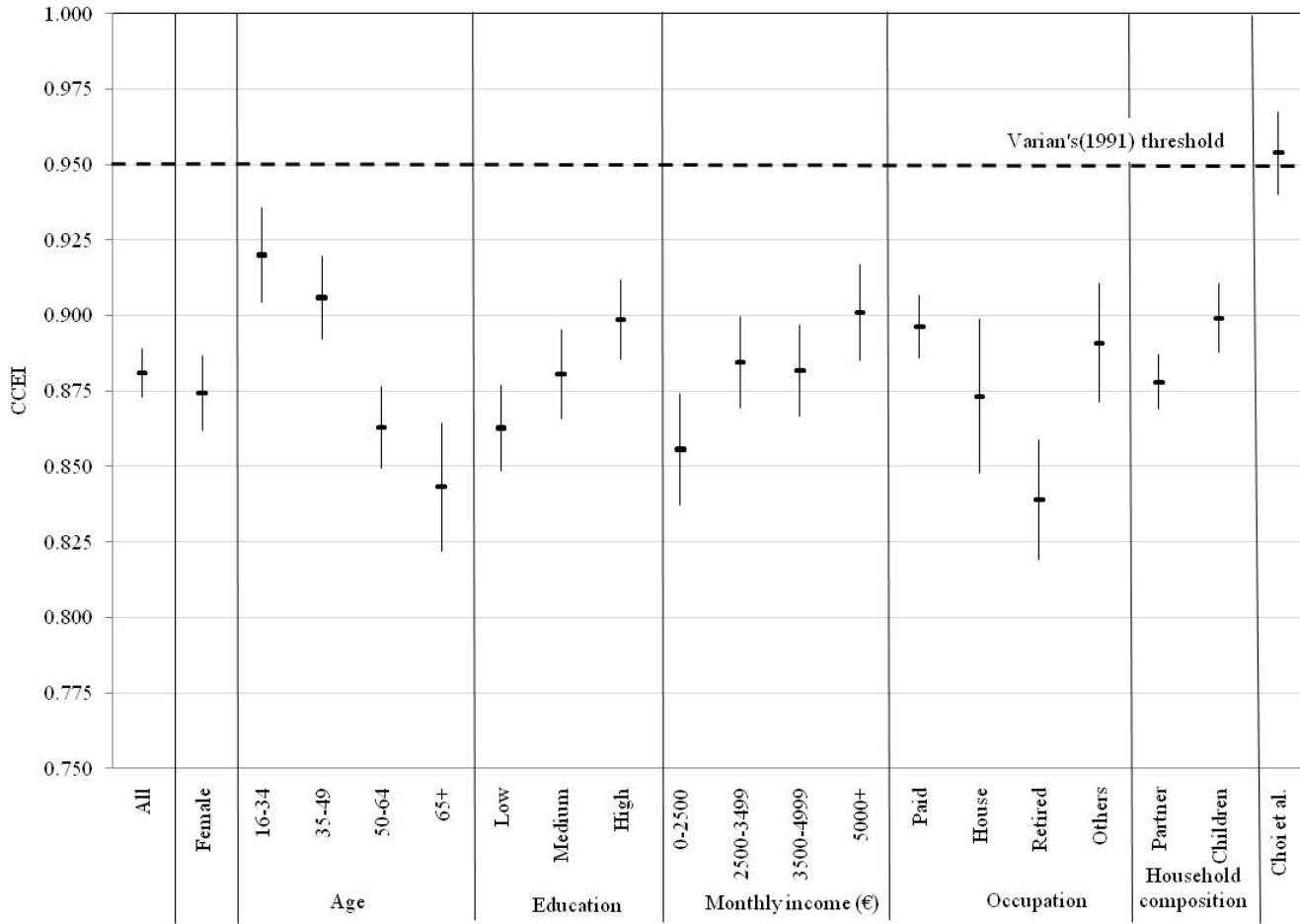
The CCEI is bounded between zero and one. The closer it is to one, the smaller the perturbation required to remove all violations and thus the closer the data are to satisfying GARP.

The construction of the CCEI for a simple violation of GARP

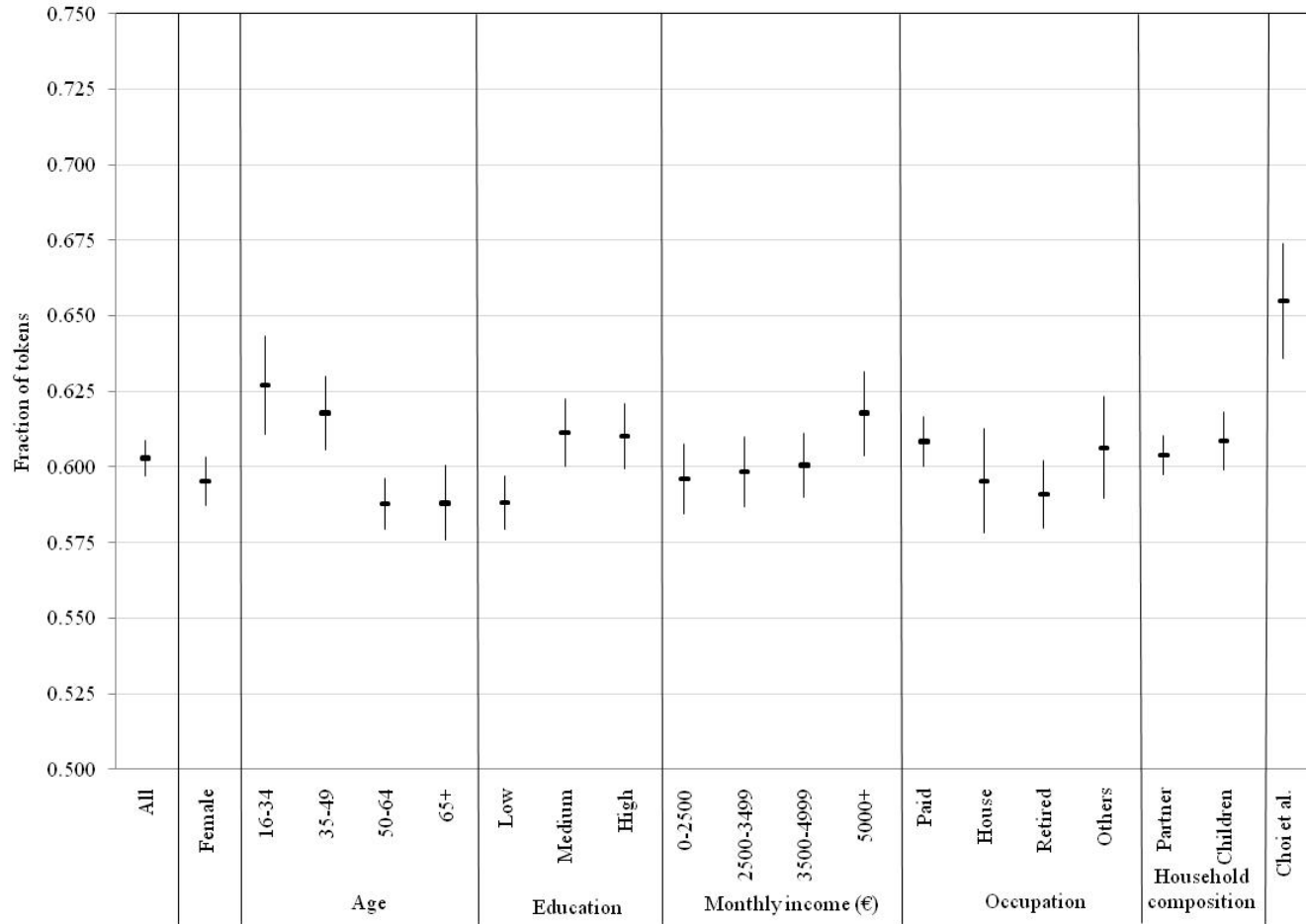


The agent is 'wasting' as much as $A/B < C/D$ of his income by making inefficient choices.

Mean CCEI scores



Risk aversion – the fraction of tokens allocated to the cheaper asset



Wealth differentials

- ⇒ The heterogeneity in wealth is not well-explained either by standard observables (income, education, family structure) or by standard unobservables (intertemporal substitution, risk tolerance).
- ⇒ If consistency with utility maximization in the experiment were a good proxy for (financial) decision-making quality then the degree to which consistency differ across subjects should help explain wealth differentials.

The relationship between CCEI scores and wealth

	(1)	(2)	(3)
CCEI	1.351** (0.566)	1.109** (0.534)	101888.0* (52691.9)
Log 2008 household income	0.584*** (0.132)	0.606*** (0.126)	
2008 household income			1.776*** (0.4)
Female	-0.313* (0.177)	-0.356** (0.164)	-32484.3* (17523.9)
Partnered	0.652*** (0.181)	0.595*** (0.171)	46201.9*** (17173.7)
# of children	0.090 (0.093)	0.109 (0.086)	14078.6* (8351.5)
Age	Y	Y	Y
Education	Y	Y	Y
Occupation	Y	Y	Y
Constant	6.292 (6.419)	0.469 (3.598)	76214.4 (559677.5)
R^2	0.179	0.217	0.188
# of obs.	517	566	568

The robustness of the correlation -- controls for constraints

	(1)	(2)	(3)	(4)	(5)
CCEI	1.322** (0.570)	1.318** (0.574)	1.925*** (0.672)	1.888*** (0.652)	1.441** (0.578)
Log household income					
2008	19.770 (14.629)	1.000 .	0.544*** (0.137)	0.285* (0.165)	0.616*** (0.128)
2008 ²	-2.194 (1.533)				
2008 ³	0.082 (0.053)				
2006				0.232 (0.231)	
2004				0.215 (0.174)	
Female	-0.291 (0.181)	-0.201 (0.173)	-0.337* (0.185)	-0.296 (0.186)	-0.321* (0.176)
Partnered	0.598*** (0.181)	0.561*** (0.178)	0.734*** (0.192)	0.707*** (0.193)	0.641*** (0.179)
# of children	0.091 (0.092)	0.101 (0.096)	0.018 (0.099)	0.031 (0.095)	0.088 (0.093)
Age	Y	Y	Y	Y	Y
Education	Y	Y	Y	Y	N
Occupation	Y	Y	Y	Y	Y
Constant	-47.059 (46.275)	0.864 (6.545)	5.354 (6.93)	3.016 (7.109)	6.398 (6.484)
R^2	0.187		0.205	0.217	0.177
# of obs.	517	517	449	449	517

The robustness of the correlation -- controls for preferences and beliefs

	(1)	(2)	(3)	(4)	(5)
CCEI	1.379** (0.568)	1.396** (0.568)	1.404** (0.569)	1.214* (0.625)	1.237** (0.623)
Risk tolerance					
Quantitative (experiment)	-0.768 (0.714)	-0.808 (0.711)	-0.766 (0.718)		
Qualitative (survey)		0.017 (0.074)	0.023 (0.076)		
Qualitative (survey) missing		-0.190 (0.335)	-0.162 (0.482)		
Conscientiousness			0.089 (0.072)		
Conscientiousness missing			-0.040 (0.668)		
Longevity expectations					-0.034 (0.040)
Log 2008 household income	0.589*** (0.132)	0.578*** (0.131)	0.572*** (0.133)	0.443*** (0.123)	0.434*** (0.123)
Female	-0.316* (0.177)	-0.310* (0.181)	-0.323* (0.181)	-0.415** (0.186)	-0.417** (0.186)
Partnered	0.655*** (0.181)	0.658*** (0.181)	0.642*** (0.182)	0.686*** (0.204)	0.687*** (0.205)
# of children	0.086 (0.093)	0.087 (0.093)	0.083 (0.093)	0.075 (0.102)	0.083 (0.102)
Age	Y	Y	Y	Y	Y
Education	Y	Y	Y	Y	Y
Occupation	Y	Y	Y	Y	Y
Constant	6.840 (6.361)	6.883 (6.357)	6.496 (6.395)	3.777 (15.258)	4.411 (15.256)
R^2	0.179	0.176	0.176	0.163	0.163
# of obs.	517	517	517	414	414

Evaluating alternative measures of *DMQ*

	(1)	(2)	(3)	(4)
CCEI	1.253* (0.712)	1.401* (0.729)	1.269* (0.729)	1.177** (0.583)
CCEI (combined dataset)	0.099 -0.38			
von Gaudecker et al. (2011)			0.927* (0.485)	
Cognitive Reflection Test (CRT)				0.120* (0.071)
CRT missing				-0.203 (0.237)
Log 2008 household income	0.586*** (0.132)	0.388* (0.155)	0.383* (0.154)	0.577*** (0.132)
Female	-0.314* (0.177)	-0.218 (0.212)	-0.207 (0.211)	-0.292* (0.176)
Partnered	0.653*** (0.181)	0.907*** (0.230)	0.926*** (0.228)	0.690*** (0.181)
# of children	0.089 (0.093)	0.105 (0.114)	0.096 (0.113)	0.091 (0.092)
Age	Y	Y	Y	Y
Education	Y	Y	Y	Y
Occupation	Y	Y	Y	Y
Constant	6.237 (6.424)	10.056 (6.976)	8.355 (6.990)	6.855 (6.464)
R^2	0.177	0.225	0.232	0.181
# of obs.	517	326	326	517

