Online supplementary materials for: Quantifying bias from measurable and unmeasurable confounders across three domains of individual determinants of political preferences

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Appendix A: variable definitions and descriptives

Political attitude items

The political attitude battery found in the STR SALTY survey contains the following 34 policy proposals, which the respondent is asked to indicate how much they agree with. All questions are answered on a 1–5 scale indicating "Very bad proposal" to "Very good proposal" with the middle option being a neutral "Neither good nor bad proposal."

1. Decrease the public sector
2. Decrease defense expenditures
3. Decrease social welfare
4. Taxes should be cut
5. Keep the estate tax
6. Sell state-owned companies to private buyers
7. Decrease income inequalities in society
8. Run more healthcare in the private sector
9. Decrease the influence of financial markets in politics
10. Keep maximum fees in child care
11. More support for free schools
12. Introduce grades in school at an earlier age
13. Increase economic assistance to the countryside
14. Legislate a six-hour work day
15. Ban all forms of pornography
16. Limit the right to free abortion
17. Introduce much harder prison sentences for criminals
18. Strenghen animal rights

19. Sweden should abolish nuclear power in the long run
20. Ban private cars in the inner cities
21. Invest more in preventing environmental degradation
22. Decrease carbon emissions
23. Increase labor market immigration to Sweden
24. Instate a language test for Swedish citizenship
25. Decrease foreign aid to developing countries
26. Take fewer refugees
27. Increase economic assistance to immigrants to preserve their native culture
28. Abolish third world debt
29. Give companies more freedom
30. Sweden should leave the EU
31. Sweden should adobt the euro as its currency
32. Sweden should apply for membership in NATO
33. Sweden should work for more free trade in the world
34. Sweden should actively support the US war on terror

Predictors

Data for the predictors outlined in the background section are gathered from a number of sources and defined as follows.

Education, wealth and income are taken from different databases in public registries from Statistics Sweden (SCB). Level of education comes from the Longitudinal integrated database for health insurance and labour market studies, LISA (Statistics Sweden 2016). We use both years of education based on the Sun2000Niva variable, as well as a dummy for whether one has taken any college/university, defined as having more than 12 years of total schooling. The same source is used for work income, which is defined as the average

work income (the variable ForvErs) in the ten years preceding the survey (i.e. 2000–2009), trimmed at the 99:th percentile to remove extreme outliers. The wealth variables are taken from the wealth registry and are defined as the inverse hyperbolic sine (IHS) of the average of the last five measurement years existing in this registry (corresponding to 2003–2007).[1] Both gross wealth (real and financial assets) and net wealth (subtract liabilities) are included. The IHS transformation is defined as $ihs(x) = log(x + \sqrt{x^2 + 1})$ and is used since it largely aligns with the more conventional log transformation but also allows zero or negative values, which is necessary for net wealth (Friedline et al. 2015).

Our measures of social trust, altruism, antisocial attitudes and utilitarian judgment are all from the SALTY survey. Social trust is based on the answers to two questions: "Do you think that on the whole you can trust most people, or do you think you can't be careful enough around other people?" and "Do you think most people would take advantage of you if they got the chance, or do you think most people would be fair to you?" These are both answered on scales raning between 1 and 10, and have been summed to get our measure of trust, where higher scores indicate higher trust.

The measure of altruism is based on self-reported answers to four questions regarding prosocial behavior: being a registered blood donor, being a registered organ donor, giving money to charity and doing volunteer work. The number of self-reported behaviors are added up to a simple altruism index. Similarly, antisocial attitudes are operationalized using four survey questions regarding perceived acceptability of illegal and/or harmful behaviors – specifically, taking disability benefits without being sick, skipping fares on public transports, evading taxes and accepting bribes at work. The number of affirmative answers (that the behavior in question is deemed acceptable) are added up to form an antisocial index.

Utilitarian judgement, furthermore, is based on the answers to three moral dilemma

[1] When the wealth tax was abolished following the election of a conservative government in 2006, the wealth registry was also abolished, meaning that there is a small gap between the last year of the wealth data and the SALTY survey used for the outcomes.

scenarios: two versions of the famed trolley problem (Thompson 1985) as well as a question on throwing an already fatally injured passenger off a life boat to save all others. Each of these scenarios have options where the respondent can choose to sacrifice one to save a larger number of people, i.e. a utilitarian calculus – the number of such choices have been added up and forms the utilitarian judgment index we use.[2]

The psychological constructs extraversion, locus of control and risk preferences are also from the SALTY survey. Locus of control is based on a 12-item version of the validated Rotter forced-choice questionnaire (Marsh & Richards 1985). Extraversion, furthermore, is based on the validated 16-item Adult Measure of Behavioural Inhibition (AMBI) questionnaire (Gladstone & Parker 2005). Behavioral inhibition is strongly negatively correlated with extraversion (Gladstone & Parker 2005) and has previously been used as a measure of extraversion (Oskarsson et al. 2012). The measure of risk preferences is based on two direct questions addressing risk aversion: "How do you see yourself: are you a person who, in general, is ready to take risks, or do you try to avoid risks?", and "Are you a person who is ready to take financial risks or do you try to avoid financial risks?" Both items have response scales ranging from 1–10. We have summed the two scales to get our measure of risk preference. Lastly, our measure of IQ is based on the cognitive capacity section of military conscription tests. It covers around 95% of the males in the applicable cohorts, but almost no females. We have summed the scores from the four subtests (logical, verbal, spatial and technical) and standardized resulting the index by birth cohort. Conscription data used in this way have previously been shown to be a good measure of general intelligence (Carlstedt 2000).

[2]Interpreting answers to sacrificial dilemmas as measures of utilitarianism has been critized (e.g. Kahane 2015). Some have argued that utilitarianism should be understood as two separate phenomena: a positive "impartial concern for the greater good" on the one hand, and a negative "permissiveness of instrumental harm" on the other, and that these are empirically independent of each other (Kahane et al. 2018). The measure we have used aligns with the dimension of "permissiveness of instrumental harm."

Table 1: Descriptives, dependent variables

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
decrease_public_sector	1,942	2.502	1.180	1	5
decrease_defense_spending	1,958	3.298	1.025	1	5
decrease_welfare	1,968	2.691	1.074	1	5
lower_taxes	1,970	3.399	1.148	1	5
keep_property_taxes	1,954	2.551	1.237	1	5
sell_public_enterprise	1,964	2.433	1.122	1	5
decrease_economic_inequality	1,978	3.954	0.997	1	5
more_private_healthcare	1,950	2.761	1.125	1	5
decrease_finmarket_impact	1,906	3.524	0.928	1	5
keep_maxtaxa	1,934	3.599	1.029	1	5
more_freeschools	1,952	2.555	1.037	1	5
earlier_grades	1,970	3.332	1.236	1	6
more_support_countryside	1,970	3.813	0.892	1	5
six_hour_workday	1,978	3.303	1.330	1	5
ban_pornography	1,976	3.959	1.197	1	5
limit_abortion	1,964	1.844	1.125	1	5
harder_punishment	1,988	3.844	1.104	1	5
better_animal_protection	1,960	3.798	1.017	1	5
no_nuclear_power	1,960	2.926	1.298	1	5
no_cars_in_cities	1,966	2.913	1.145	1	5
decrease_pollution	1,968	4.329	0.734	1	5
less_carbondioxide	1,950	4.367	0.724	1	5
more_skilled_immigration	1,936	2.640	0.999	1	5
language_test_citizenship	1,962	3.665	1.186	1	5
decrease_aid	1,964	2.685	1.060	1	5
fewer_refugees	1,970	3.215	1.199	1	5
more_support_immigrant_culture	1,962	2.183	0.983	1	5
abolish_debt	1,944	3.115	1.057	1	5
more_freedom_companies	1,946	3.290	0.952	1	5
leave_eu	1,966	2.418	1.275	1	5
instate_euro	1,974	3.123	1.414	1	5
join_nato	1,910	2.571	1.100	1	5
more_free_trade	1,906	3.581	0.899	1	5
support_war_on_terror	1,934	2.878	1.160	1	5

Table 2: Descriptives, predictors

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
Extraversion	1,812	0.555	0.156	0.0625	0.969
Locus of control	1,514	0.547	0.178	0	1
Work income	6,014	0.298	0.181	0	0.998
Altruism	1,976	2.251	0.633	0	4
Risk preference	2,006	8.037	3.792	2	20
Utilitarian	848	1.600	0.954	0	3
Antisocial attitudes	1,960	0.114	0.144	0	1
Trust	1,998	14.62	3.499	2	20
Education years	8,746	12.12	2.530	7	19
stdIQ	2,496	0.0426	0.979	-3.034	2.885
College	13,302	0.590	0.492	0	1
Gross wealth	12,846	0.366	0.569	0	5.070
Net wealth	12,846	0.260	0.514	-2.033	5.062

Control variables

The naive models add a comprehensive set of controls available in the register data. These controls are described here. First, fixed effects for birth years of both parents are included, capturing possible cohort effects in parental socialization (e.g. Beck & Jennings 1991; Jennings et al. 2009).[3] Further, we add the parental household's socioeconomic status, measured as a) education years of the highest educated parent, and b) income of the parent with the highest income (income measured in 1970, and taken from the Statistics Sweden Census, FoB, and education taken from the LISA database in 1990, or the FoB database in 1970 if the parents were deceased in 1990).[4]

Fixed effects for birth municipality (using the equivalent 284 municipalities existing

[3]Missing parental birth years were imputed with the cohort specific average maternal and paternal birth year, and a binary indicator is included in the models for observations subject to this imputation.

[4]Missing parental income and education were imputed using multiple imputation based on birth municipality, occupation and birth year – importantly variables used as predictors later (income and education) are excluded since these would lead to parental SES capturing some of the variation we wish to capture with the predictor of interest. A binary indicator is included in the models for observations subject to this imputation.

in 2005) is added to capture influences from the local context. Contextual effects in political attitudes and behavior can come about in several ways, including interpersonal communication, conformity effects or locally shared experiences (Burbank 1995; Marsh 2002). Municipalities in Sweden vary substantially with respect to dominant political parties, as well as demographic and economic factors that could potentially have important influences on political preference formation early in life.[5]

At the individual level, we control for a fine-grained measure of employment sector category, education years and income.[6] These variables are all taken from the LISA databases (Statistics Sweden 2016). Employment category is based on the first two digits of the Swedish Standard for Occupational Categorization (SSYK, an adapted version of the ISCO standard), amounting to a total of 27 categories. Education years and income is constructed as outlined in the Predictors section above.

[5] Although finer grained geographical data is available (i.e. parishes) this would saturate the degrees of freedom.

[6] Where income and education are used as main predictors, these are dropped as controls.

Appendix B: result tables

Main results

Tables 3–5 contain more detailed information about the results presented in figures 1–4 in the main paper. Table 3 contains results using all 34 outcomes, while tables 4 and 5 contain the winners curse selected outcomes based on naive significance (4) and effect size (5), respectively.

Table 3: Main results

Predictor	**Empty**	**Naive**	**Naive, rn**	**Within**	%1	%2	**min-max N**
Education years	0.119	0.079	0.093	0.031	66.8%	33.4%	1818-1900
	(0.007)	(0.010)	(0.010)	(0.014)	(t=-3.206)	(t=-3.531)	
College	0.109	0.065	0.073	0.015	59.3%	20.6%	1818-1900
	(0.006)	(0.010)	(0.011)	(0.014)	(t=-3.785)	(t=-3.274)	
Gross wealth	0.097	0.068	0.079	0.049	69.6%	62.1%	1818-1900
	(0.007)	(0.008)	(0.010)	(0.014)	(t=-2.68)	(t=-1.748)	
Net wealth	0.079	0.054	0.062	0.033	68.3%	52.5%	1818-1900
	(0.007)	(0.008)	(0.009)	(0.013)	(t=-2.226)	(t=-1.873)	
Work income	0.088	0.042	0.051	0.018	47.4%	35.7%	1818-1900
	(0.007)	(0.010)	(0.009)	(0.011)	(t=-3.719)	(t=-2.232)	
Trust	0.082	0.059	0.061	0.015	72.2%	25.0%	1782-1858
	(0.007)	(0.008)	(0.008)	(0.010)	(t=-2.189)	(t=-3.44)	
Extraversion	0.078	0.046	0.049	0.032	58.7%	65.4%	1644-1698
	(0.008)	(0.008)	(0.008)	(0.011)	(t=-2.882)	(t=-1.245)	
Locus of control	0.078	0.042	0.048	0.037	54.0%	77.9%	1376-1422
	(0.008)	(0.009)	(0.008)	(0.009)	(t=-3.065)	(t=-.879)	
Risk preference	0.081	0.053	0.055	0.022	66.3%	40.4%	1784-1864
	(0.007)	(0.008)	(0.008)	(0.010)	(t=-2.53)	(t=-2.704)	
Antisocial att.	0.062	0.058	0.060	0.041	93.3%	68.4%	1754-1826
	(0.009)	(0.009)	(0.009)	(0.011)	(t=-.322)	(t=-1.309)	
Altruism	0.039	0.030	0.031	0.024	77.3%	75.8%	1762-1836
	(0.006)	(0.006)	(0.006)	(0.008)	(t=-1.025)	(t=-.786)	
Utilitarian	0.034	0.035	0.041	0.041	102.3%	100.0%	764-794
	(0.007)	(0.009)	(0.009)	(0.009)	(t=.071)	(t=0)	
IQ	0.116	0.076	0.085	0.071	65.1%	83.8%	688-708
	(0.011)	(0.017)	(0.016)	(0.021)	(t=-2.013)	(t=-.522)	

Averages of beta coefficients for all 34 political issue variables. Columns %1 and %2 are the proportion of the remaining effect size when moving to the next model, in per cent. min-max N is the smallest and largest number of observations across the 34 outcomes per predictor.

Table 4: Winners curse results, from naive models

Predictor	**Naive, sig**	**Within**	%	k
Education years	0.142	0.052	37.0%	18
	(0.016)	(0.023)	(t=-3.136)	
College	0.125	0.049	39.3%	14
	(0.017)	(0.022)	(t=-2.737)	
Gross wealth	0.112	0.070	62.7%	21
	(0.013)	(0.018)	(t=-1.893)	
Net wealth	0.096	0.050	52.3%	17
	(0.013)	(0.018)	(t=-2.09)	
Work income	0.101	0.047	45.9%	10
	(0.017)	(0.021)	(t=-2.056)	
Trust	0.106	0.030	28.7%	15
	(0.013)	(0.016)	(t=-3.651)	
Extraversion	0.096	0.047	48.9%	11
	(0.013)	(0.018)	(t=-2.156)	
Locus of control	0.090	0.062	68.6%	11
	(0.013)	(0.015)	(t=-1.423)	
Risk preference	0.096	0.035	37.1%	14
	(0.012)	(0.016)	(t=-3.017)	
Antisocial att.	0.087	0.062	72.1%	19
	(0.012)	(0.015)	(t=-1.272)	
Altruism	0.084	0.053	63.2%	5
	(0.012)	(0.014)	(t=-1.663)	
IQ	0.181	0.094	51.8%	8
	(0.031)	(0.042)	(t=-1.673)	

Average beta coefficients for outcomes with $p < .05$ in naive model. Only predictors with at least 5 included outcomes shown. The % column contains the proportion of the remaining effect size when moving to the next model, in per cent. k is the number of outcomes retained.

Table 5: Beta selection results, from naive models

Predictor	**Naive, sig**	**Within**	%	k
Education years	0.162	0.065	40.1%	13
	(0.019)	(0.026)	(t=-3.001)	
College	0.152	0.068	45.1%	8
	(0.024)	(0.030)	(t=-2.2)	
Gross wealth	0.155	0.096	61.7%	9
	(0.015)	(0.022)	(t=-2.217)	
Net wealth	0.130	0.077	59.4%	8
	(0.015)	(0.022)	(t=-2.004)	
Trust	0.130	0.053	41.2%	8
	(0.017)	(0.021)	(t=-2.875)	
Risk preference	0.117	0.040	34.3%	7
	(0.016)	(0.021)	(t=-2.953)	
Antisocial att.	0.115	0.079	68.8%	5
	(0.016)	(0.019)	(t=-1.456)	
IQ	0.157	0.100	64.0%	12
	(0.028)	(0.037)	(t=-1.226)	

Average beta coefficients for outcomes with $\beta > .1$ in naive model. Only predictors with at least 5 included outcomes shown. The % column contains the proportion of the remaining effect size when moving to the next model, in per cent. k is the number of outcomes retained.

Table 6: Main results

Predictor	**Empty**	**Naive**	**Naive, rn**	**Within**	%1	%2	**min-max N**
Education years	0.119	0.083	0.094	0.030	69.7%	31.5%	1818-1900
	(0.007)	(0.010)	(0.010)	(0.014)	(t=-2.97)	(t=-3.745)	
College	0.109	0.068	0.076	0.015	62.8%	19.7%	1818-1900
	(0.006)	(0.010)	(0.011)	(0.014)	(t=-3.479)	(t=-3.444)	
Gross wealth	0.097	0.072	0.079	0.049	73.4%	61.8%	1818-1900
	(0.007)	(0.008)	(0.010)	(0.014)	(t=-2.341)	(t=-1.771)	
Net wealth	0.079	0.055	0.062	0.033	70.6%	54.4%	1818-1900
	(0.007)	(0.008)	(0.009)	(0.012)	(t=-2.065)	(t=-1.825)	
Work income	0.088	0.051	0.057	0.020	58.2%	34.4%	1818-1900
	(0.007)	(0.010)	(0.009)	(0.011)	(t=-2.993)	(t=-2.58)	
Trust	0.082	0.063	0.064	0.017	77.2%	27.1%	1782-1858
	(0.007)	(0.008)	(0.008)	(0.010)	(t=-1.798)	(t=-3.675)	
Extraversion	0.078	0.048	0.051	0.032	62.0%	62.1%	1644-1698
	(0.008)	(0.008)	(0.008)	(0.011)	(t=-2.656)	(t=-1.445)	
Locus of control	0.078	0.048	0.052	0.033	61.1%	63.1%	1376-1422
	(0.008)	(0.009)	(0.008)	(0.009)	(t=-2.591)	(t=-1.573)	
Risk preference	0.081	0.059	0.059	0.020	72.8%	34.0%	1784-1864
	(0.007)	(0.008)	(0.008)	(0.010)	(t=-2.045)	(t=-3.068)	
Antisocial att.	0.062	0.059	0.061	0.040	95.1%	65.6%	1754-1826
	(0.009)	(0.009)	(0.010)	(0.012)	(t=-.234)	(t=-1.367)	
Altruism	0.039	0.032	0.033	0.024	82.4%	72.8%	1762-1836
	(0.006)	(0.006)	(0.006)	(0.008)	(t=-.791)	(t=-.913)	
Utilitarian	0.034	0.034	0.042	0.041	100.3%	97.6%	764-794
	(0.007)	(0.009)	(0.009)	(0.009)	(t=.008)	(t=-.079)	
IQ	0.116	0.084	0.094	0.070	72.3%	74.9%	688-708
	(0.011)	(0.016)	(0.016)	(0.022)	(t=-1.654)	(t=-.86)	

Averages of beta coefficients for all 34 political issue variables. Columns %1 and %2 are the proportion of the remaining effect size when moving to the next model, in per cent. min-max N is the smallest and largest number of observations across the 34 outcomes per predictor.

Main results, alternative controls

Table 6 contains the main results with all predictors and all 34 outcomes, but with income and education years removed from the list of controls. These two controls may be particularly liable to cause collider bias or being mediators, and it is therefore of interest to make sure the pattern of results does not deviate substantially when these are removed.

Results using reduced preference dimensions

The main outcome space of 34 political preferences can also be treated as measures of underlying ideological constructs. In this section we present detailed results using the first five dimensions of the outcome space previously identified via PCA. We have opted to define these with equal weight to each item (similar to Oskarsson et al. 2015). Tables 7–11 contain regular regression output for each predictor in separate tables by dimension.

These are the dimensions:

1. Decrease public sector (+), lower taxes (+), sell state-owned companies (+), more private healthcare (+), more support for freeschools (+), more freedom for companies (+)
2. More support for the countryside (+), introduce six-hour work day (+)
3. Harder prison sentences for criminals (+), more skilled immigration (-), language test for citizenship (+), decrease foreign aid (+), fewer refugees (+), more support for immigrant culture (-)
4. Prevent environmental degradation (+), decrease carbon emissions (+)
5. Leave the EU (+), instate the euro as currency (-), join NATO (-)

Table 7: Reduced dimension 1, raw results

Predictor	**Empty**	**Naive**	**Within**	**N**
Education years	0.014	-0.030	-0.001	1722
	(0.025)	(0.038)	(0.056)	
College	0.008	-0.040	-0.002	1722
	(0.024)	(0.036)	(0.048)	
Gross wealth	0.177	0.172	0.078	1722
	(0.023)	(0.027)	(0.037)	
Net wealth	0.143	0.130	0.062	1722
	(0.023)	(0.026)	(0.036)	
Work income	0.033	0.048	0.013	1722
	(0.027)	(0.034)	(0.044)	
Trust	-0.025	-0.019	0.055	1688
	(0.028)	(0.029)	(0.035)	
Extraversion	0.109	0.078	0.034	1584
	(0.027)	(0.030)	(0.038)	
Locus of control	0.102	0.077	0.058	1318
	(0.029)	(0.032)	(0.037)	
Risk preference	0.157	0.139	0.046	1690
	(0.026)	(0.028)	(0.033)	
Antisocial att.	0.121	0.129	0.088	1666
	(0.026)	(0.026)	(0.030)	
Altruism	0.032	0.033	0.028	1676
	(0.025)	(0.028)	(0.033)	
Utilitarian	-0.002	0.019	0.011	730
	(0.040)	(0.048)	(0.049)	
IQ	0.043	-0.049	-0.033	656
	(0.037)	(0.053)	(0.078)	

Regression coefficients per predictor and model. Each predictor run separately. Full set of controls included (see section 4.1.2 in main text).