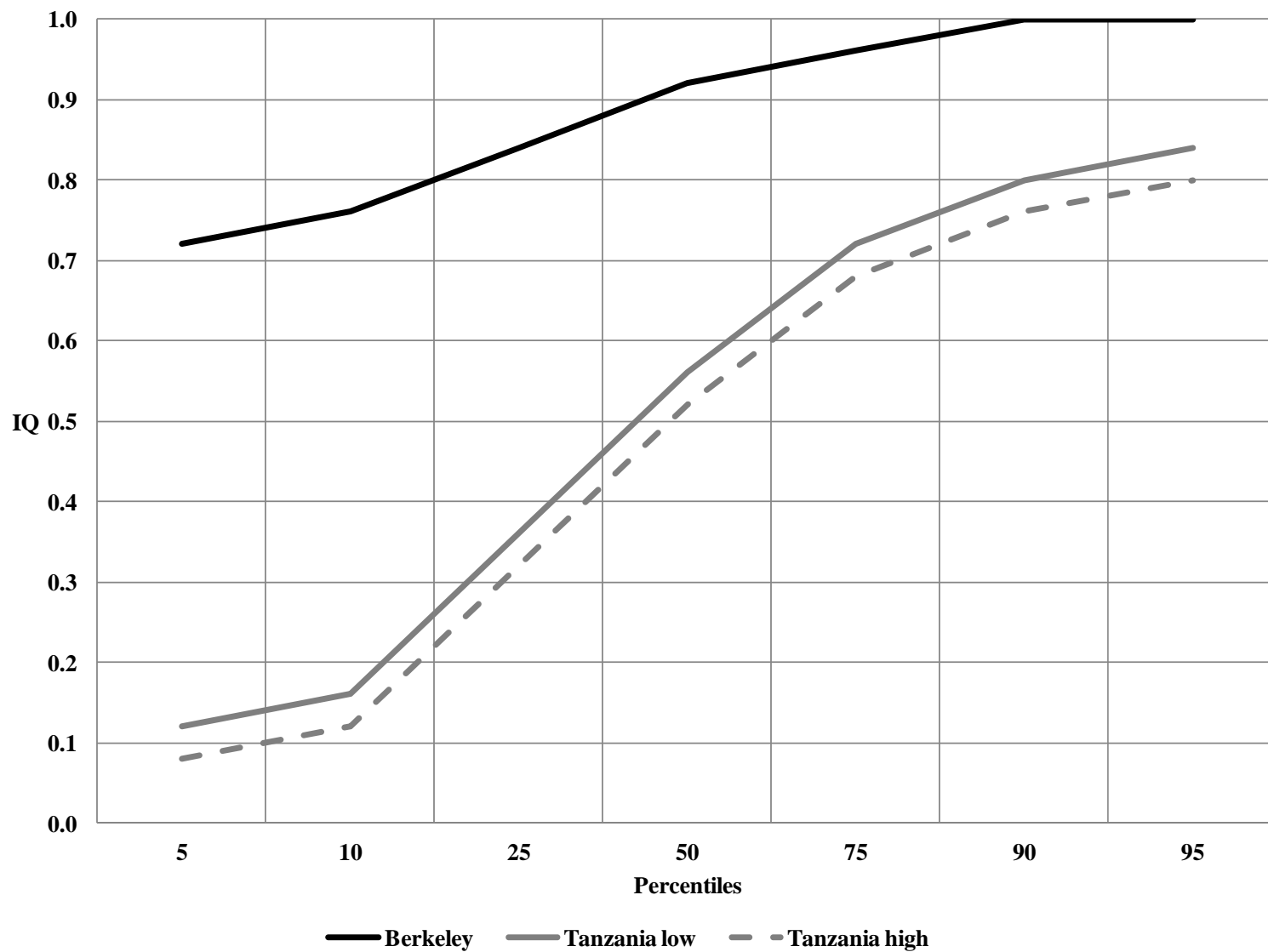
The sources of the relationship

	(1)	(2)	(3)	(4)
	Have checking	Fraction in checking	Have saving	Fraction in saving
CCEI	0.03 (0.032)	-0.098* (0.057)	-0.047 (0.053)	-0.162* (0.097)
Log 2008 household income	0.001 (0.002)	-0.029** (0.013)	0.003 (0.010)	-0.068*** (0.021)
Female	0.007 (0.005)	0.023 (0.020)	0.014 (0.019)	0.038 (0.033)
Partnered	-0.005 (0.004)	-0.031 (0.020)	0.017 (0.022)	-0.054 (0.033)
# of children	0.000 (0.001)	-0.004 (0.010)	-0.025* (0.014)	-0.043*** (0.013)
Age	Y	Y	Y	Y
Education	Y	Y	Y	Y
Occupation	Y	Y	Y	Y
Constant	0.998*** (0.172)	0.106 (0.822)	1.126 (0.848)	1.448 (1.288)
R^2	-0.007	0.021	-0.011	0.083
# of obs.	512	512	502	502

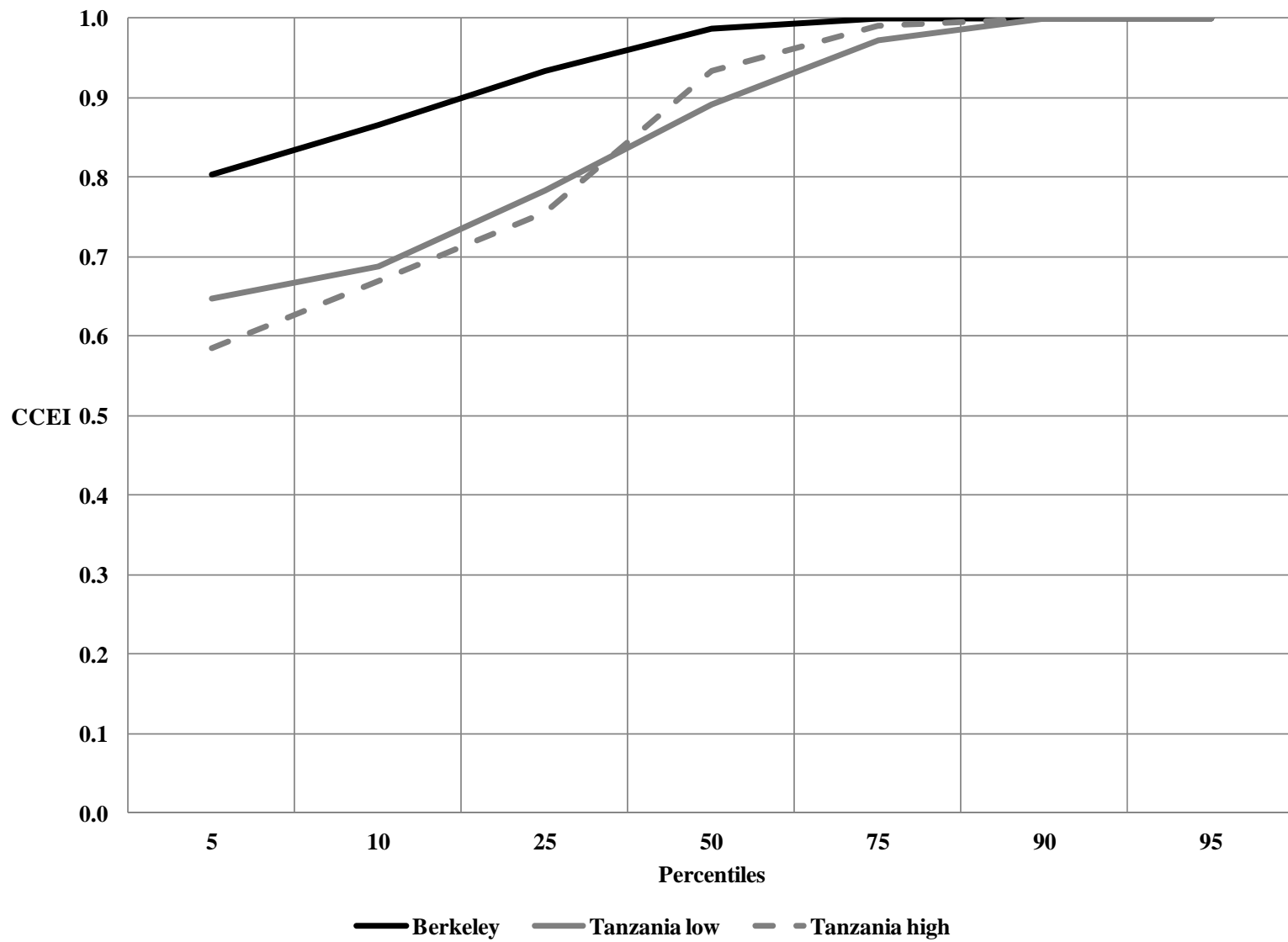
The sources of the relationship (cont.)

	(5)	(6)	(7)	(8)
	Have stocks	Fraction in stocks	Have a house	Fraction in house
CCEI	0.167 (0.163)	0.001 (0.050)	0.352** (0.152)	0.324** (0.129)
Log 2008 household income	0.148*** (0.031)	0.013 (0.009)	0.134*** (0.029)	0.096*** (0.024)
Female	0.007 (0.050)	0.009 (0.013)	-0.038 (0.050)	-0.066 (0.043)
Partnered	0.005 (0.049)	-0.007 (0.014)	0.207*** (0.051)	0.127*** (0.044)
# of children	0.003 (0.026)	0.000 (0.007)	0.048** (0.020)	0.063*** (0.019)
Age	Y	Y	Y	Y
Education	Y	Y	Y	Y
Occupation	Y	Y	Y	Y
Constant	-3.152* (1.856)	-0.317 (0.398)	-1.047 (1.760)	-1.151 (1.419)
R^2	0.079	0.002	0.148	0.123
# of obs.	514	514	479	479

Is there a development gap in rationality (IQ)?



Is there a development gap in rationality (CCEI)?



Social (distributional) preferences

Distributional preferences

- Distributional preferences shape individual opinions on a range of issues related to the redistribution of income.
- Examples include government-sponsored healthcare, social security, unemployment benefits, and more.
- These issues are complex and contentious in part because people promote their competing private interests.
- But people also often disagree about what constitutes a just or equitable outcome.

Fair-mindedness and equality versus efficiency

Distributional preferences may naturally be divided into two qualitatively different components:

- The weight on own income versus the incomes of others (fair-mindedness)
- The weight on reducing differences in incomes versus increasing total income (equality-efficiency tradeoffs).

Fair-minded people may disagree about the extent to which efficiency should be sacrificed to combat inequality, as a comparison of Harsanyi (1955) and Rawls (1971) would suggest.

For example:

- We typically associate the Democratic party with the promotion of policies which reduce inequality, and the Republican party with the promotion of efficiency.
- However, whether Democratic voters are more willing to sacrifice efficiency, and even their own income, to reduce inequality is an open question.

Distinguish fair-mindedness from preferences regarding equality-efficiency tradeoffs and accurately measuring both in a large and diverse sample of American voters.

Template for analysis

- [1] A generalized dictator game where each subject faces a menu of budget sets representing the feasible monetary payoffs.
- [2] An incentivized experiment using the American Life Panel (ALP), a longitudinal survey administered online by the RAND Corporation.
- [3] Combine data from the experiments with detailed individual demographic and economic information on panel members.

A choice of the allocation (π_s, π_o) from the budget set $p_s\pi_s + p_o\pi_o = 1$ represents the payoffs to persons *self* and *other*, respectively.

The budget line configuration allows to identify the equality-efficiency tradeoffs that subjects make in their distributional preferences:

- *decreasing* $p_s\pi_s$ when p_s/p_o *increases* indicates preferences weighted towards efficiency (increasing total payoffs)
- *increasing* $p_s\pi_s$ when p_s/p_o *increases* indicates preferences weighted towards equality (reducing differences in payoffs).

A more standard model of distributional preferences

We decompose distributional preferences into fair-mindedness and equality-efficiency tradeoffs by employing constant elasticity of substitution (CES) utility functions.

The CES form is commonly employed in demand analysis. In the redistribution context, the CES has the form

$$u_s(\pi_s, \pi_o) = [\alpha(\pi_s)^\rho + (1 - \alpha)(\pi_o)^\rho]^{1/\rho}$$

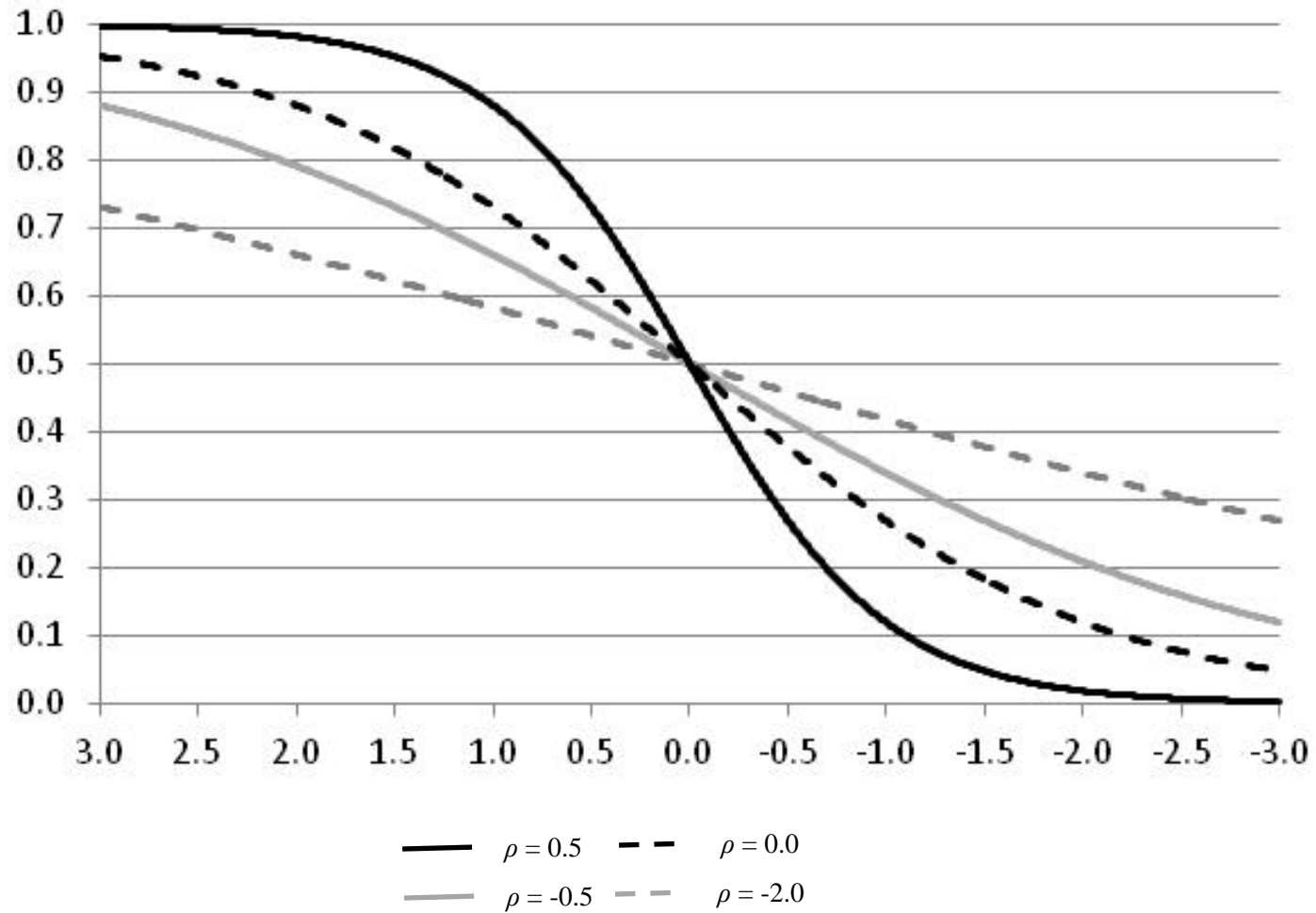
where α measures the indexical weight on payoffs to *self*, whereas ρ measures the willingness to trade off equality and efficiency.

If $\rho > 0$ ($\rho < 0$) a decrease in the relative price giving p_s/p_o lowers (raises) the expenditure on tokens allocated to *self* $p_s\pi_s$:

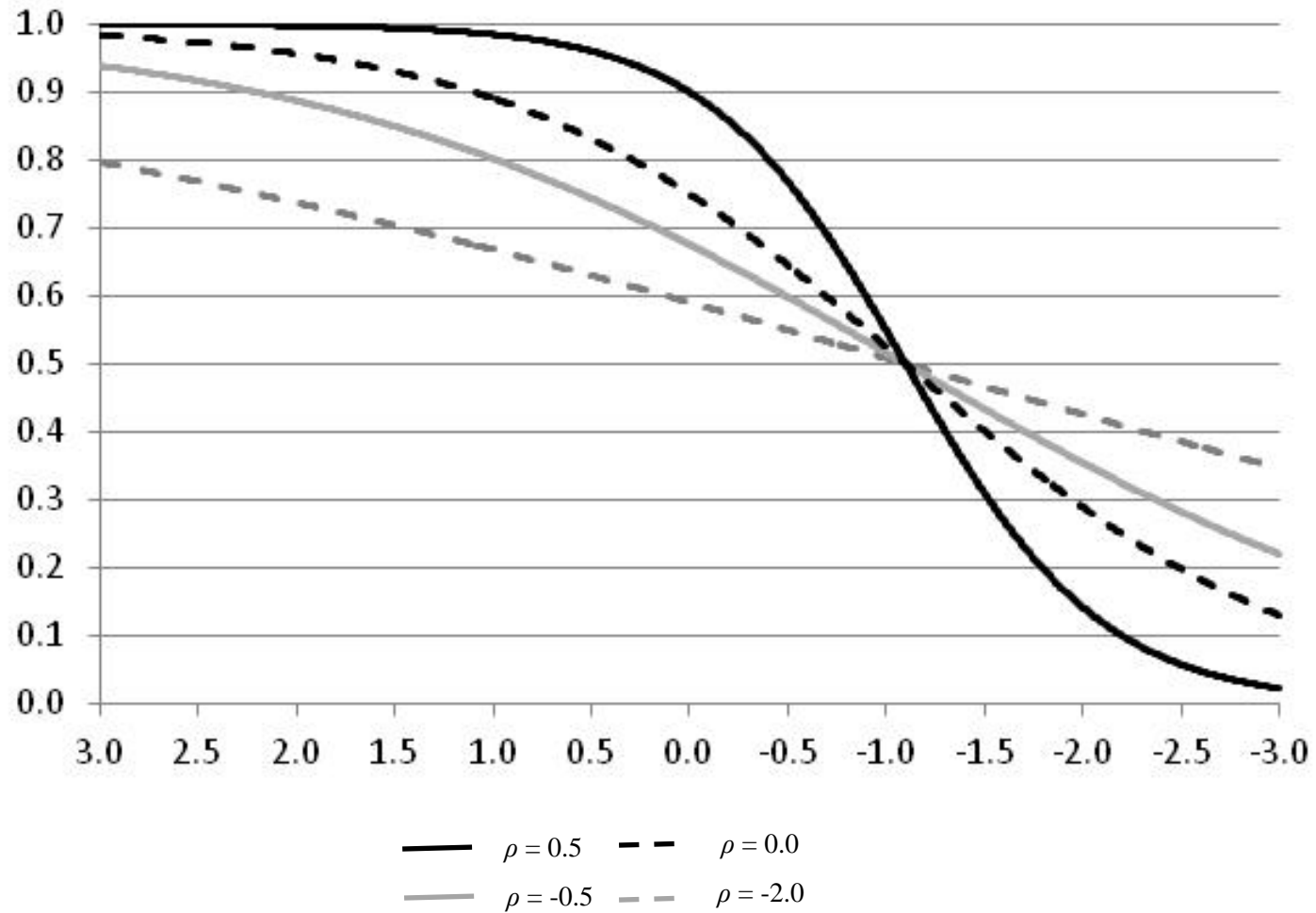
- $\rho > 0$ indicates preferences weighted towards increasing total payoffs.
- $\rho < 0$ indicates preferences weighted towards reducing differences in payoffs.

Our experimental method generates many observations per subject, and we can therefore analyze both types of distributional preferences at the individual level.

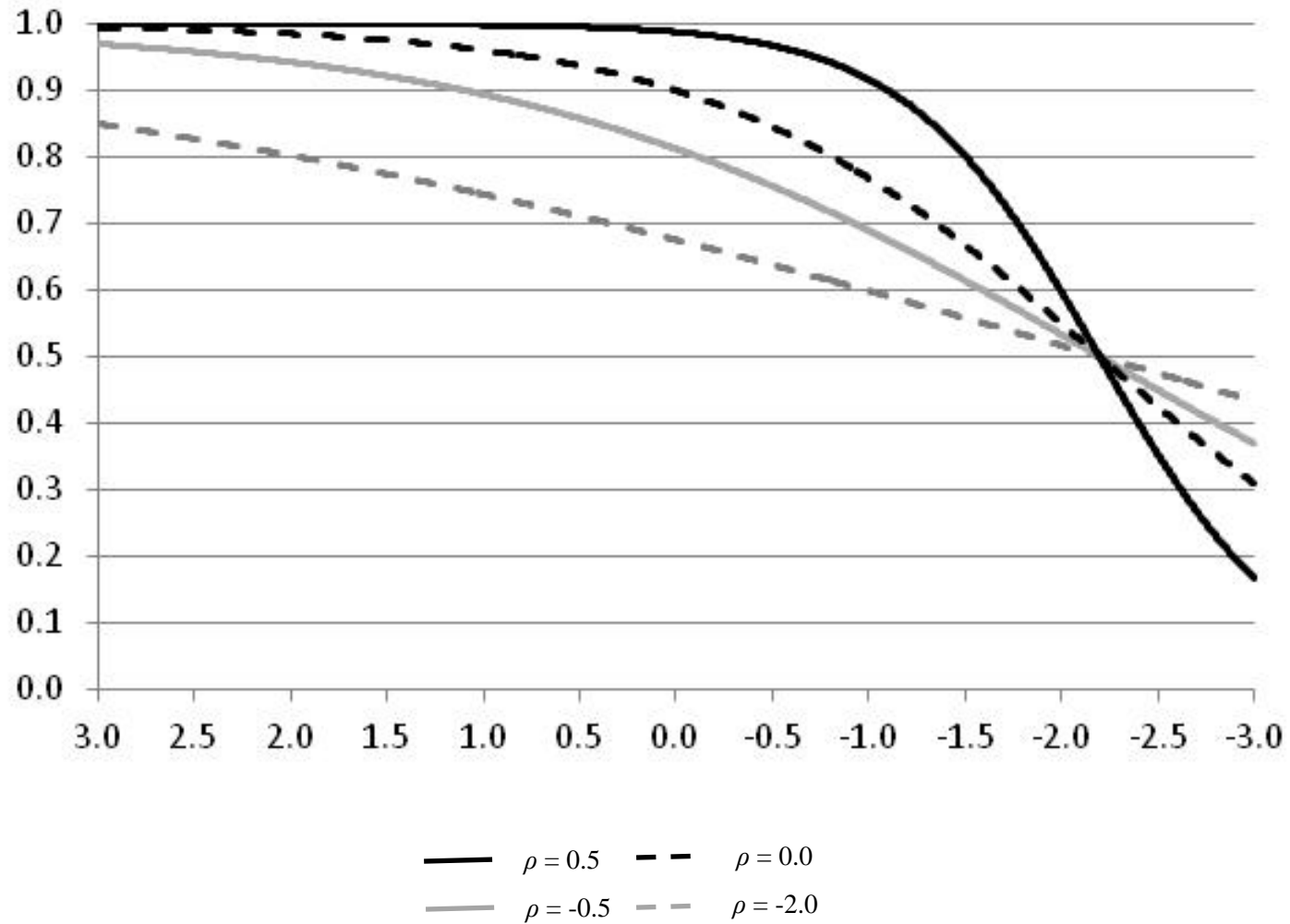
The relationship between the log-price ratio and optimal token share ($\alpha=0.5$ and different values of ρ)



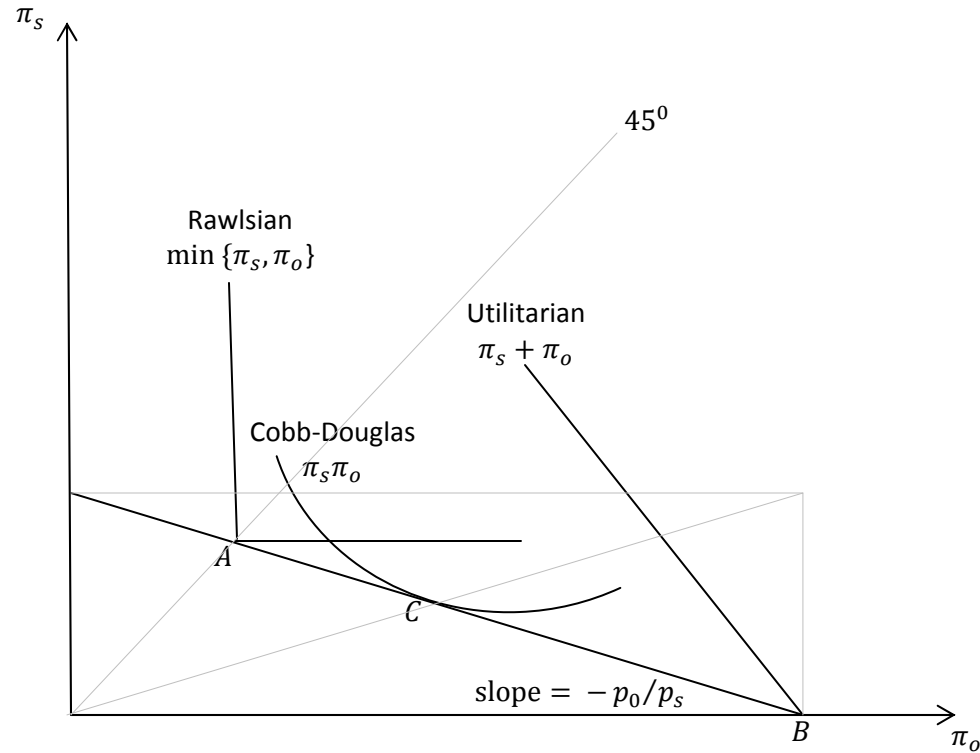
The relationship between the log-price ratio and optimal token share ($\alpha=0.75$ and different values of ρ)



The relationship between the log-price ratio and optimal token share ($\alpha=0.9$ and different values of ρ)



Prototypical fair-minded distributional preferences



The CCEI scores in the ALP sample averaged 0.862 over all subjects, but there is marked heterogeneity in the CCEI scores within and across the demographic and economic groups:

- Subjects without college degrees waste 2.6 percentage points more of their earnings by making inconsistent choices relative to college graduates.
- Men are more consistent than women, and the choices of white and Hispanic subjects are more consistent than those of African Americans.

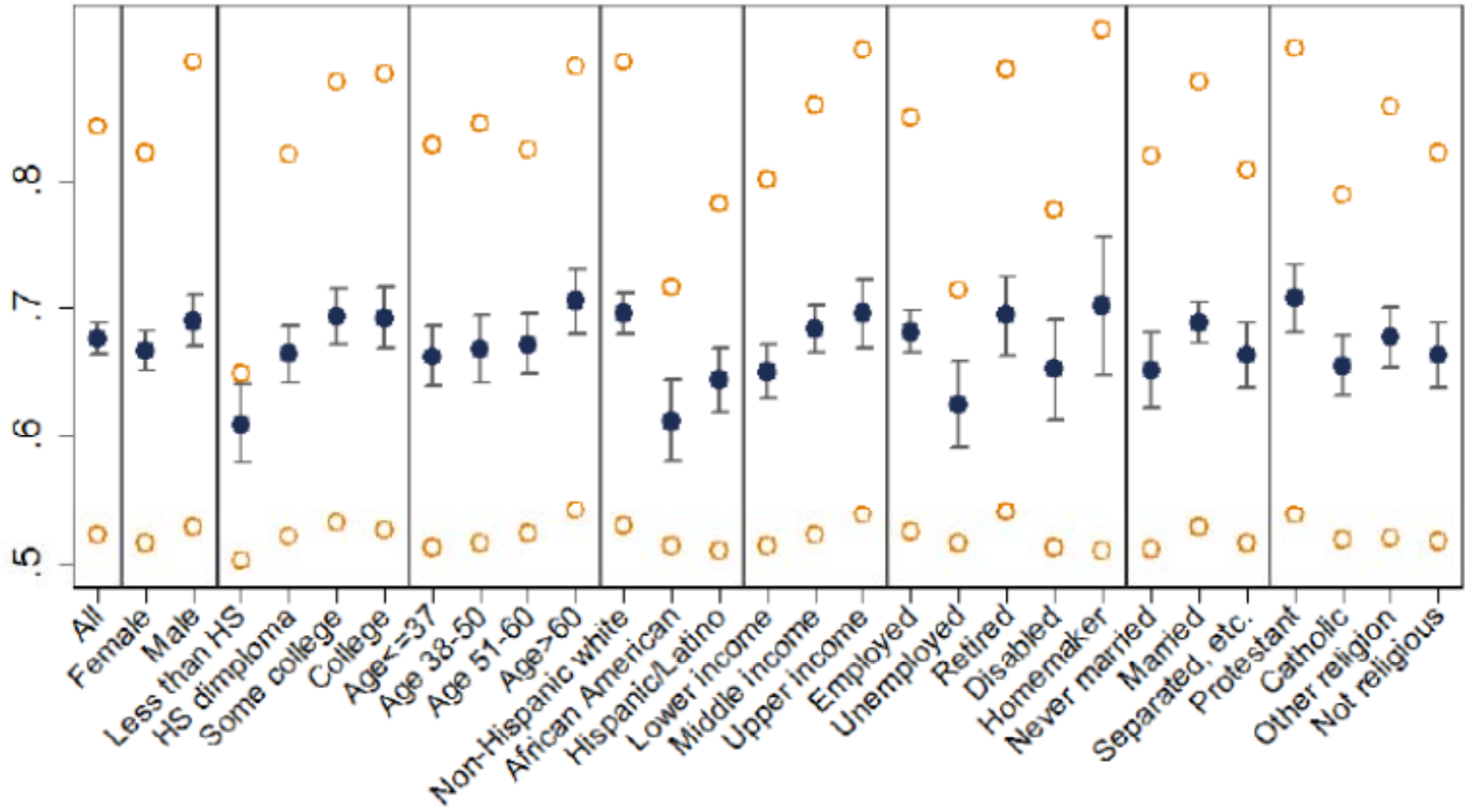
While observable attributes have predictive power in the data, marked heterogeneity remains within each demographic and economic group.