Table 8: Reduced dimension 2, raw results

Predictor	**Empty**	**Naive**	**Within**	**N**
Education years	-0.220	-0.114	-0.061	1874
	(0.023)	(0.033)	(0.054)	
College	-0.198	-0.093	-0.042	1874
	(0.023)	(0.030)	(0.042)	
Gross wealth	-0.241	-0.141	-0.092	1874
	(0.022)	(0.024)	(0.037)	
Net wealth	-0.204	-0.110	-0.061	1874
	(0.022)	(0.024)	(0.035)	
Work income	-0.249	-0.138	-0.009	1874
	(0.025)	(0.031)	(0.039)	
Trust	-0.112	-0.063	-0.027	1836
	(0.026)	(0.024)	(0.030)	
Extraversion	-0.130	-0.064	-0.057	1678
	(0.025)	(0.025)	(0.033)	
Locus of control	-0.147	-0.048	-0.014	1410
	(0.028)	(0.031)	(0.033)	
Risk preference	-0.151	-0.080	-0.035	1840
	(0.025)	(0.026)	(0.031)	
Antisocial att.	0.006	-0.020	-0.013	1806
	(0.025)	(0.024)	(0.027)	
Altruism	-0.029	0.005	-0.005	1814
	(0.023)	(0.025)	(0.031)	
Utilitarian	0.056	0.055	-0.008	788
	(0.038)	(0.042)	(0.042)	
IQ	-0.278	-0.195	-0.187	706
	(0.033)	(0.053)	(0.074)	

Regression coefficients per predictor and model. Each predictor run separately. Full set of controls included (see section 4.1.2 in main text).

Table 9: Reduced dimension 3, raw results

Predictor	**Empty**	**Naive**	**Within**	**N**
Education years	-0.383	-0.307	-0.121	1798
	(0.022)	(0.034)	(0.045)	
College	-0.342	-0.237	-0.106	1798
	(0.023)	(0.034)	(0.040)	
Gross wealth	-0.071	0.025	0.028	1798
	(0.024)	(0.027)	(0.033)	
Net wealth	-0.054	0.027	0.013	1798
	(0.023)	(0.025)	(0.031)	
Work income	-0.181	-0.034	0.006	1798
	(0.023)	(0.029)	(0.034)	
Trust	-0.249	-0.185	-0.070	1770
	(0.025)	(0.025)	(0.028)	
Extraversion	-0.136	-0.079	-0.044	1618
	(0.029)	(0.028)	(0.033)	
Locus of control	-0.176	-0.070	-0.057	1372
	(0.030)	(0.029)	(0.031)	
Risk preference	-0.122	-0.056	-0.019	1768
	(0.027)	(0.027)	(0.029)	
Antisocial att.	0.102	0.068	0.035	1740
	(0.025)	(0.026)	(0.027)	
Altruism	-0.099	-0.061	-0.044	1746
	(0.026)	(0.026)	(0.027)	
Utilitarian	-0.042	-0.037	-0.032	770
	(0.037)	(0.036)	(0.033)	
IQ	-0.325	-0.187	0.024	684
	(0.034)	(0.053)	(0.081)	

Regression coefficients per predictor and model. Each predictor run separately. Full set of controls included (see section 4.1.2 in main text).

Table 10: Reduced dimension 4, raw results

Predictor	**Empty**	**Naive**	**Within**	**N**
Education years	0.043	0.021	-0.088	1854
	(0.022)	(0.036)	(0.063)	
College	0.060	0.034	-0.055	1854
	(0.021)	(0.033)	(0.057)	
Gross wealth	-0.018	-0.050	-0.086	1854
	(0.023)	(0.026)	(0.042)	
Net wealth	-0.020	-0.039	-0.082	1854
	(0.023)	(0.025)	(0.040)	
Work income	-0.011	-0.034	0.024	1854
	(0.025)	(0.033)	(0.047)	
Trust	0.071	0.049	-0.023	1816
	(0.027)	(0.029)	(0.035)	
Extraversion	0.037	0.013	0.019	1654
	(0.025)	(0.028)	(0.039)	
Locus of control	0.136	0.127	0.104	1392
	(0.027)	(0.033)	(0.040)	
Risk preference	0.031	0.018	0.043	1820
	(0.026)	(0.029)	(0.038)	
Antisocial att.	-0.070	-0.099	-0.067	1784
	(0.024)	(0.028)	(0.032)	
Altruism	0.028	0.030	0.005	1794
	(0.024)	(0.027)	(0.034)	
Utilitarian	0.036	-0.003	0.022	786
	(0.038)	(0.046)	(0.052)	
IQ	0.031	0.022	-0.073	698
	(0.039)	(0.058)	(0.106)	

Regression coefficients per predictor and model. Each predictor run separately. Full set of controls included (see section 4.1.2 in main text).

Table 11: Reduced dimension 5, raw results

Predictor	**Empty**	**Naive**	**Within**	**N**
Education years	-0.155	-0.073	-0.023	1804
	(0.023)	(0.035)	(0.053)	
College	-0.138	-0.063	-0.076	1804
	(0.022)	(0.031)	(0.047)	
Gross wealth	-0.190	-0.100	-0.039	1804
	(0.021)	(0.024)	(0.034)	
Net wealth	-0.159	-0.081	-0.018	1804
	(0.021)	(0.024)	(0.034)	
Work income	-0.187	-0.145	-0.015	1804
	(0.023)	(0.030)	(0.041)	
Trust	-0.117	-0.080	-0.039	1768
	(0.026)	(0.027)	(0.034)	
Extraversion	-0.210	-0.160	-0.074	1636
	(0.027)	(0.028)	(0.040)	
Locus of control	-0.146	-0.075	-0.020	1366
	(0.028)	(0.032)	(0.038)	
Risk preference	-0.197	-0.148	-0.056	1774
	(0.025)	(0.027)	(0.035)	
Antisocial att.	-0.065	-0.065	-0.073	1742
	(0.027)	(0.029)	(0.032)	
Altruism	-0.001	-0.000	0.015	1746
	(0.025)	(0.025)	(0.031)	
Utilitarian	0.031	0.043	0.037	760
	(0.041)	(0.044)	(0.049)	
IQ	-0.197	-0.115	-0.079	690
	(0.036)	(0.052)	(0.094)	

Regression coefficients per predictor and model. Each predictor run separately. Full set of controls included (see section 4.1.2 in main text).

Robustness checks

The robustness of the results will hinge on the extent to which some of the underlying assumptions are met. One that is of particular concern if we are to interpret the changes between naive and within-pair models as reductions in bias is the independence assumption. The independence assumption, sometimes called the SUTVA, assumes that observations do not have any influence on each other – the "treatment" (in this setting, treatment will simply mean variation in a given predictor, such as more or less education) for any given person i does not influence the outcome of some other "untreated" person j. In most cases, this would lead us to underestimate the effect (if the sign of the primary effect on person i is the same as on the secondary person j – if not, we would instead overestimate the effect). Strictly speaking, this assumption is almost never precisely met in practice in social settings. The problem becomes of particular importance, however, in within-pair models since the extent to which the assumption *could* be violated is potentially much larger. There are two reasons for this: first, we should expect twins to influence each other vastly more than any two randomly chosen individuals from the study population. Second, in a discordant twin model (using the treatment analogy) one twin will always be the treated and one the untreated, meaning that this influence is "across" treatment conditions by definition. The implication, if this would in fact be a substantial issue, is that part or all of the effect size reduction between the naive and the within-pair models could be attributed to cotwin influence rather than a reduction in bias.

To investigate how concerning this problem is for our results, we used a subsample of the twins that have answered contact rate questionnaires (how often the twins are in contact with each other – here defined as number of days of the year that the twins report they are in contact). Modeling the interaction effect between the pair-wise contact rate and within-pair differences in the predictor on the within-pair difference in the outcome allows us to compare the average within-pair effect (corresponding to the within-

pair models, but with renormed outcomes), with within-pair effects conditional on zero contact. If independence violations are causing a substantial downward bias in the within-pair estimates, the effects conditional on zero contact should be larger. To rule out that differences are due to effect size heterogeneity across types of twins and not in fact due to independence violations, we also compare empty models with and without contact rate interactions.

The effects conditional on zero contact are generally roughly the same or somewhat higher, but none are significantly higher with the exception of IQ. The offset for the predictors that show higher average effects conditional on zero contact is in no case larger than the reductions found in Figure 2 in the main text, again with the exception of IQ. The conditional effect of IQ, however, is substantially higher than even the empty model results. The comparison with the empty contact models show that this is not likely due to effect size heterogeneity. These results in total suggest that the reduction in the within models may in some cases be moderately overestimated, and that particular caution should be taken when interpreting the results for IQ.

Table 12: Contact rate robustness check

Predictor	**Within, avg**	**Within, 0 cnt**	% **Empty, avg**	**Empty, 0 cnt**	%	
Education years	0.049	0.069	141.4%	0.118	0.122	103.2%
	(0.010)	(0.014)	(t=1.165)	(0.006)	(0.010)	(t=.313)
College	0.046	0.068	145.8%	0.108	0.115	106.8%
	(0.009)	(0.014)	(t=1.237)	(0.006)	(0.010)	(t=.625)
Gross wealth	0.054	0.084	155.0%	0.107	0.118	110.3%
	(0.013)	(0.019)	(t=1.284)	(0.007)	(0.014)	(t=.713)
Net wealth	0.040	0.053	134.2%	0.086	0.093	108.1%
	(0.009)	(0.013)	(t=.854)	(0.007)	(0.014)	(t=.445)
Work income	0.033	0.034	104.5%	0.092	0.095	103.8%
	(0.007)	(0.010)	(t=.124)	(0.006)	(0.012)	(t=.258)
Trust	0.034	0.034	101.2%	0.081	0.097	120.0%
	(0.006)	(0.010)	(t=.034)	(0.006)	(0.011)	(t=1.32)
Extraversion	0.040	0.057	142.2%	0.075	0.087	115.6%
	(0.008)	(0.013)	(t=1.112)	(0.007)	(0.013)	(t=.802)
Locus of control	0.039	0.035	92.0%	0.079	0.068	85.7%
	(0.008)	(0.013)	(t=-.201)	(0.007)	(0.014)	(t=-.727)
Risk preference	0.038	0.019	50.3%	0.085	0.076	90.3%
	(0.007)	(0.011)	(t=-1.386)	(0.007)	(0.012)	(t=-.592)
Antisocial att.	0.047	0.048	102.7%	0.063	0.066	103.6%
	(0.009)	(0.015)	(t=.073)	(0.008)	(0.015)	(t=.135)
Altruism	0.033	0.043	132.8%	0.035	0.021	60.2%
	(0.006)	(0.010)	(t=.93)	(0.005)	(0.010)	(t=-1.247)
Utilitarian	0.048	0.050	103.3%	0.046	0.052	111.2%
	(0.009)	(0.014)	(t=.095)	(0.009)	(0.016)	(t=.275)
IQ	0.091	0.150	165.1%	0.115	0.120	104.4%
	(0.017)	(0.025)	(t=1.934)	(0.009)	(0.016)	(t=.273)

Average beta coefficients with and without conditioning on zero contact. The % column contains the proportion of the remaining effect size when moving from zero contact to the average effect, in per cent.