Distributional preference types

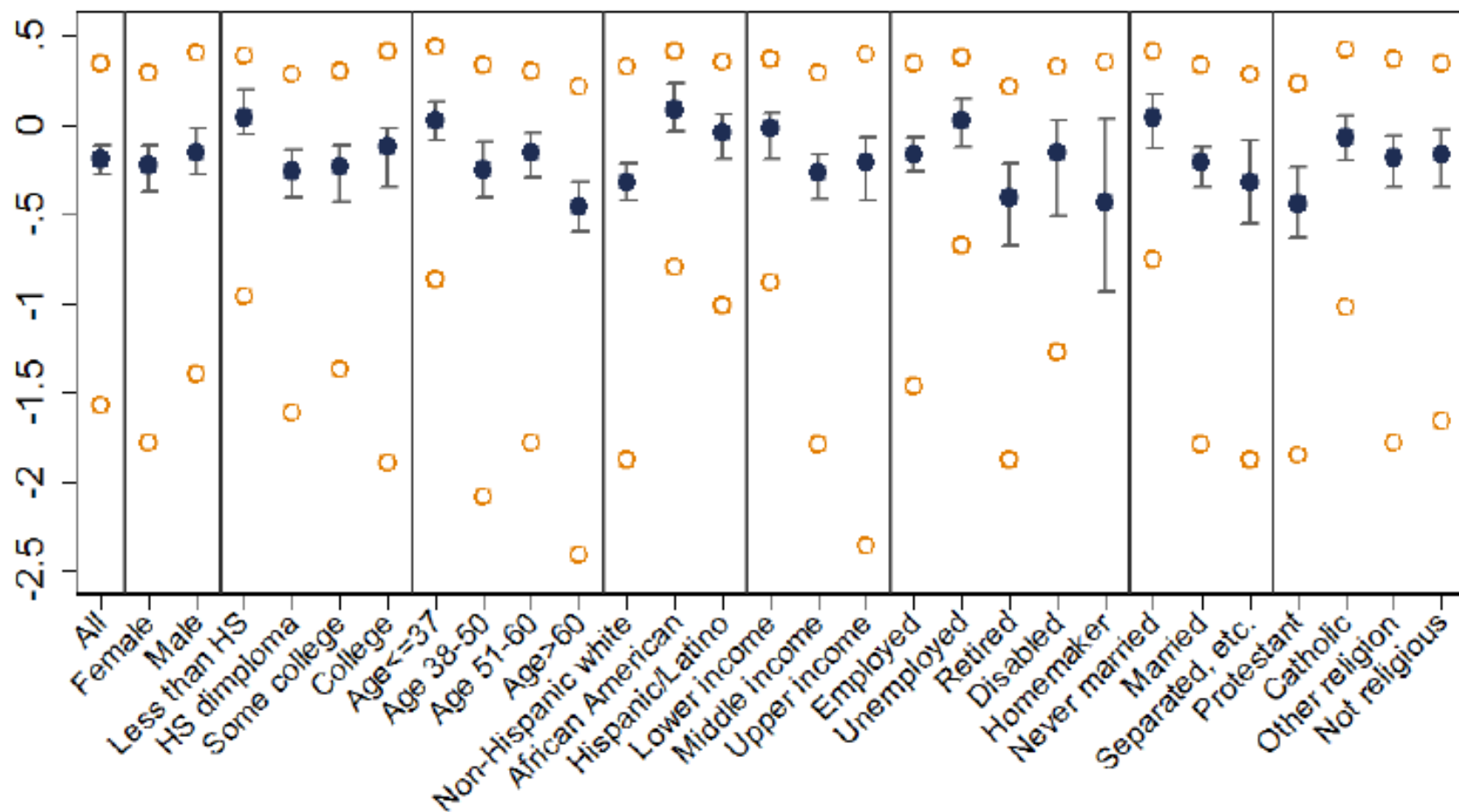
	FAIR-MINDED	INTERMEDIATE	SELFISH	ALL SUBJECTS
EQUALITY-FOCUSED	6.3	14.6	3.6	24.5
INTERMEDIATE	14.7	24.5	8.0	47.1
EFFICIENCY-FOCUSED	12.0	13.0	3.5	28.4
ALL SUBJECTS	32.9	52.0	15.1	100.0

The numbers indicate the percentage of subjects in each cell. We classify a subject as fair-minded if we cannot reject the null hypothesis that $\hat{\alpha}_n = 1/2$; similarly, a subject is classified as selfish if we cannot reject the null that $\hat{\alpha}_n = 1$ (both tests are at the 10 percent level, though the test for selfishness is one-sided since $\hat{\alpha}_n = 1$ at the boundary of the parameter space). One subject who had many revealed preference violations is classified as both fair-minded and selfish, and is therefore included in the intermediate category. We classify a subject as equality-focused or efficiency-focused if we can reject the hypothesis that $\hat{\rho}_n = 0$ at the 10 percent level using a one-sided test. When we can reject the null in favor of the alternative hypothesis that $\hat{\rho}_n$ is less (greater) than 0, we classify a subject as being focused on equality (efficiency).

The mean estimated fair-mindedness by sub-group



The median estimated equality-efficiency tradeoff by sub-group



Distributional preferences and voting behavior

- It is natural to examine the empirical relationship between distributional preferences and subjects' political decisions.
- Whether efficiency-focused distributional preferences are associated with political support for government redistribution is an open question.
- Democrats are not more averse to inequality than Republicans – they instead look more favorably on government intervention in general.
- We explore the link between equality-efficiency tradeoffs and political behavior by looking at voting decisions in the 2012 presidential election.

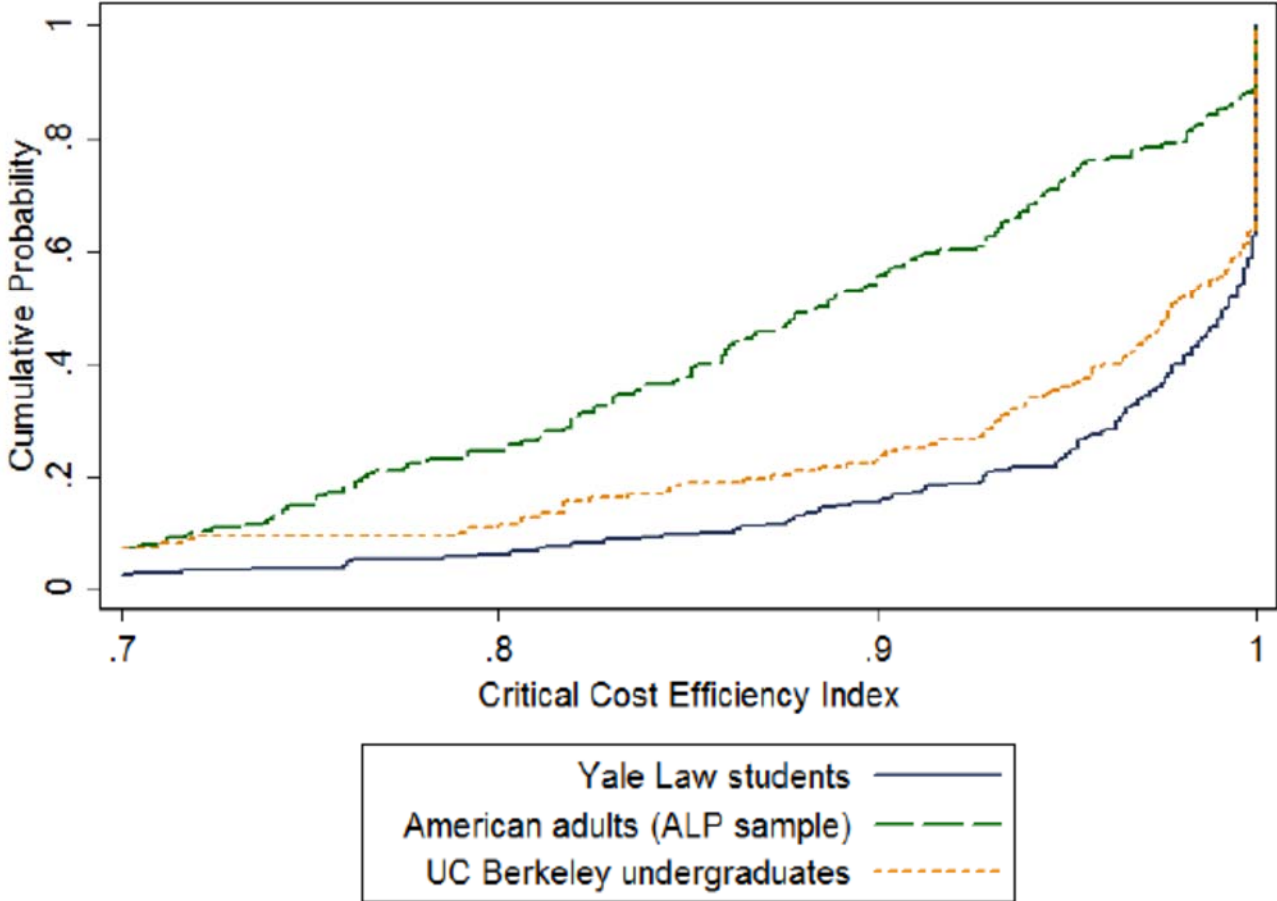
The distributional preferences of an elite

Elite law students hold especial interest because they assume positions of substantial power in national and indeed global social, economic and political affairs:

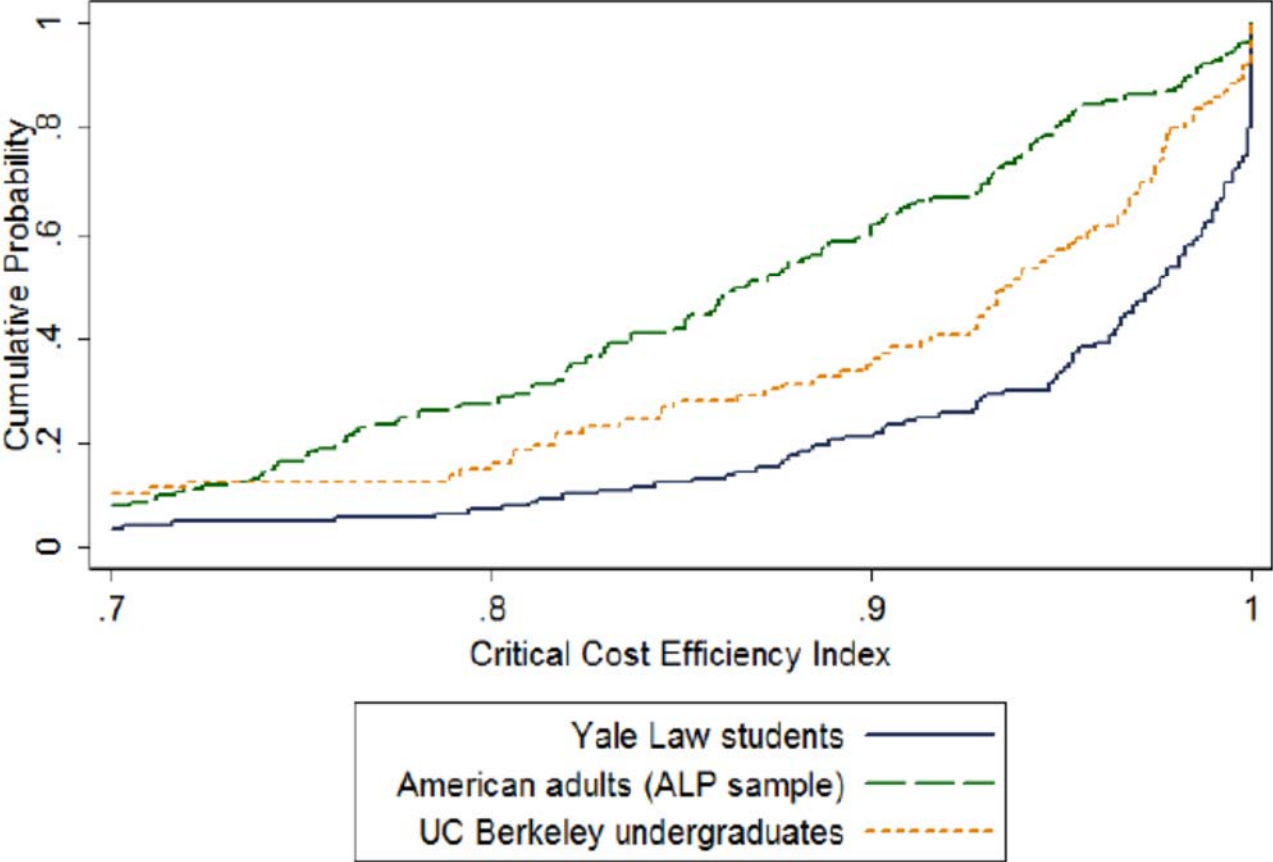
- All nine sitting Supreme Court Justices and two of the past three Presidents (as well as a frontrunner to become the next President) are graduates of either Yale or Harvard Law Schools.
- Over the past century more than half of the presidents attended Yale, Harvard or Princeton, and the last four are graduates of Yale or Harvard.