Appendix C: additional datasets

To test the external validity of the naive models, a number of other datasets containing a sufficient number of similar political preference measures are used. More specifically, the types of preference items found in the SALTY survey can also be found in a variety of election studies. Here, we present results using election studies from (in descending order of items) Sweden, Norway, Denmark and Great Britain. Below, we outline the available preference items, and which items in the SALTY survey they have been matched to in the cases where they might differ (in many cases, the matched items are not identical but are rather intended to capture the same type of preference variation).

In all cases, almost all predictors of interest are missing in the election studies, but we have been able to test three: income, education years and college, and additionally a version of Trust in the Danish data. While this is a very small selection of predictors, it still allows us to tentatively evaluate the external validity of the overall results.

Note that the naive models are not the same as in the main results, since not all control variables could be matched to corresponding controls in the election studies. The naive models used are described below.

Swedish election study, 2010

The variables from the 2010 Swedish election study (Holmberg & Oscarsson 2017) that we have matched to items in the SALTY survey are the following:

1. Decrease the public sector
2. Decrease defense expenditures
3. Taxes should be cut
4. Sell state-owned companies to private buyers
5. Decrease economic inequality in society
6. Run more healthcare in the private sector

7. Lower maximum fees in childcare (match to *Keep maximum fees in childcare* in STR)
8. Increase economic assistance to the countryside
9. Legislate a six-hour work day
10. Ban all forms of pornography
11. Introduce much harder prison sentences for criminals
12. Sweden should abolish nuclear power in the long run
13. Increase labor market immigration to Sweden
14. Decrease foreign aid to developing countries
15. Take fewer refugees
16. Increase economic assistance to immigrants to preserve their native culture
17. Sweden should leave the EU
18. Sweden should adopt the euro as its currency
19. Sweden should apply for membership in NATO
20. Sweden should work for more free trade in the world
21. Cancel the Swedish UN mission to Afhanistan (matched to *Sweden should actively support the US war on terror* in STR)

All questions are answered on a 1–5 scale indicating "Very bad proposal" to "Very good proposal" with the middle option being a netrual "Neither good nor bad proposal."[7]

The control variables in the naive models that could be matched for the Swedish election study are (except for education years and income that also act as predictors), occupational codes and municipal fixed effects.

[7]Note that due to the standardization by absolute values of coefficients in the empty models, the fact that some items are inversely coded makes no difference to the results.

Table 13: Comparison results, Swedish election study

Predictor	STR **Empty**	STR **Naive**	STR **Naive, rn**	STR **Within**	%1	%2	SES **Empty**	SES **Naive**	Δ
Edu. yrs	0.138	0.106	0.109	0.040	76.8%	37.1%	0.140	0.082	58.3%
	(0.008)	(0.012)	(0.01)	(0.017)	(t=-2.215)	(t=-3.318)	(0.010)	(0.013)	(t=-3.537)
College	0.126	0.088	0.090	0.032	70.2%	35.2%	0.139	0.080	57.7%
	(0.008)	(0.011)	(0.01)	(0.015)	(t=-2.844)	(t=-3.211)	(0.010)	(0.012)	(t=-3.726)
Work inc.	0.103	0.043	0.056	0.018	41.7%	31.8%	0.136	0.077	56.7%
	(0.009)	(0.012)	(0.01)	(0.013)	(t=-4.038)	(t=-2.246)	(0.013)	(0.017)	(t=-2.713)

Averages of beta coefficients for 21 shared political issue variables.

Norwegian election study, 2009

The variables from the 2009 Norwegian election study[8] that we have matched to items in the SALTY survey are the following:

1. Norways aid to developing countries [cut/increase] (matched to *Decrease foreign aid to developing countries*)
2. Too little emphasis on environmental protection (matched to *Invest more in preventing environmental degradation*)
3. Open for considerable reductions of duties in taxes (matched to *Taxes should be cut*)
4. Banks and industry have too much influence (matched to *Decrease the influence of financial markets in politics*)
5. Norwegian immigration policy [less strict/stricter] (matched to *Take fewer refugees*)
6. EU membership [should/should not become member] (matched to *Sweden should leave the EU*)
7. Climate change [is not/is a major problem] (matched to *Decrease carbon emissions*)
8. Reduce economic differences (matched to *Decrease economic inequalities in society*)
9. Strenghen the Norwegian Armed Forces (matched to *Decrease defense expenditures*)
10. Attitudes towards abortion (matched to *Limit the right to free abortion*)
11. Allow commercial private schools (matched to *More support for free schools*)

[8]The data are provided by Statistics Norway (SSB), and prepared and made available by the Norwegian Social Science Data Services (NSD). Prof. Bernt Aardal and the Institute of Social Research (ISF) were responsible for the original study and Statistics Norway collected the data. Neither Bernt Aardal, ISF, SSB nor NSD are responsible for the analyses/interpretation of the data presented here.

Table 14: Comparison results, Norwegian election study

Predictor	STR **Empty**	STR **Naive**	STR **Naive, rn**	STR **Within**	%1	%2	NES **Empty**	NES **Naive**	Δ
Edu. yrs	0.116	0.090	0.095	0.034	77.7%	36.1%	0.153	0.131	85.5%
	(0.008)	(0.013)	(0.011)	(0.016)	(t=-1.701)	(t=-3.073)	(0.010)	(0.013)	(t=-1.36)
College	0.106	0.075	0.075	0.034	71.2%	45.6%	0.143	0.126	87.8%
	(0.008)	(0.012)	(0.012)	(0.016)	(t=-2.146)	(t=-2.056)	(0.010)	(0.013)	(t=-1.073)
Work inc.	0.080	0.044	0.056	0.003	55.1%	4.5%	0.086	0.065	75.5%
	(0.008)	(0.011)	(0.013)	(0.016)	(t=-2.689)	(t=-2.627)	(0.008)	(0.009)	(t=-1.732)

Averages of beta coefficients for 14 shared political issue variables (standardized by positive sign in the empty model).

12. Reduce control over private industry (matched to *Give companies more freedom*)
13. Public activities better done by private sector (matched to *Sell state-owned companies to private buyers*)
14. Social security schemes [cut/increase] (matched to *Decrease social welfare*)

The control variables in the naive models that could be matched for the Norwegian election study are (except for education years and income that also act as predictors), occupational codes and municipal fixed effects.

Danish election study, 2007

The variables from the 2007 Danish election study (Stubager et al. 2020) that we have matched to items in the SALTY survey are the following:

1. Decrease the public sector
2. Decrease defense expenditures
3. Decrease economic inequality
4. Increase private healthcare
5. Fewer refugees
6. Lower taxes
7. Environmentally friendly society (matched to *Invest more in preventing environmental degradation*)
8. State control over companies (matched to *More freedom for companies*)

Table 15: Comparison results, Danish election study

Predictor	STR **Empty**	STR **Naive**	STR **Naive, rn**	STR **Within**	%1	%2	DES **Empty**	DES **Naive**	Δ
Edu. yrs	0.156	0.124	0.129	0.039	79.5%	30.6%	0.103	0.093	90.1%
	(0.009)	(0.014)	(0.013)	(0.019)	(t=-1.961)	(t=-3.827)	(0.007)	(0.007)	(t=-1.023)
College	0.143	0.043	0.048	0.014	29.8%	29.3%	0.100	0.051	50.7%
	(0.009)	(0.019)	(0.020)	(0.025)	(t=-4.864)	(t=-1.066)	(0.007)	(0.014)	(t=-3.27)
Work inc.	0.094	0.032	0.052	-0.002	34.0%	-4.1%	0.105	0.092	88.0%
	(0.010)	(0.013)	(0.012)	(0.015)	(t=-3.889)	(t=-2.893)	(0.007)	(0.008)	(t=-1.2)
Trust	0.111	0.079	0.082	-0.005	71.4%	-6.6%	0.083	0.068	81.9%
	(0.010)	(0.011)	(0.011)	(0.014)	(t=-2.169)	(t=-4.782)	(0.006)	(0.006)	(t=-1.757)

Averages of beta coefficients for 13 shared political issue variables (standardized by positive sign in the empty model).

9. Aid expenditures
10. Harder punishment for violent criminals
11. Sending Danish soldiers to armed conflicts (matched to *Sweden should actively support the US war on terror*)
12. Import labor migrants (matched to *Increase labor market immigration to Sweden*)
13. Attitude towards EU (matched to *Sweden should leave the EU*)

The control variables in the naive models that could be matched for the Danish election study are (except for education years and income that also act as predictors), occupational codes (though in these data the occupational codes more closely resemble SES) and municipal fixed effects.

British election study, 2015

The variables from the 2015 British election study (Fieldhouse et al. 2015) that we have matched to items in the SALTY survey are the following:

1. Cuts to public spending have gone too far (matched to *Decrease the public sector*)
2. Private companies running public services have gone too far (matched to *Sell state-owned companies to private buyers*)

Table 16: Comparison results, British election study

Predictor	STR **Empty**	STR **Naive**	STR **Naive, rn**	STR **Within**	%1	%2	BES **Empty**	BES **Naive**	Δ
Edu. yrs	0.126	0.103	0.103	0.034	81.6%	32.6%	0.143	0.119	83.4%
	(0.009)	(0.014)	(0.014)	(0.021)	(t=-1.408)	(t=-2.774)	(0.003)	(0.004)	(t=-4.488)
College	0.120	0.086	0.086	0.052	71.5%	60.2%	0.132	0.130	97.8%
	(0.010)	(0.014)	(0.014)	(0.019)	(t=-2.009)	(t=-1.437)	(0.006)	(0.006)	(t=-.346)
Work inc.	0.093	0.044	0.061	0.019	47.7%	30.5%	0.117	0.112	95.9%
	(0.010)	(0.013)	(0.013)	(0.016)	(t=-2.879)	(t=-2.094)	(0.004)	(0.005)	(t=-.759)

Averages of beta coefficients for 8 shared political issue variables (standardized by positive sign in the empty model).