The distributional preferences of YLS students will likely exercise a major influence over public and private orderings in the United States.

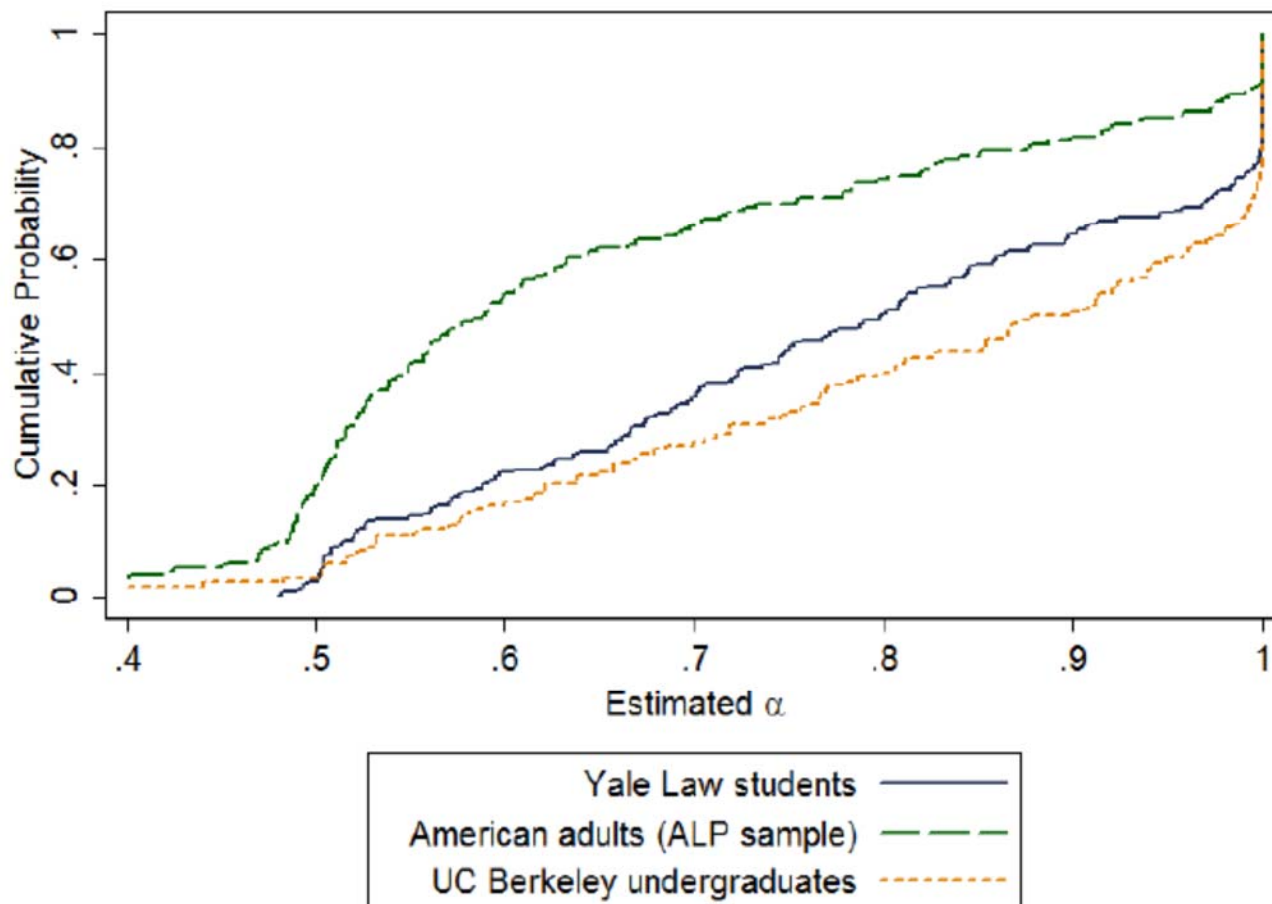
The distributions of the CCEIs – all subjects



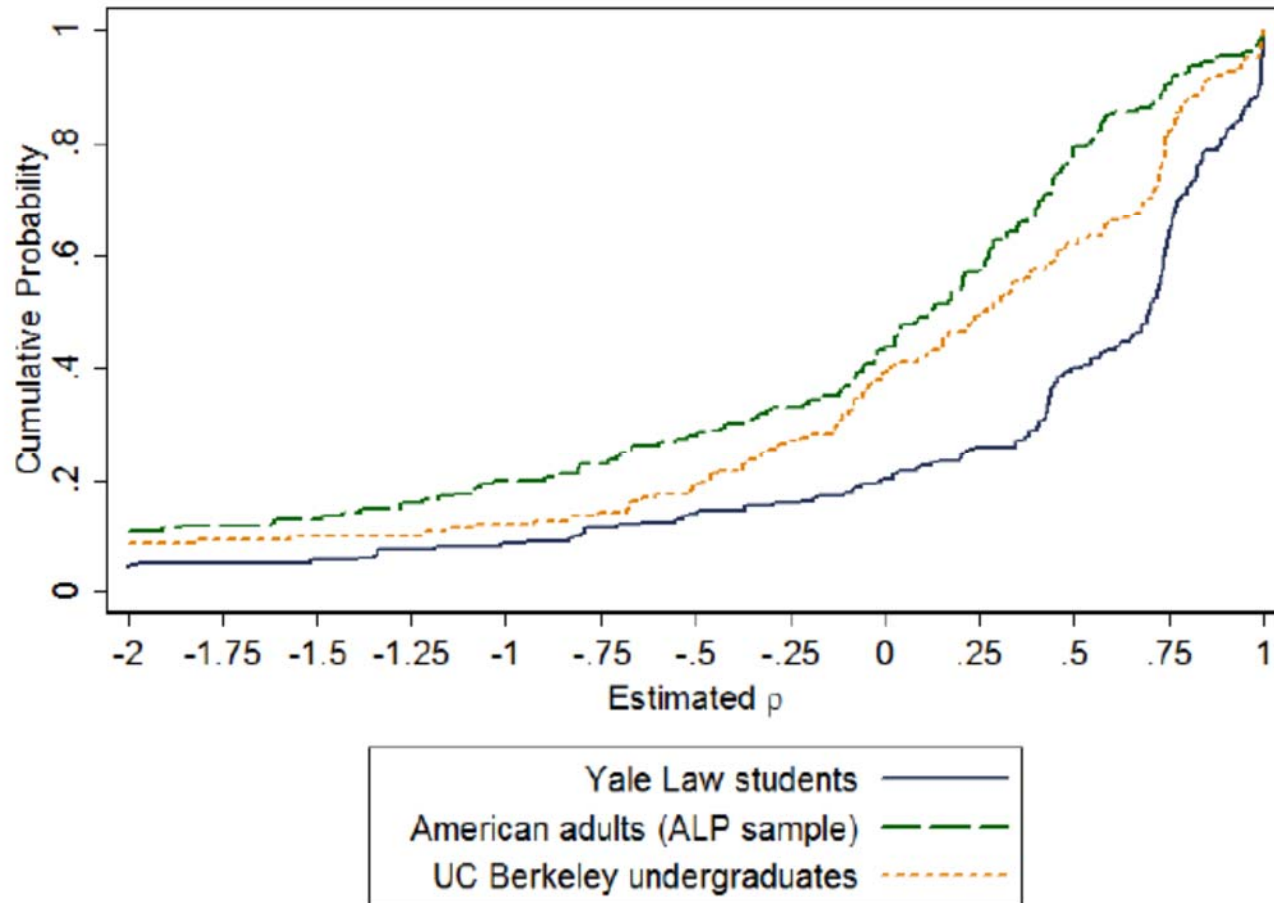
The distributions of the CCEIs – non-selfish subjects



The distributions of the individual-level α estimates



The distributions of the individual-level ρ estimates



- YLS subjects show markedly higher consistency than ALP subjects and, to a lesser extent, also relative to UCB subjects, and the vast majority make decisions that are perfectly consistent.
- YLS subjects are substantially less fair-minded than the ALP subjects, but display similar levels of fair-mindedness relative to the UCB subjects.
- YLS subjects are far more inclined to favor efficiency over equality relative to both the ALP and UCB subject pools, (although self-identified as much more supportive of the Democratic Party than the general population).

How did the Great Recession impact distributional preferences?

We assess the relationship between exposure to different economic conditions and redistributive decisions:

- Boom → money drops from the sky → who will get the lion's share of the gains.
- Recession → losses relative to past levels → who is going to take the biggest cut.

How distributional preferences are affected by the 'loss' frame of recession versus the 'gain' frame of an economic boom?

Identification concerns

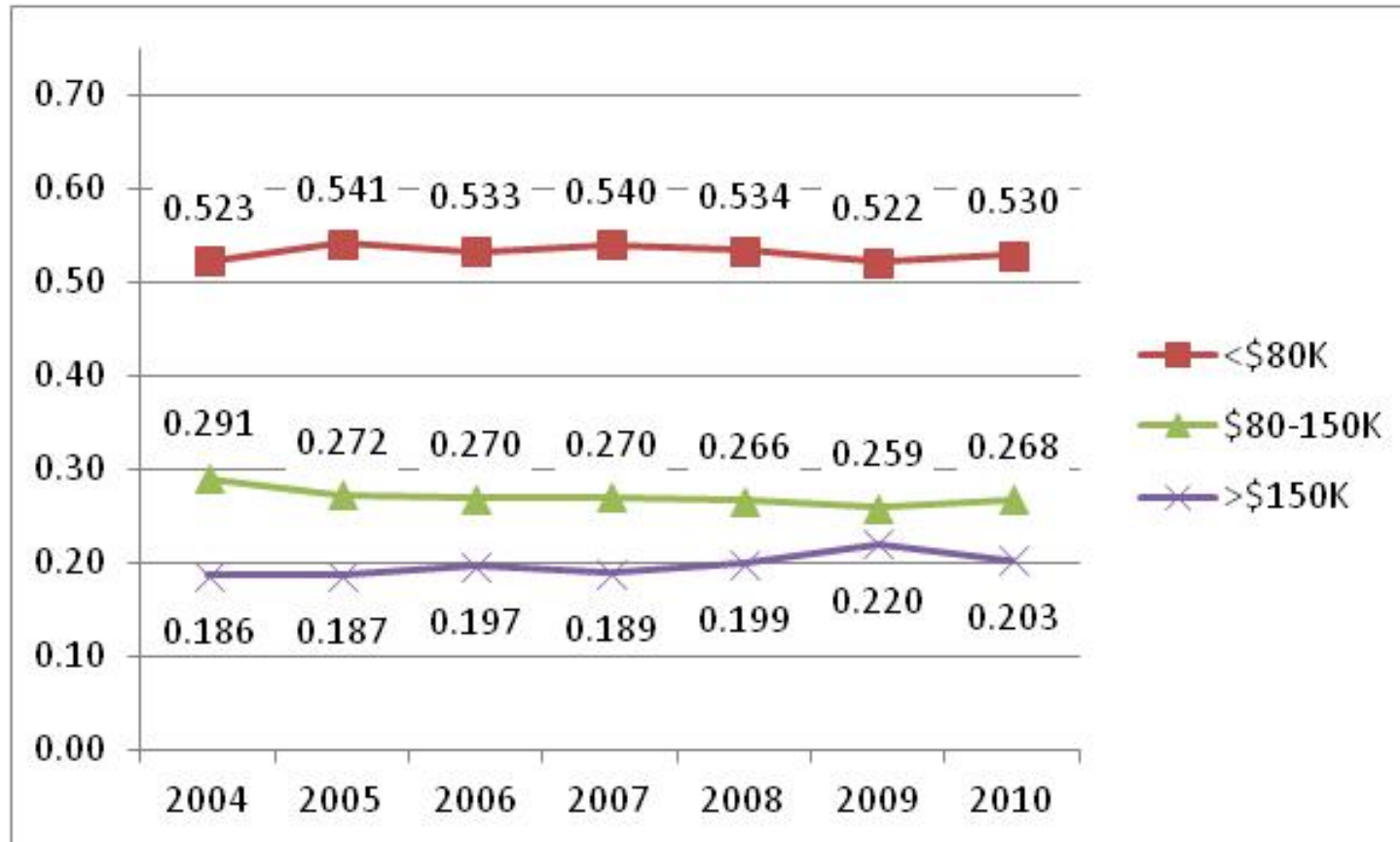
- [1] Exogenous variation in exposure to economic contraction is rare and limited in scope, and we cannot conduct experiments on the US economy.
- [2] Many other societal shifts may be coincident with macroeconomic changes, making it difficult to disentangle the effects of different factors.
- [3] Differential selection across economic conditions, or factors other than the recession, may be driving results.

There are three elements to our approach that, we argue, allow us to credibly relate macroeconomic conditions to individual behavior:

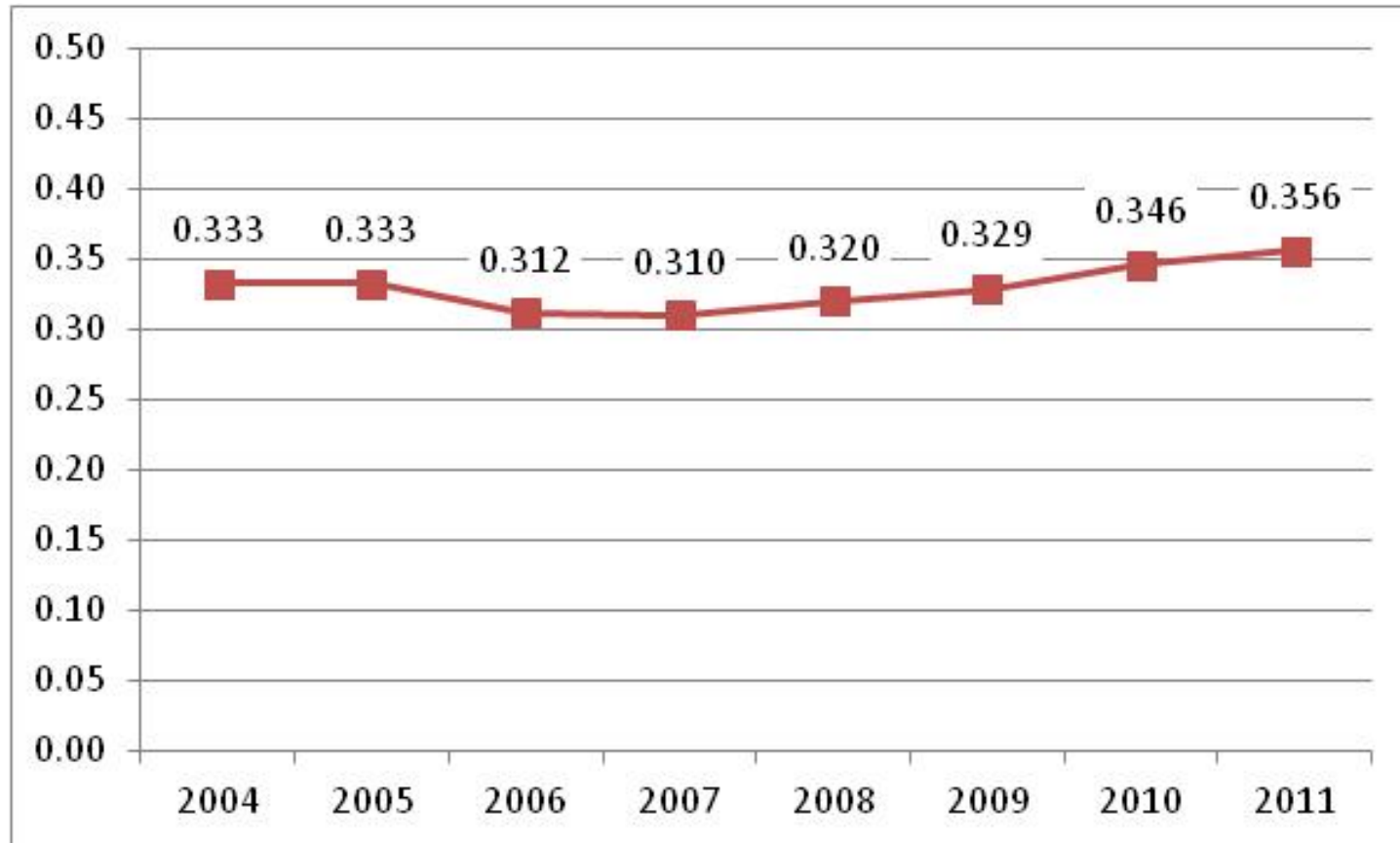
- A subject pool that is drawn primarily from a large and diverse student body, the socioeconomic composition of which is held relatively constant by the admissions office.
- Combine student admissions and financial aid data with a broad range of survey responses about the experience of students and postgraduate activities.
- Simulate recessionary conditions in the laboratory and compare the impact of the experimental treatment is to that of the real-world recession.

- [1] Students faced higher student-loan debts and weakened job prospects during and after the recession than in the preceding years.
- [2] The makeup of the student body, students' overall social and academic experiences, opinions about student life, and perceptions of campus climate fluctuated very little.
- [3] Both real-world and lab-simulated recessionary conditions are associated with comparable shifts, though the impact of the experimental treatment is relatively modest.

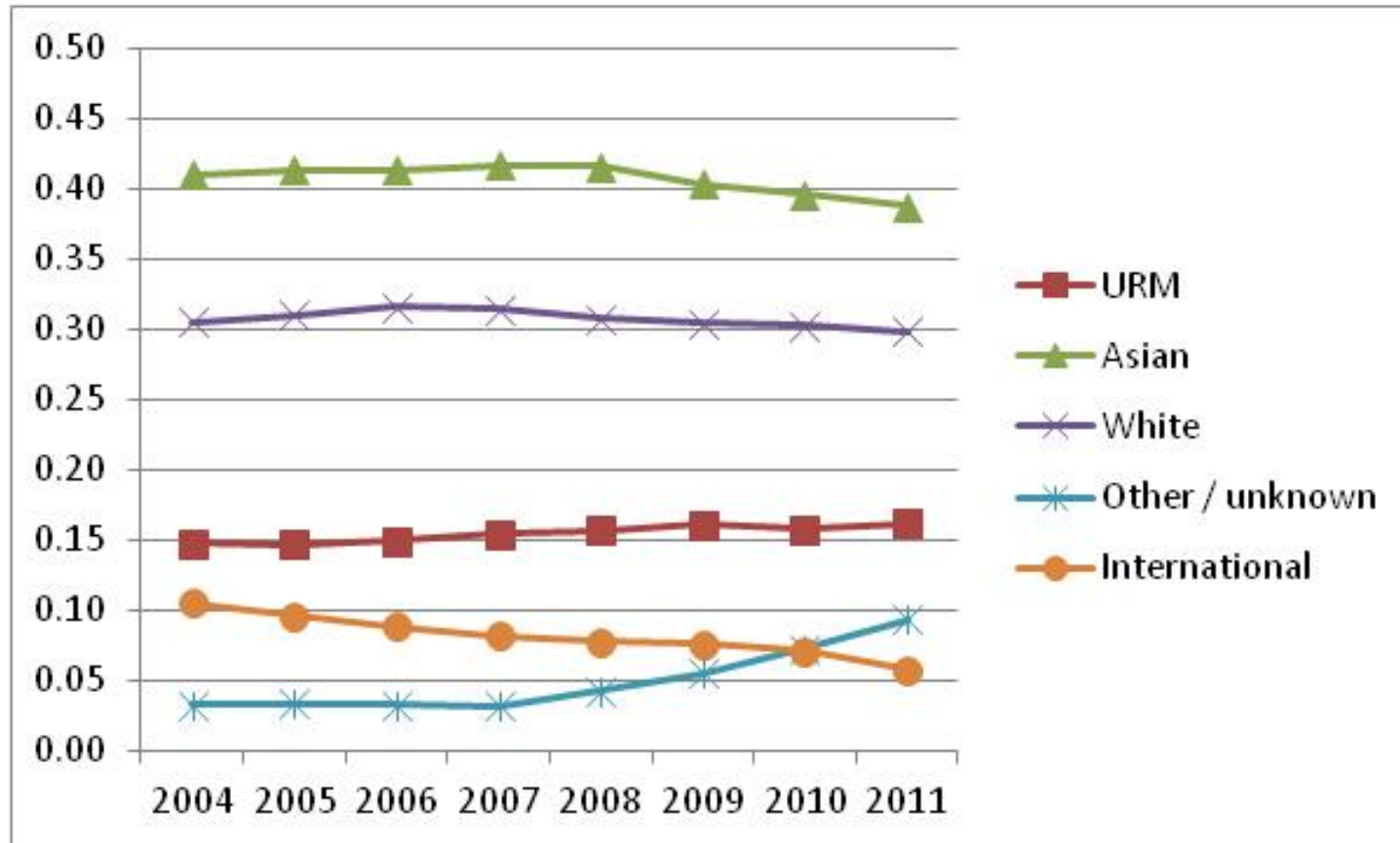
Undergraduate student self-reported family income (2010-11 inflation adjusted dollars)



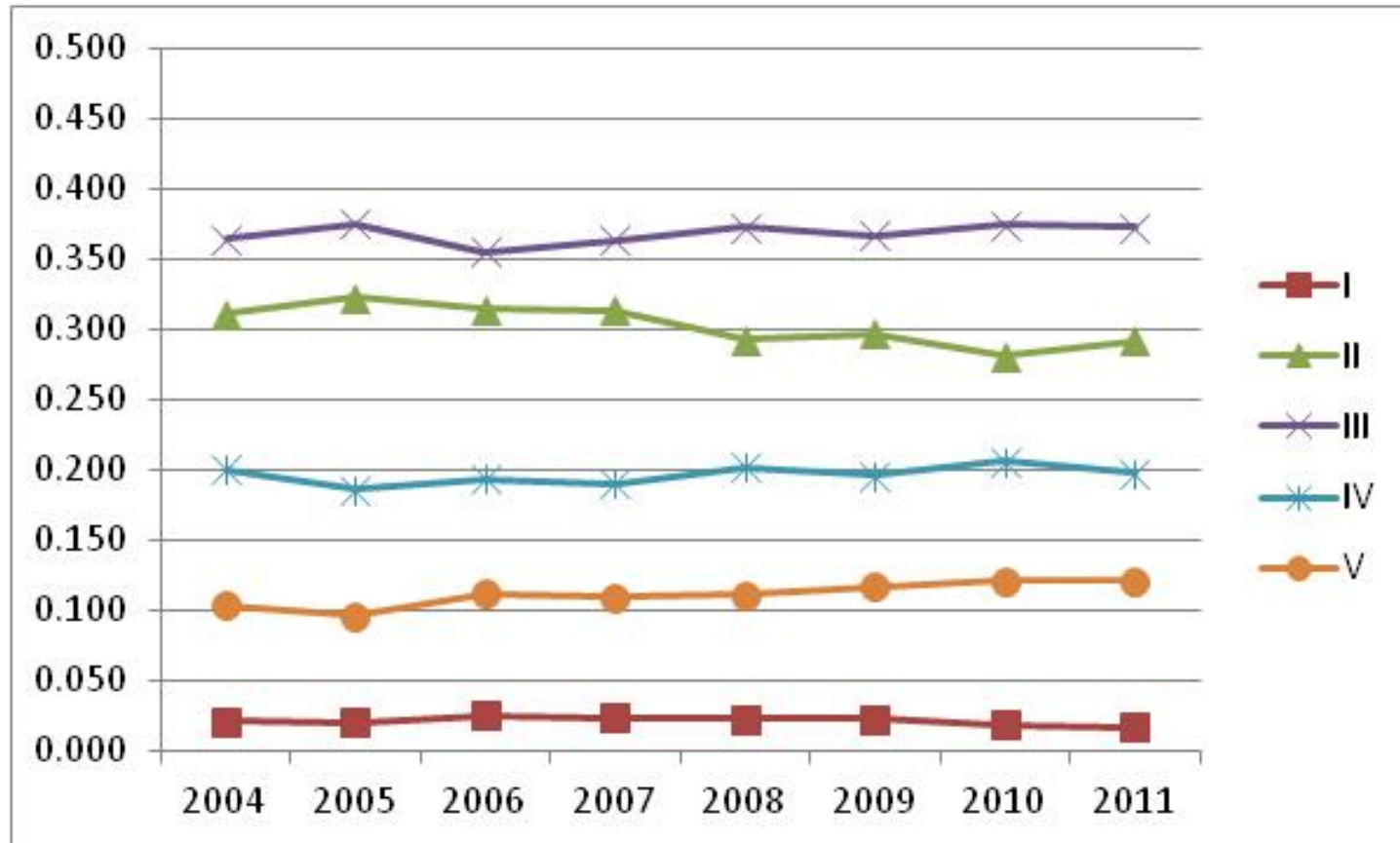
UC Berkeley undergraduate students receiving Federal Pell Grants (family incomes generally less than \$45,000 a year)



Ethnic distribution of UC Berkeley undergraduate enrollment



Self-reported social class when growing up (University of California undergraduate experience survey)



[I] Wealthy

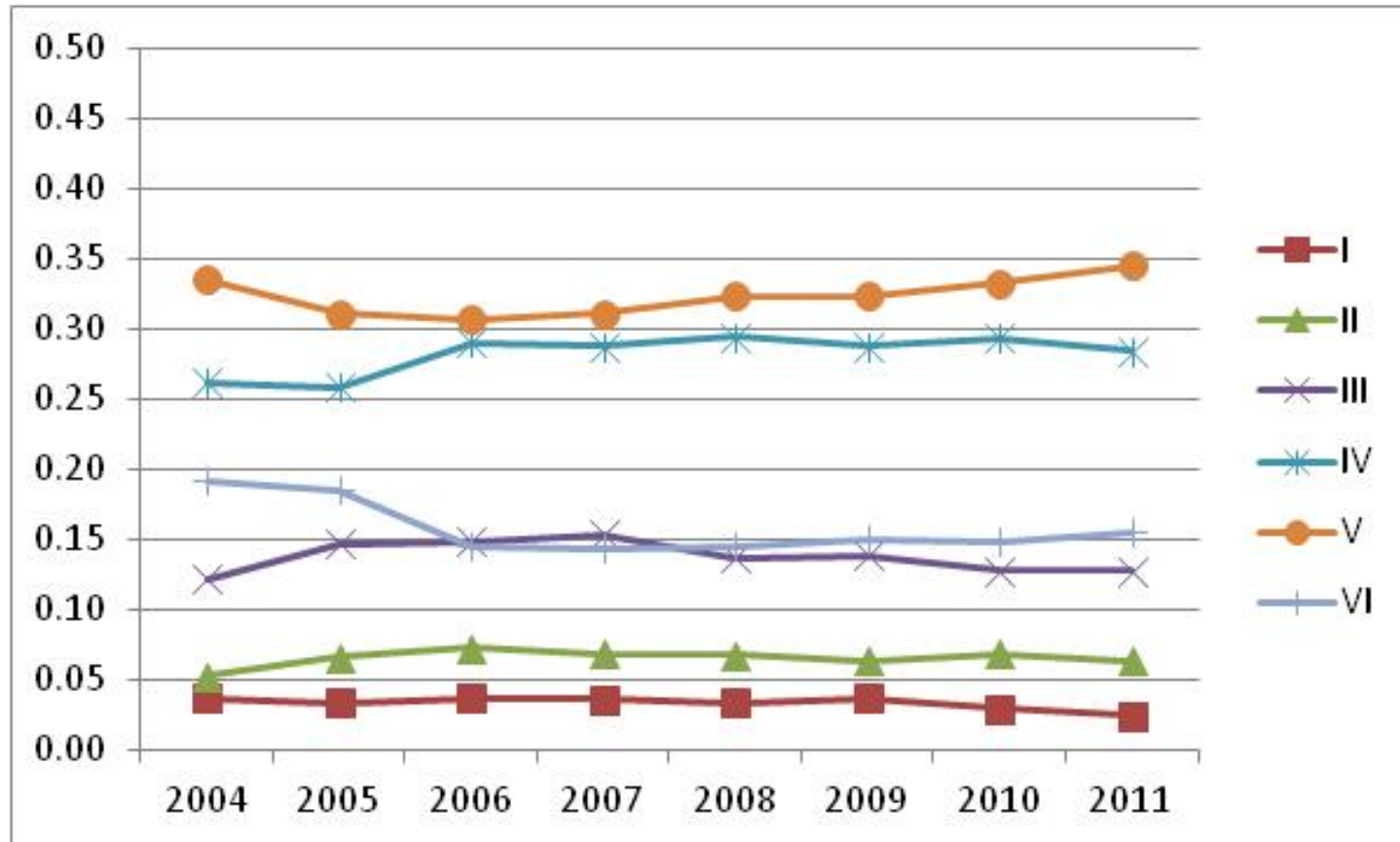
[II] Upper- or professional-middle

[III] Middle-class

[IV] Working-class

[V] Low-income or poor

Overall social experience at UC Berkeley (University of California undergraduate experience survey)