3. Opinion on how to reduce deficit [increasing taxes/cutting spending] (matched to *Taxes should be cut*)

4. Measures to protect the environment have gone too far (matched to *Invest more in preventing environmental degradation*)

5. Should immigration level increase/decrease? (matched to *Take fewer refugees*)

6. Redistribution scale, self (mathed to *Decrease income inequalities in society*)

7. Vote intention on EU membership (matched to *Sweden should leave the EU*)

8. Too many people rely on government handouts (matched to *Decrease social welfare*)

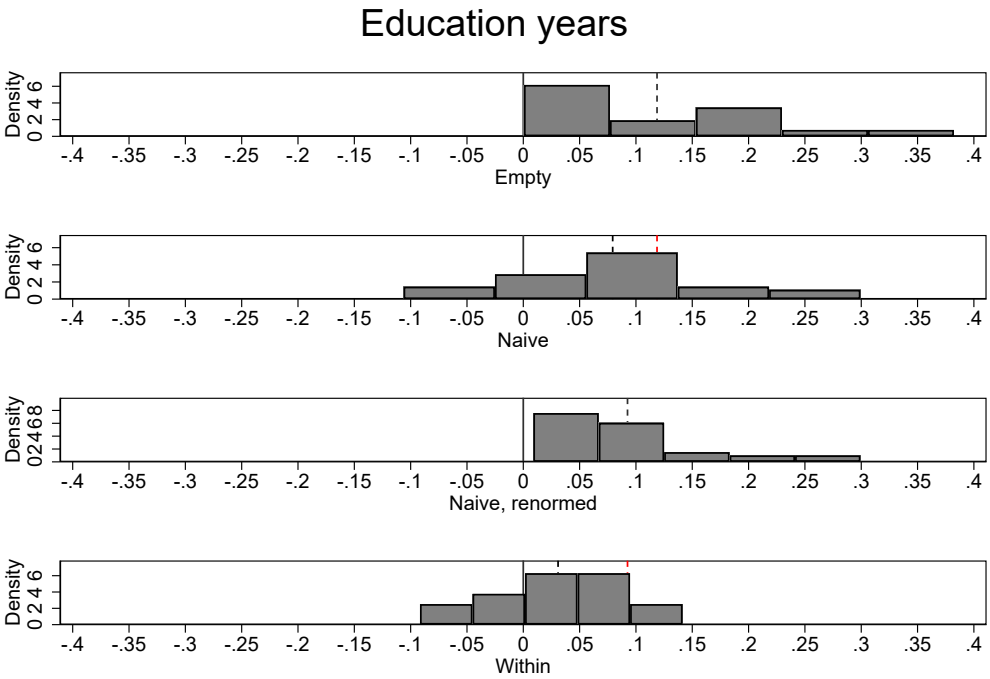
The control variables in the naive models that could be matched for the Swedish election study are (except for education years and income that also act as predictors), occupational codes and municipal (regional) fixed effects.

Appendix D: effect distributions and p-curves

This section contains histograms of the effect size distributions in each of the models for each predictor. The general decrease in effect sizes in the within-pair models should be taken to suggest that naive estimates of the effects sizes are inflated, but does not imply that there are no effects of the included predictors on political preferences. Looking only at unadjusted significant results is going to be misleading due to multiple comparisons issues (and because of the winners curse problem), but one way of assessing whether there is likely to be any remaining effect is to inspect the p-curves for each of the predictors. Under the "general' null hypothesis that the independent variable has zero effect on *all* of the preference measures, the p-curve of all the 34 tests should be uniformly distributed.

Therefore, we've also included p-curves for the within-pair models along with Kolmogorov-Smirnov test statistics comparing each curve to the uniform distribution below. For several predictors, the general null hypothesis of a uniform distribution of p-values can be rejected at the 95% level (college, extraversion, locus of control, wealth and antisocial attitudes) indicating that even in the within-models we find significant effects for these more often than would be expected by random chance. For the other predictors, caution is warranted since the test is underpowered with only 34 observations. This means that it is possible that several other predictors also in fact deviate from the general null, but the number of tests is too small to detect this overall pattern.

Figure 1: Effect size distributions, education years



Black dashed lines are means; red dashed lines are means from model above

Figure 2: P-curve, education years

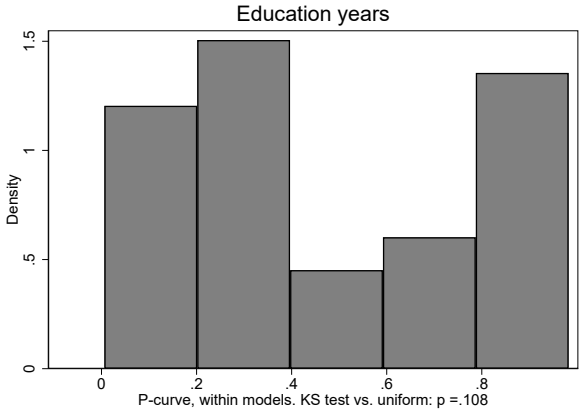
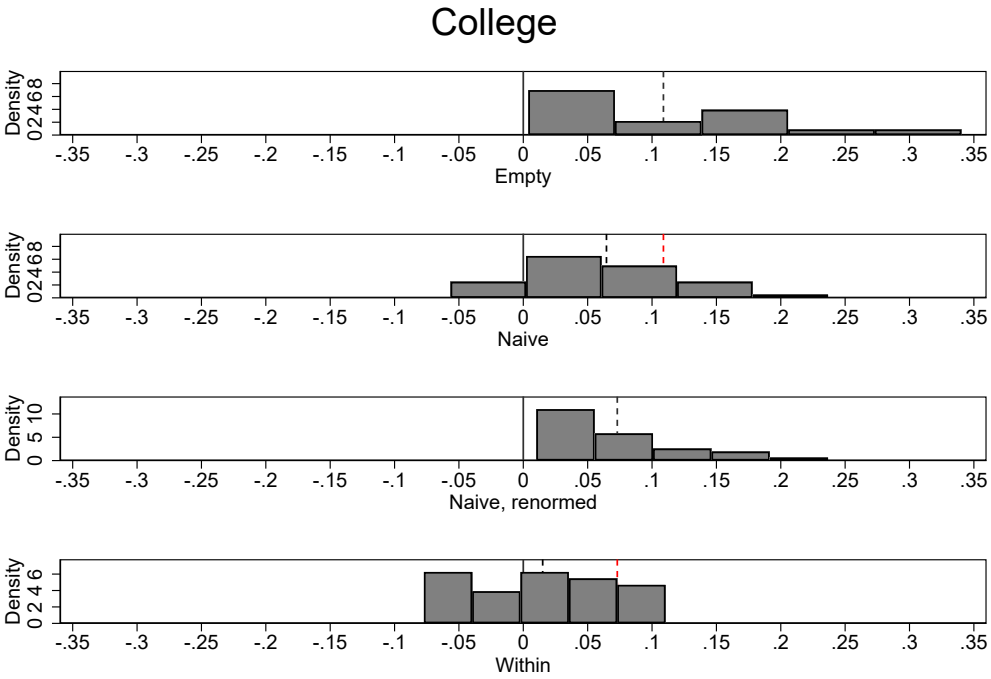


Figure 3: Effect size distributions, college



Black dashed lines are means; red dashed lines are means from model above

Figure 4: P-curve, college

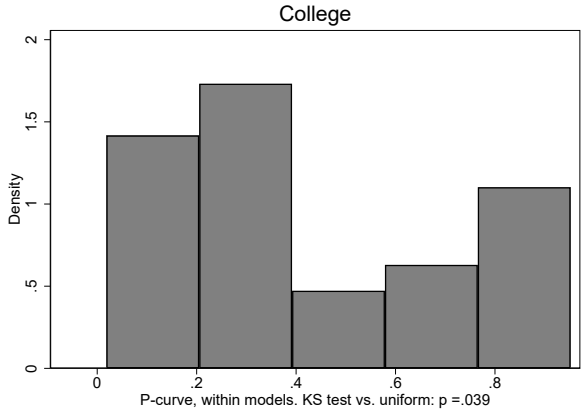
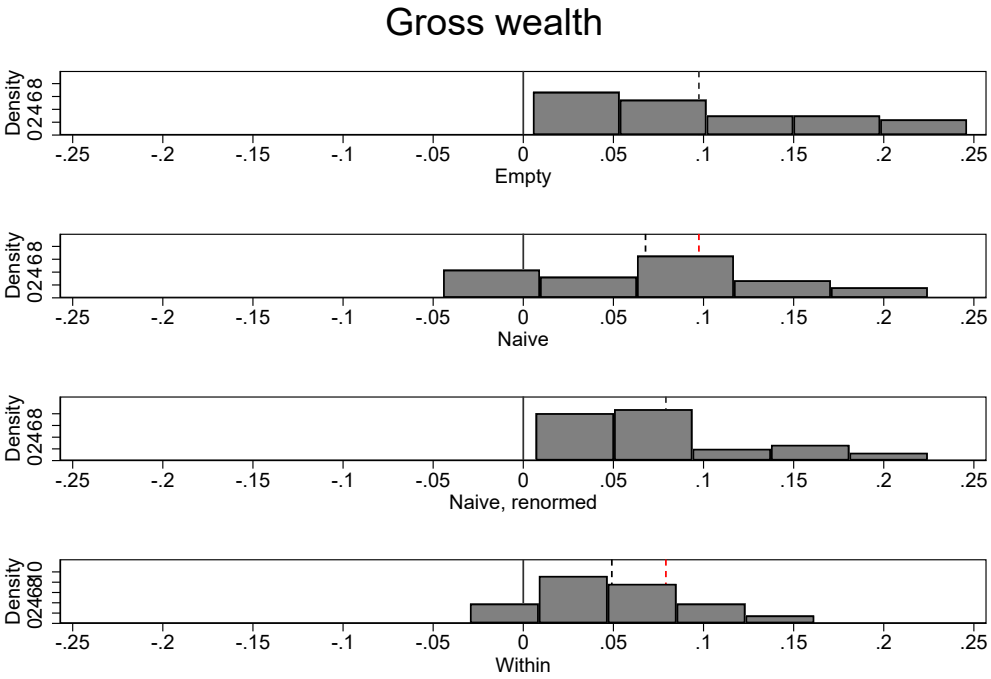