[I] Very dissatisfied

[II] Dissatisfied

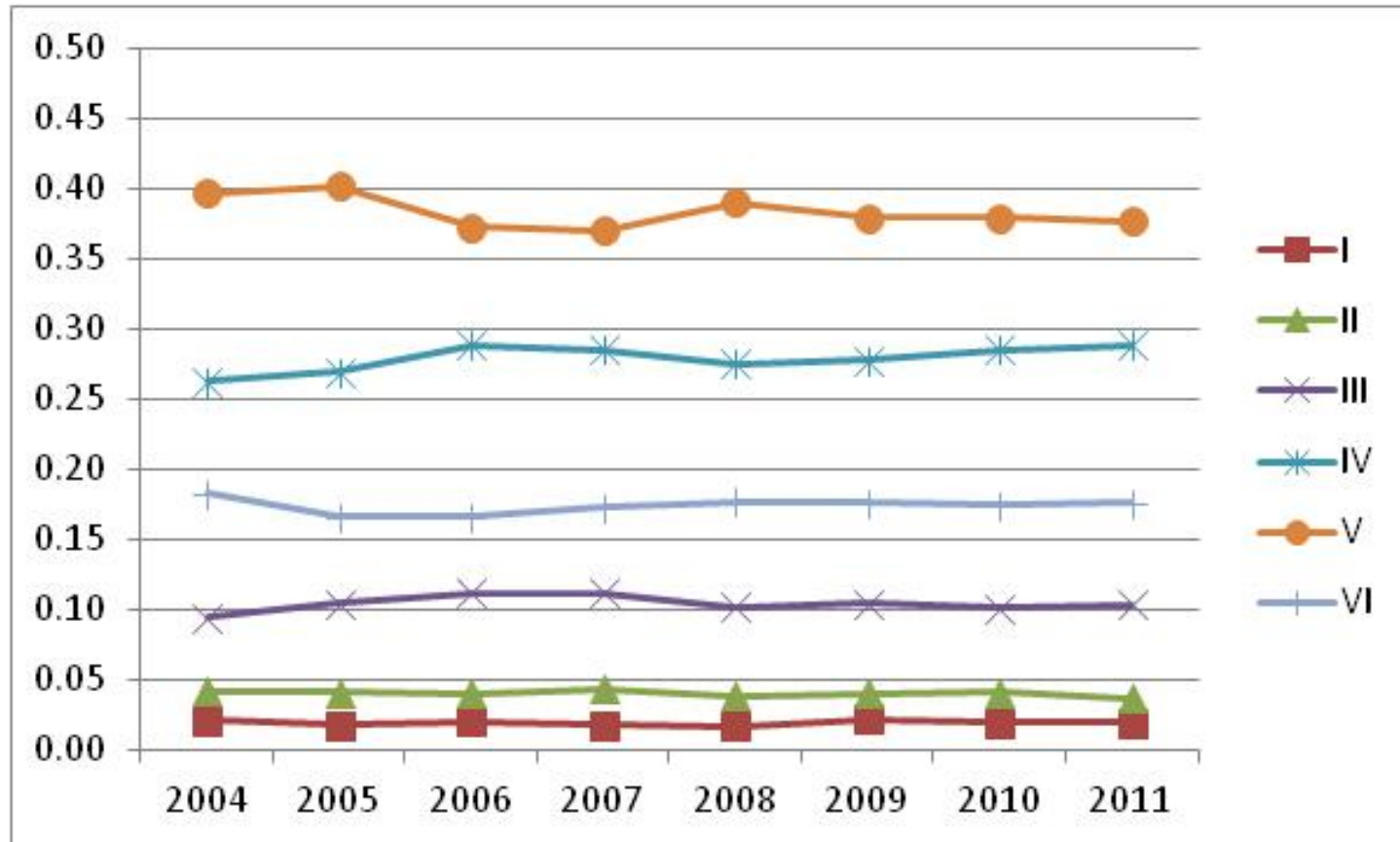
[III] Somewhat dissatisfied

[IV] Somewhat satisfied

[V] Satisfied

[VI] Very satisfied

Overall academic experience at UC Berkeley (University of California undergraduate experience survey)



[I] Very dissatisfied

[II] Dissatisfied

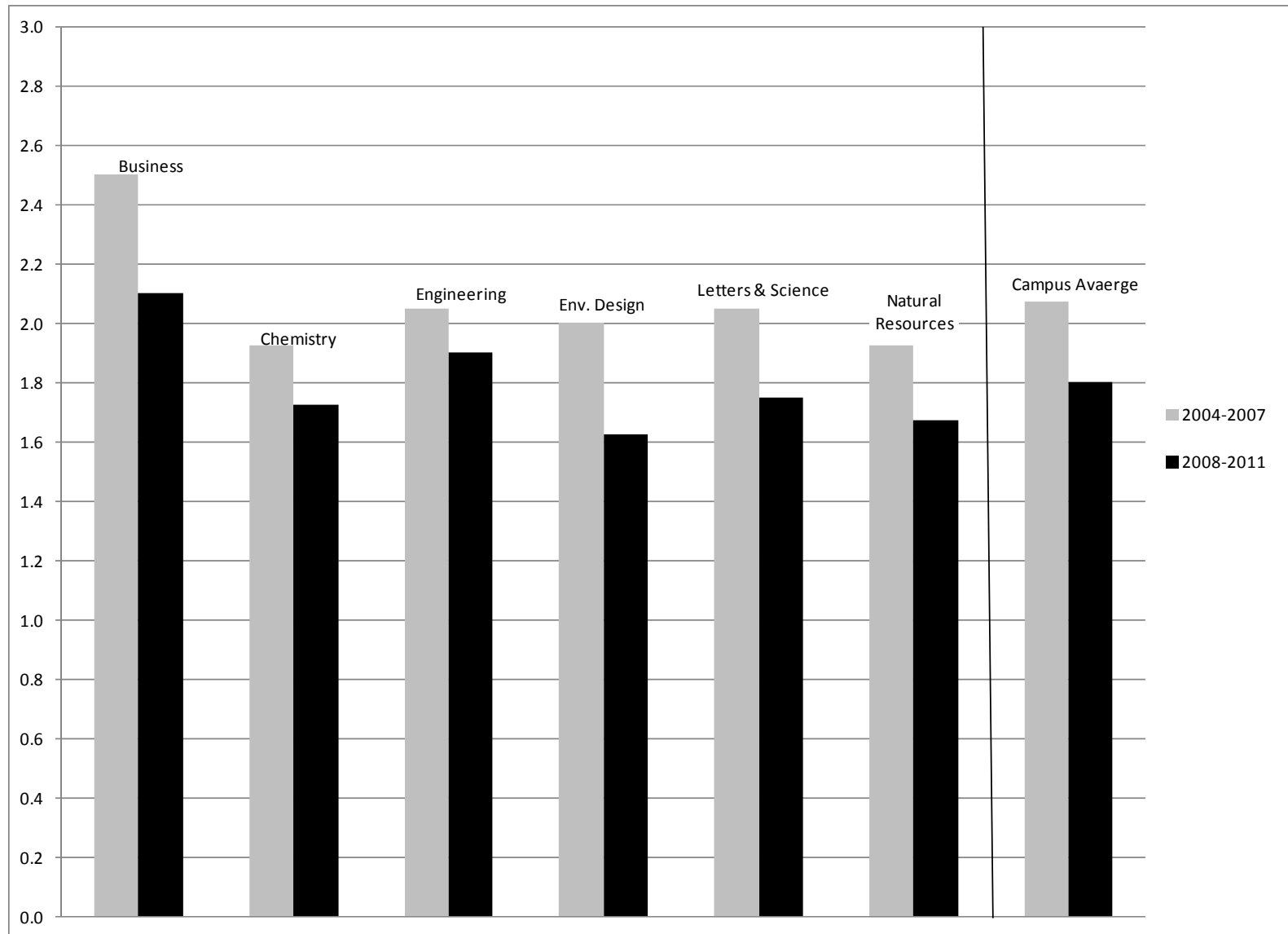
[III] Somewhat dissatisfied

[IV] Somewhat satisfied

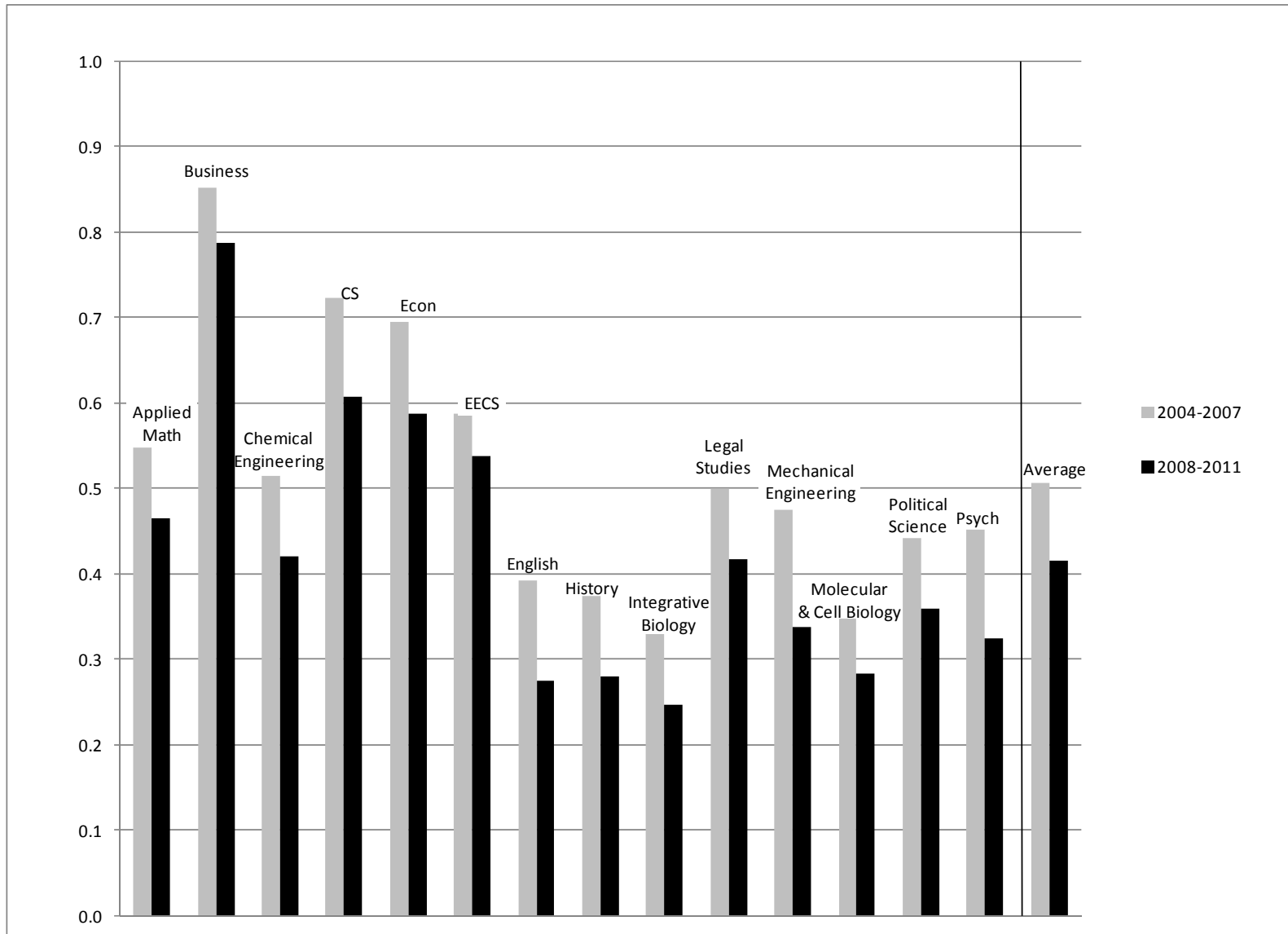
[V] Satisfied

[VI] Very satisfied

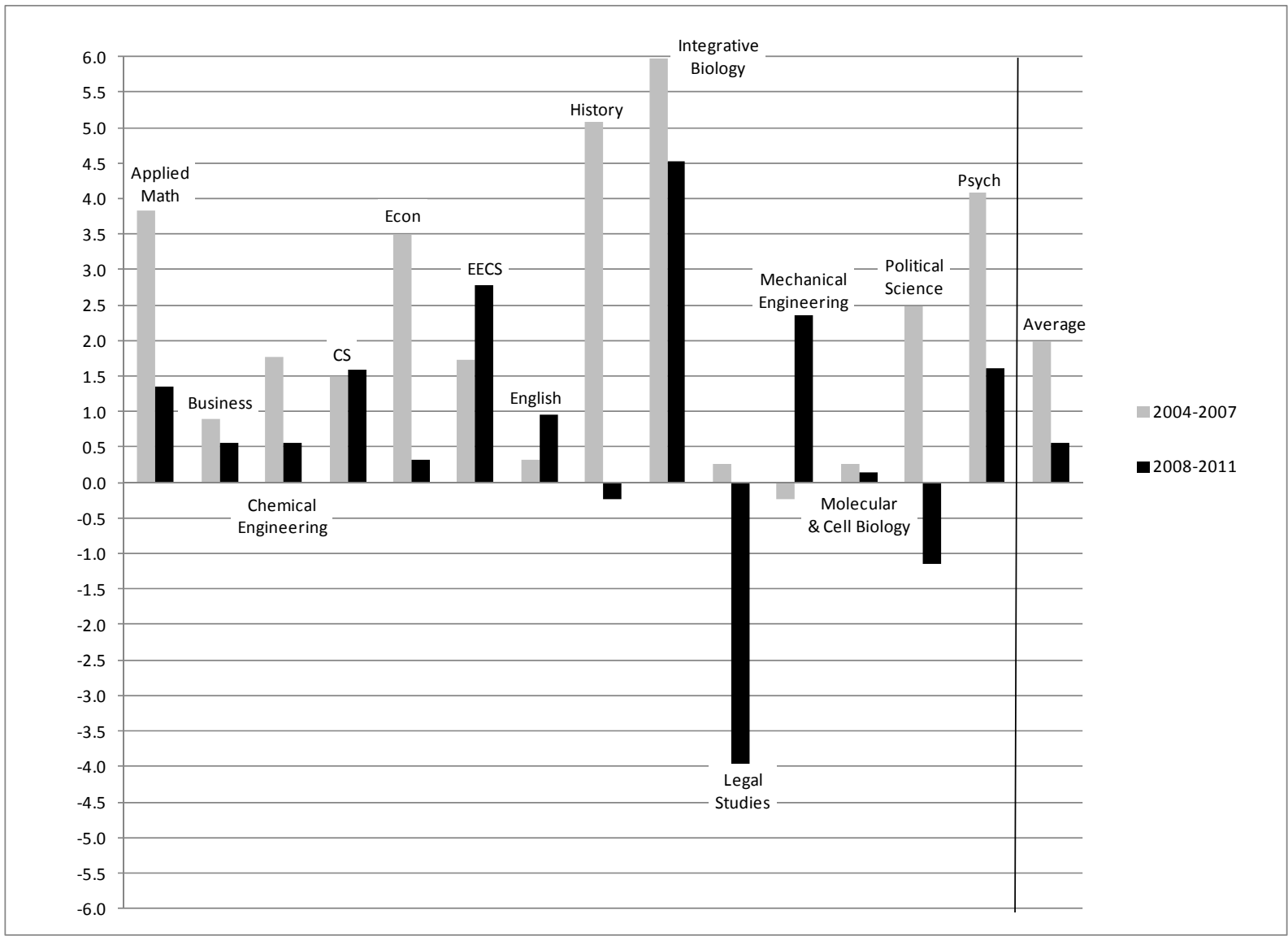
Job offers received by UC Berkeley students at graduation



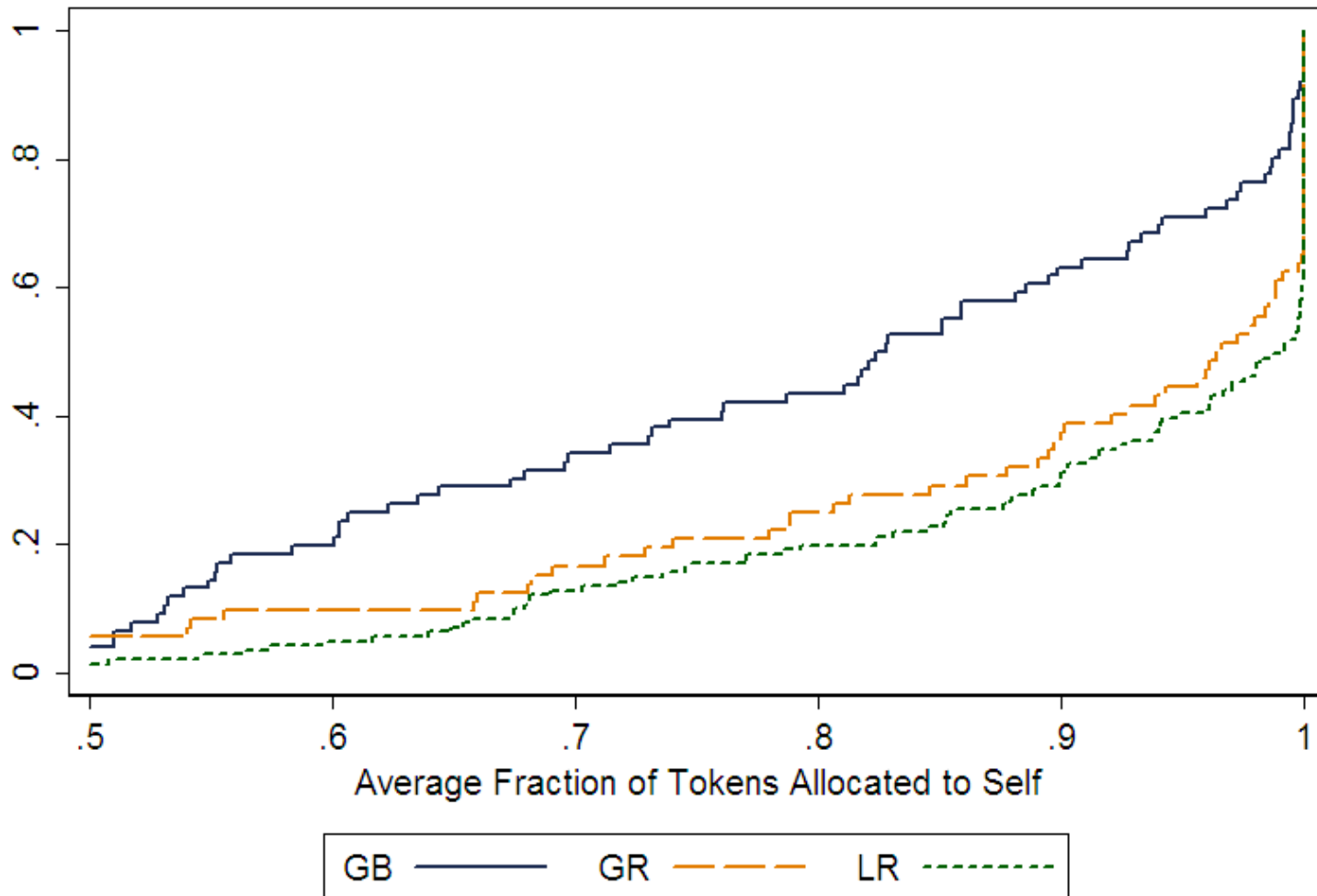
Employment rate of UC Berkeley students after graduation



Real growth of starting salaries for UC Berkeley graduates

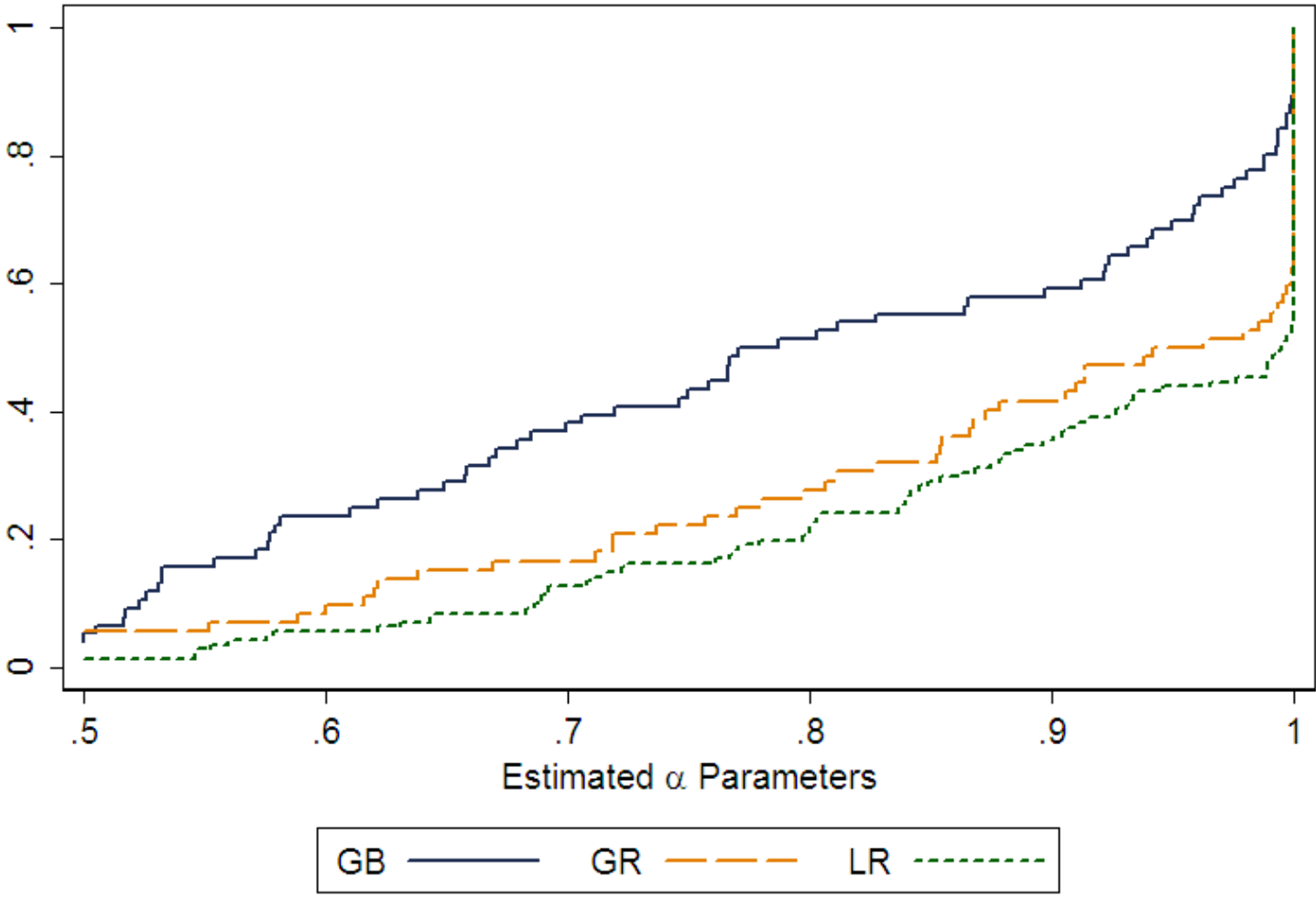


The distributions of the fraction tokens kept



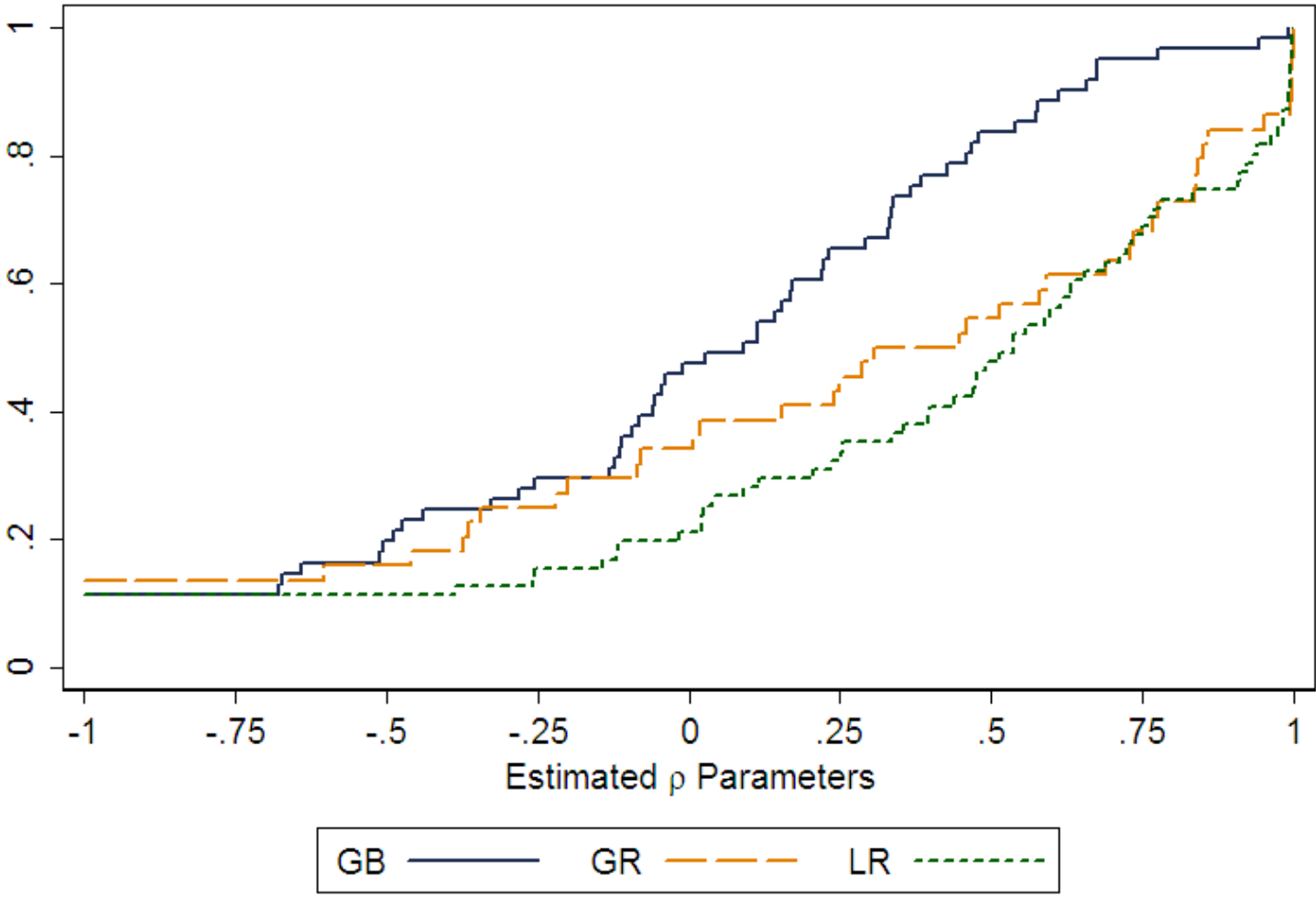
Note: the share of tokens allocated to self is less than 0.5 for 6 of 289 subjects.

The distributions of the individual-level α estimates



Note: 6 of 289 estimated α parameters are less than 0.5.

The distributions of the individual-level ρ estimates



Note: 18 of 176 estimated ρ parameters are less than -1.