Figure 5: Effect size distributions, gross wealth



Black dashed lines are means; red dashed lines are means from model above

Figure 6: P-curve, gross wealth

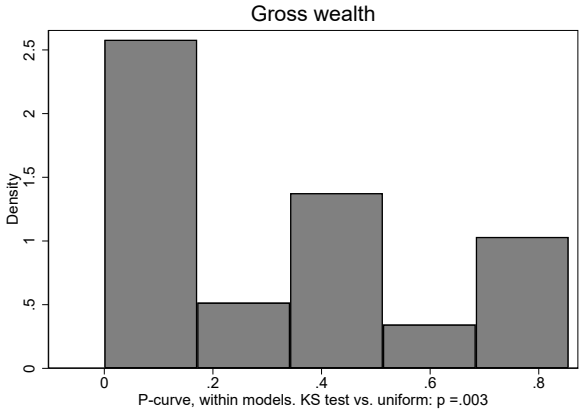
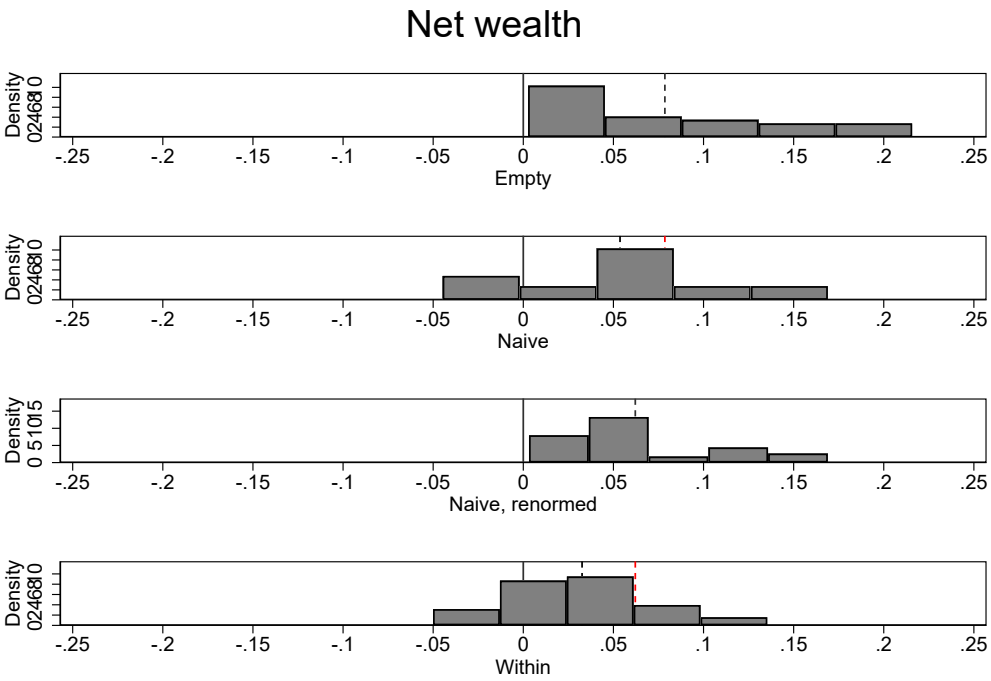


Figure 7: Effect size distributions, net wealth



Black dashed lines are means; red dashed lines are means from model above

Figure 8: P-curve, net wealth

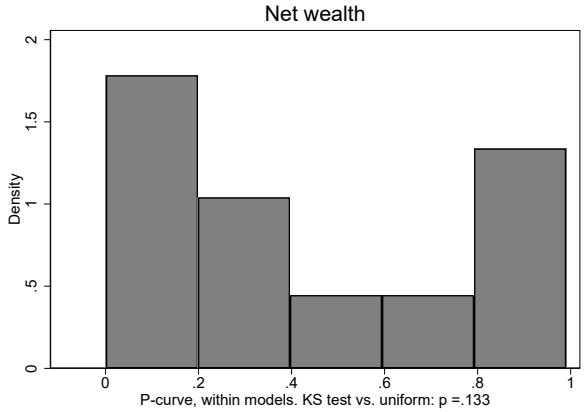
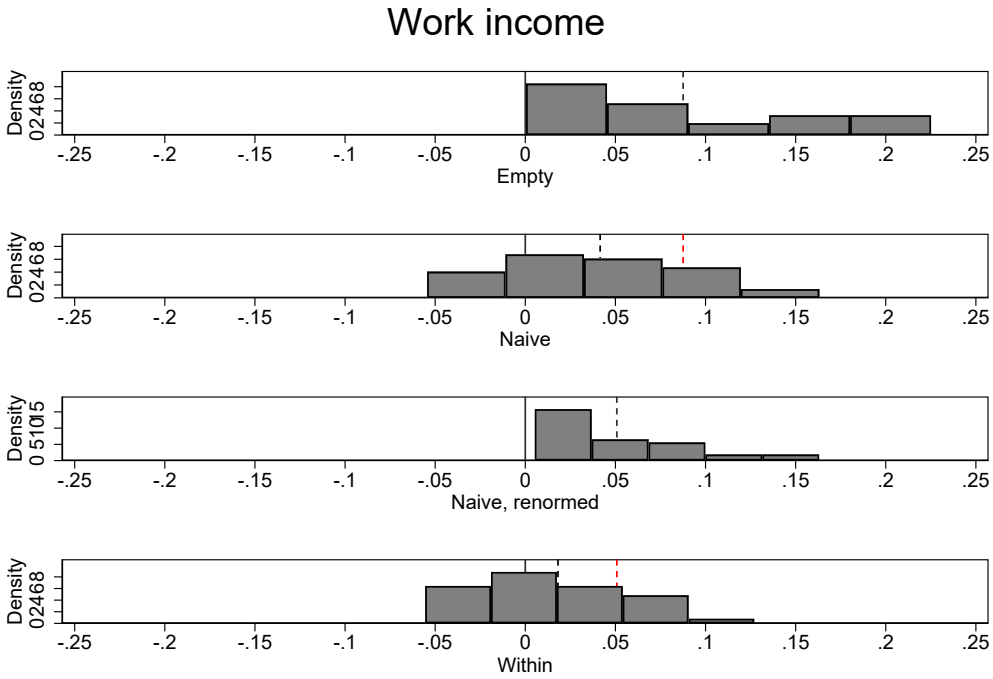


Figure 9: Effect size distributions, work income



Black dashed lines are means; red dashed lines are means from model above

Figure 10: P-curve, work income

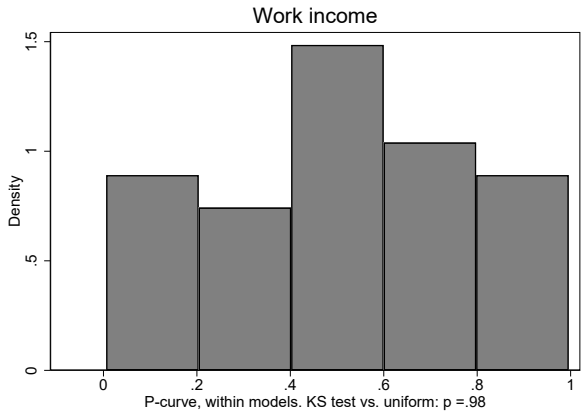
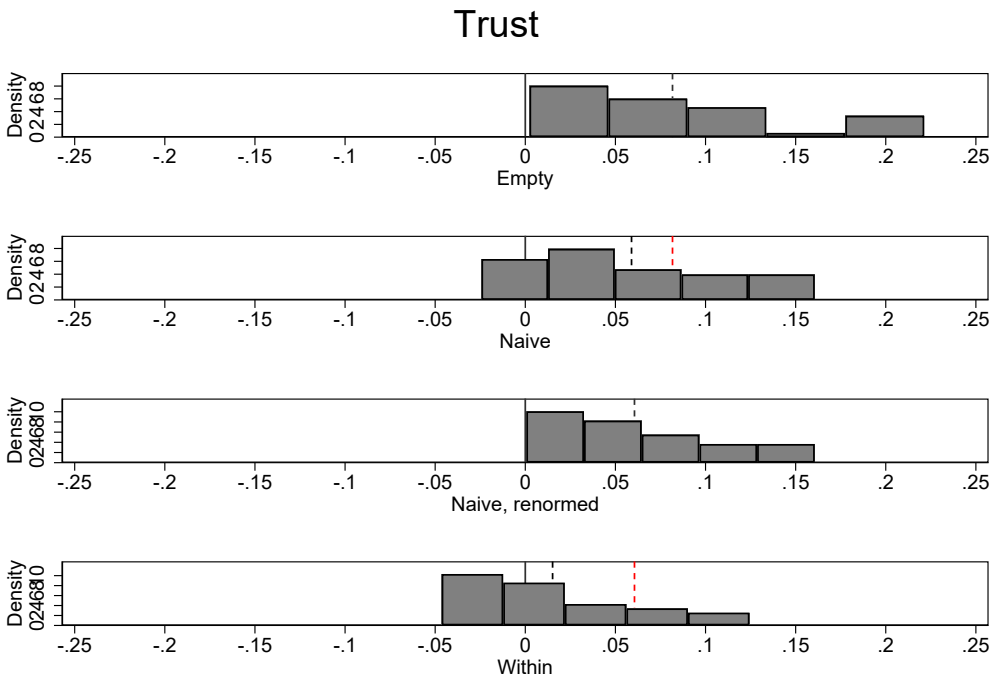


Figure 11: Effect size distributions, trust



Black dashed lines are means; red dashed lines are means from model above

Figure 12: P-curve, trust

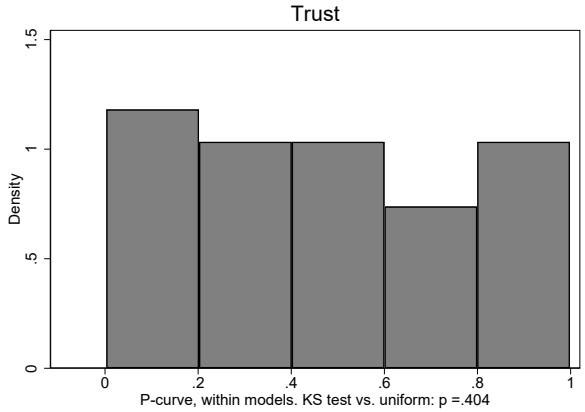
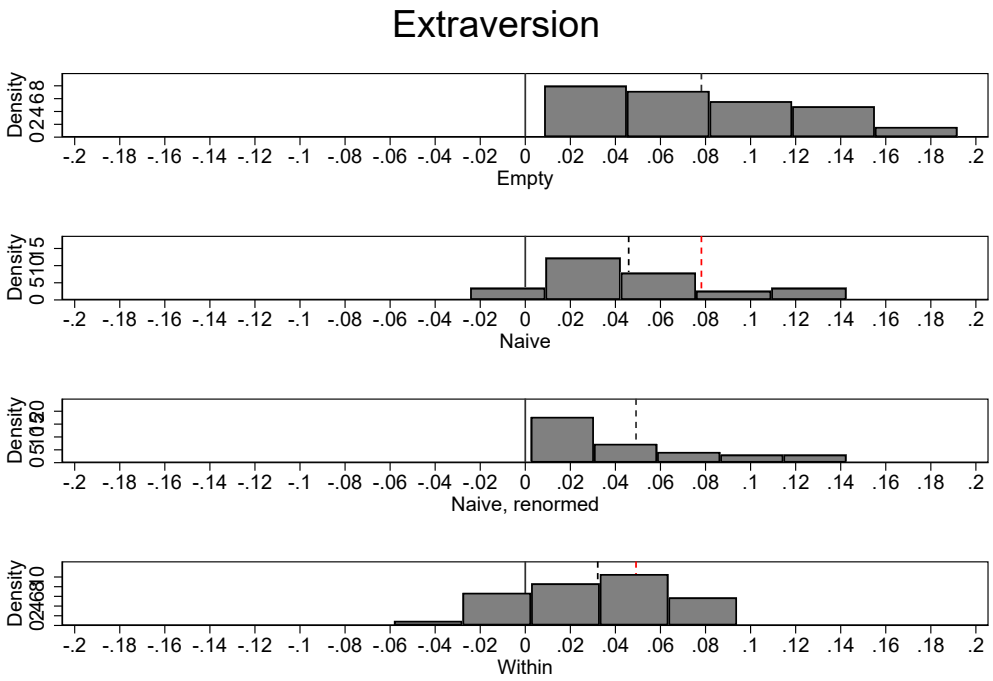


Figure 13: Effect size distributions, extraversion



Black dashed lines are means; red dashed lines are means from model above

Figure 14: P-curve, extraversion

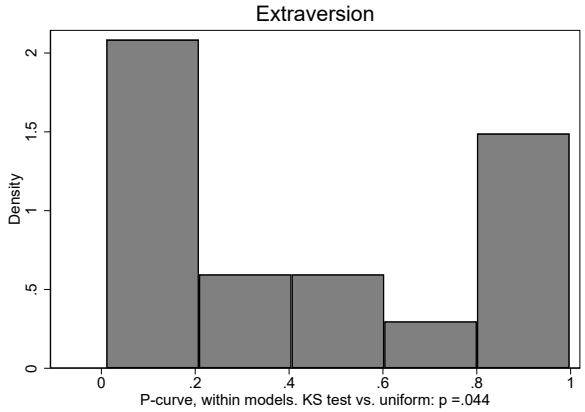
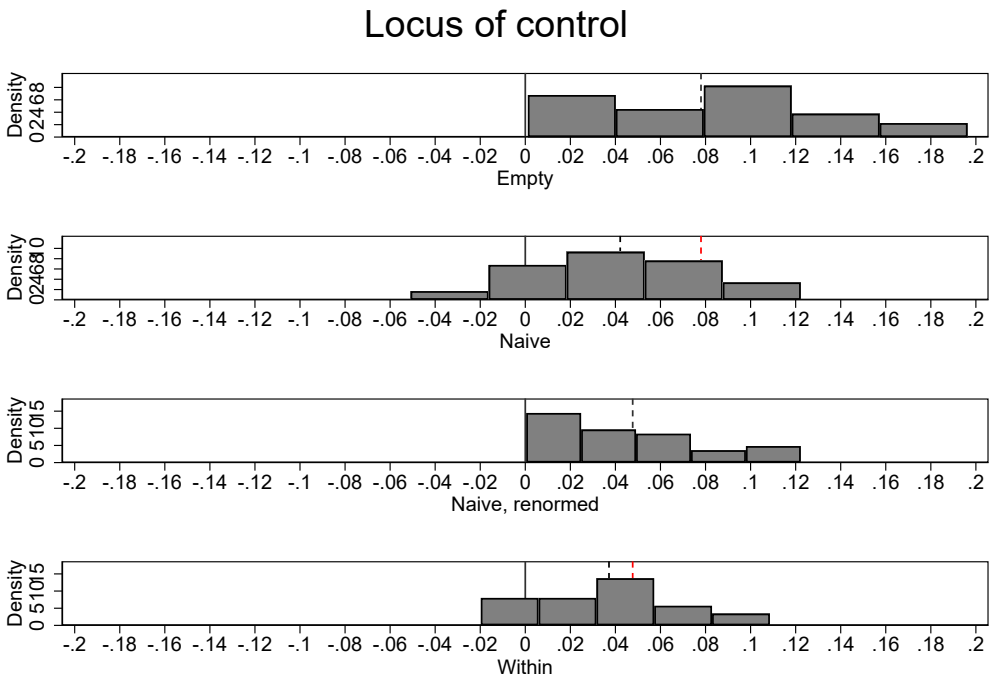


Figure 15: Effect size distributions, locus of control



Black dashed lines are means; red dashed lines are means from model above

Figure 16: P-curve, locus of control

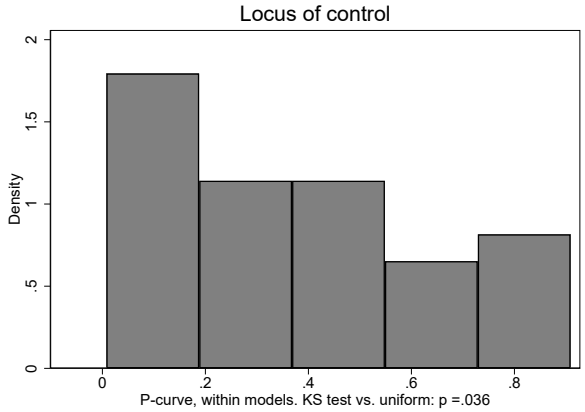
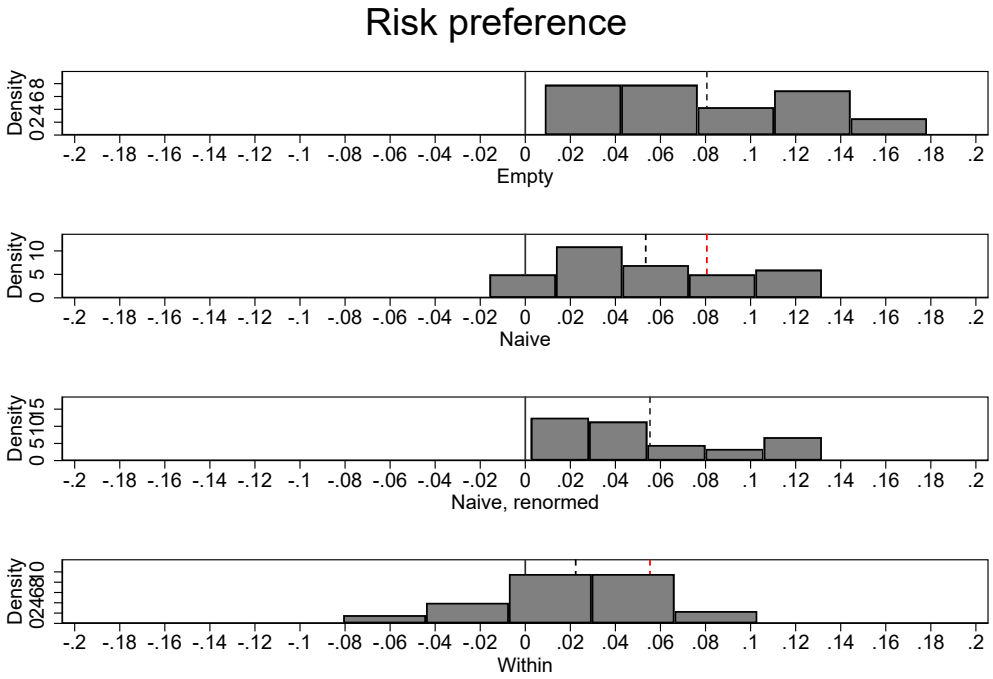


Figure 17: Effect size distributions, risk preference



Black dashed lines are means; red dashed lines are means from model above

Figure 18: P-curve, risk preference

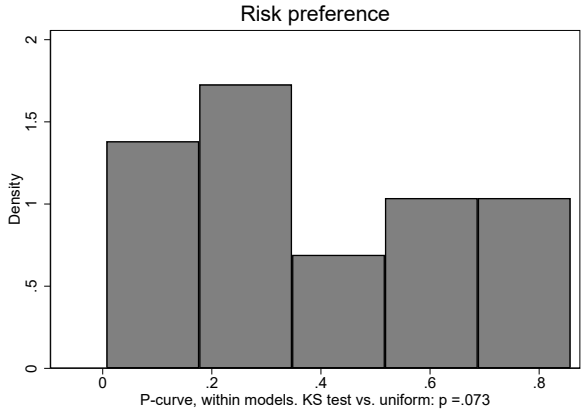


Figure 19: Effect size distributions, antisocial attitudes

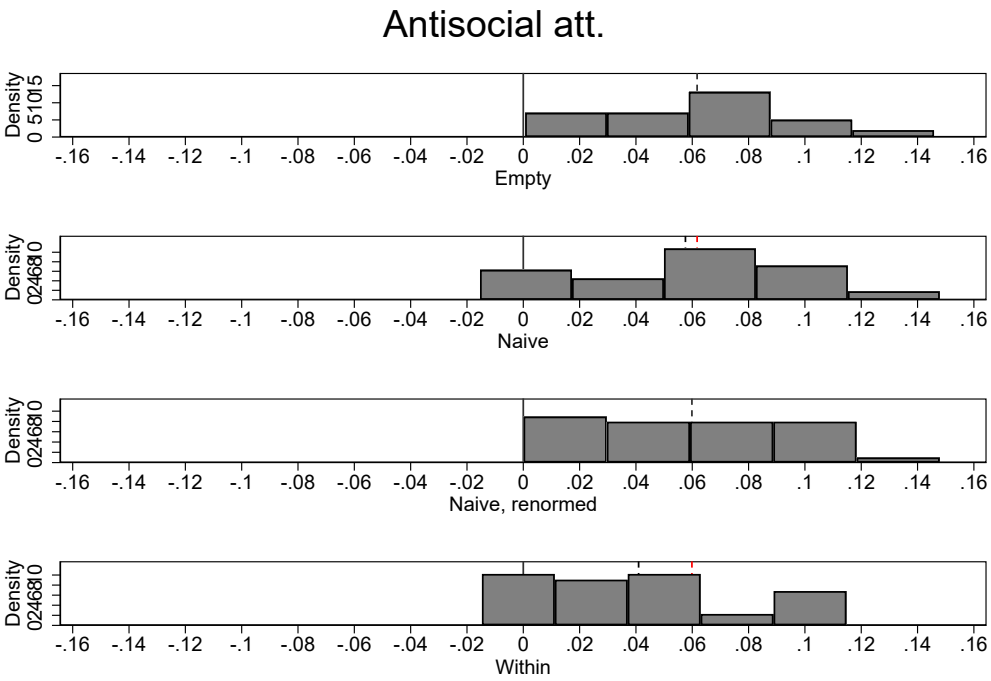


Figure 20: P-curve, antisocial attitudes

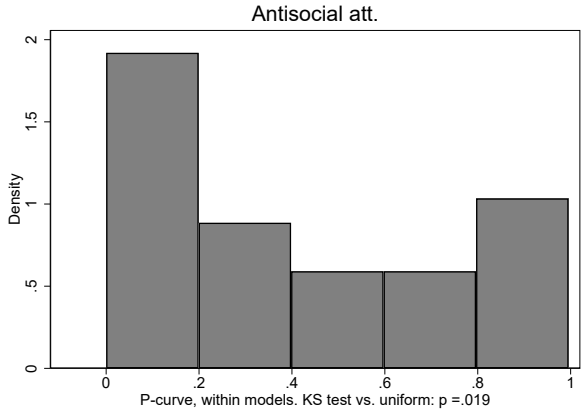
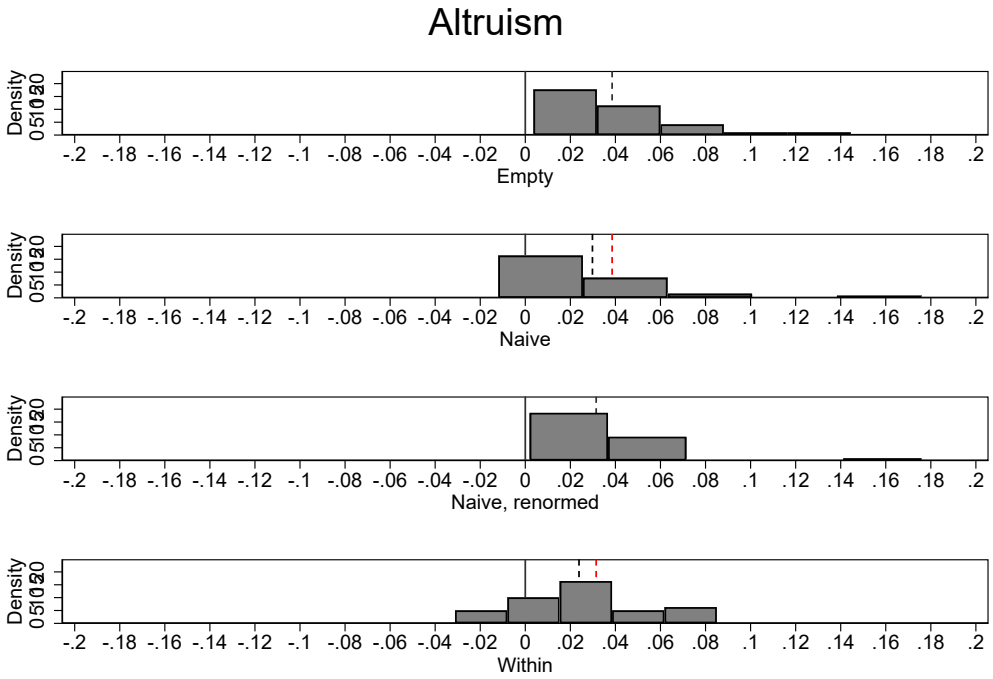


Figure 21: Effect size distributions, altruism



Black dashed lines are means; red dashed lines are means from model above

Figure 22: P-curve, altruism

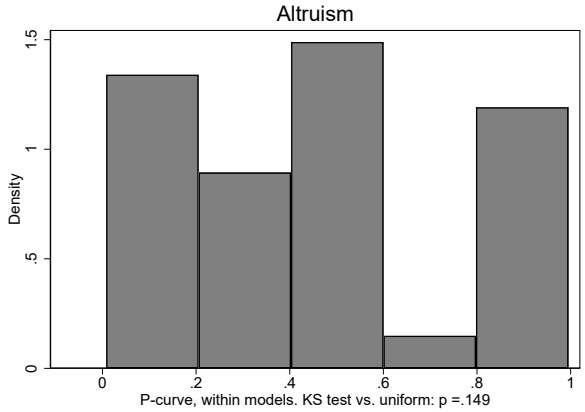
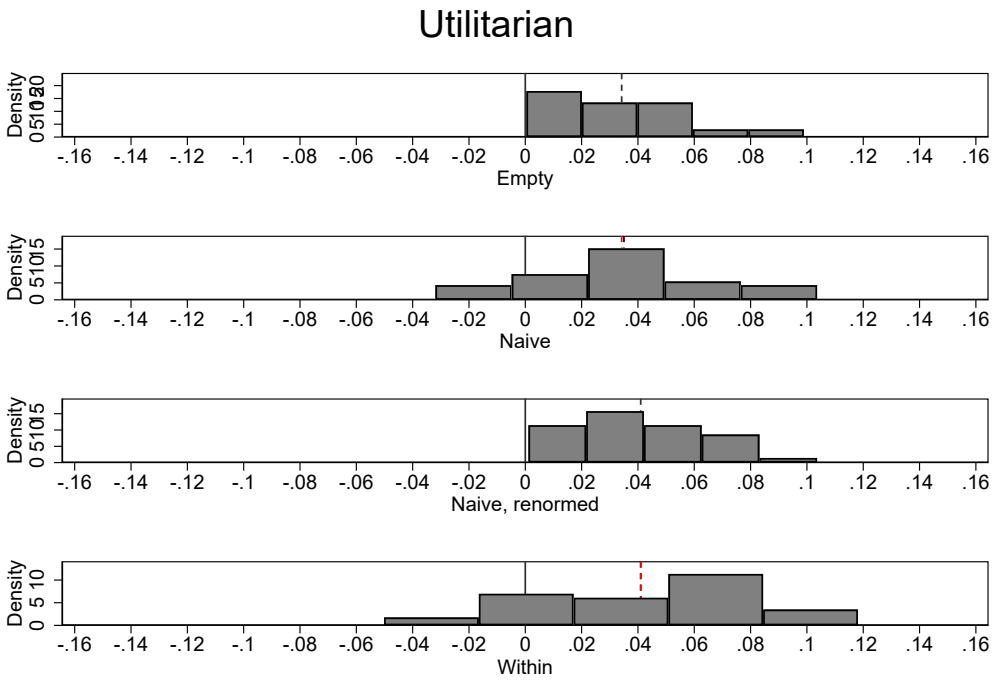


Figure 23: Effect size distributions, utilitarianism



Black dashed lines are means; red dashed lines are means from model above

Figure 24: P-curve, utilitarianism

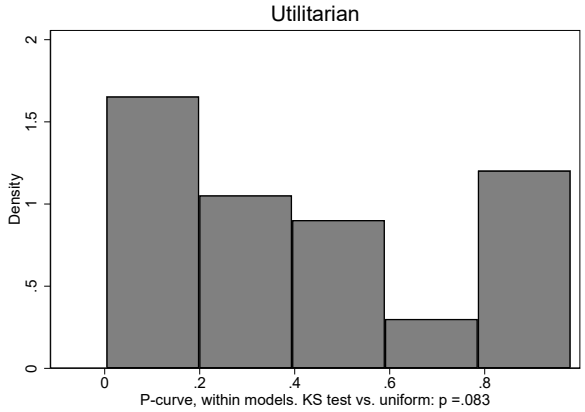
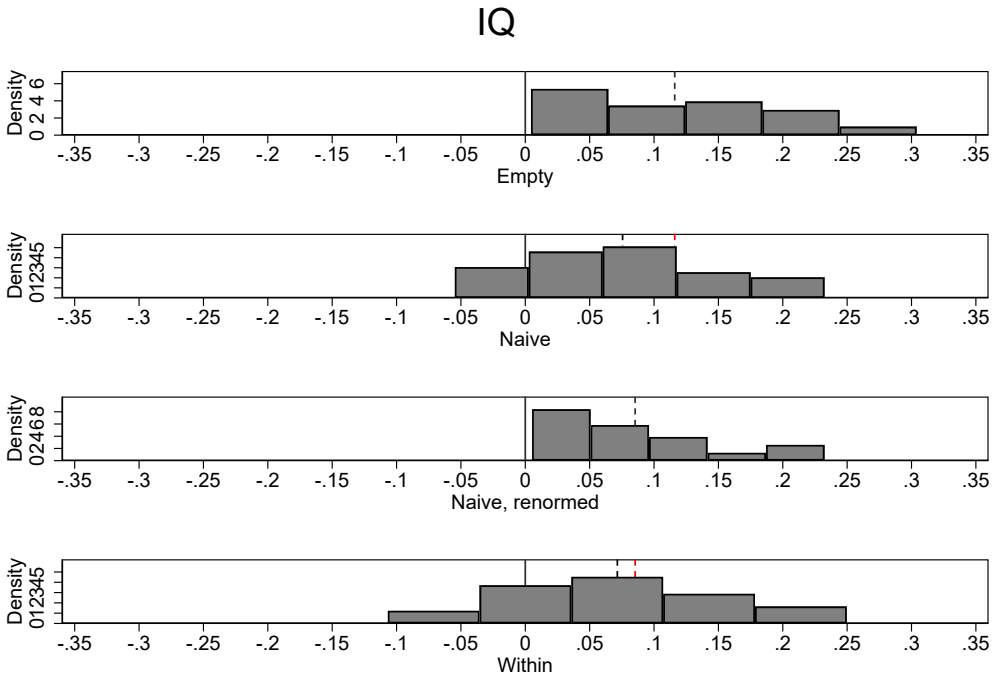
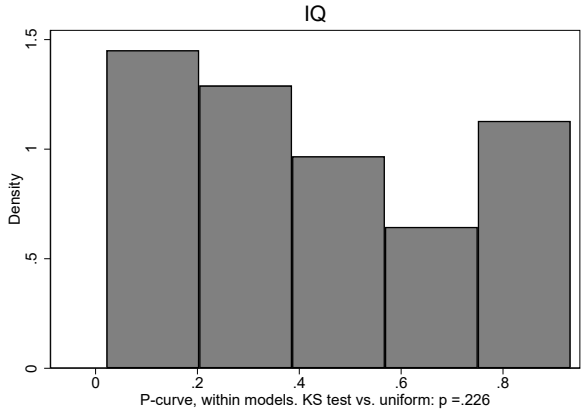


Figure 25: Effect size distributions, IQ



Black dashed lines are means; red dashed lines are means from model above

Figure 26: P-curve, IQ



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