Are Economists’ Preferences Psychologists’ Personality Traits? A Structural Approach

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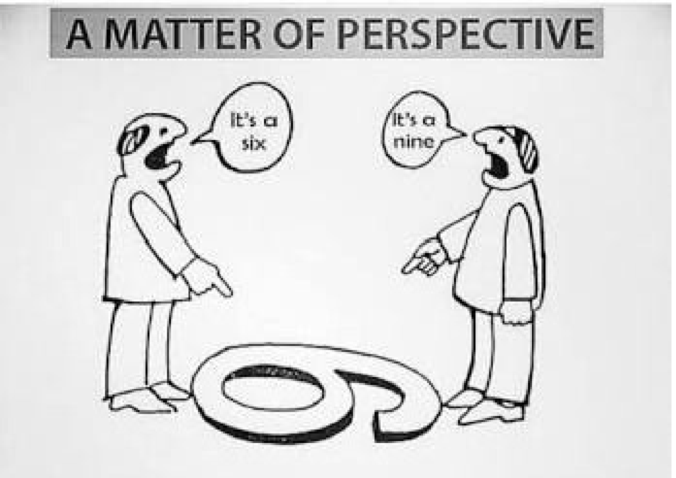
June 2024 Journal club by Helena Luo



TITLE	CITED BY	YEAR
Some contributions of economics to the study of personality JJ Heckman, T Jagelka, TD Kautz Handbook of Personality: Theory and Research 4 (w26459)	125 *	2021
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Bilateral trade and the Eurozone: Evidence from new member countries T Jagelka The World Economy 36 (1), 48-63	17	2013
Accounting for Individual-Specific Reliability of Self-Assessed Measures of Economic Preferences and Personality Traits T Dohmen, T Jagelka Journal of Political Economy Microeconomics	5	2024
Preferences, Ability, and Personality: Understanding Decision-making Under Risk and Delay T Jagelka Université Paris-Saclay (ComUE)		2019
The Specificity of Human Capital Investment under Agent Heterogeneity and Market Frictions: Theory and Empirics T Jagelka LIS Working Paper Series		2017

What do you think the relationship is?

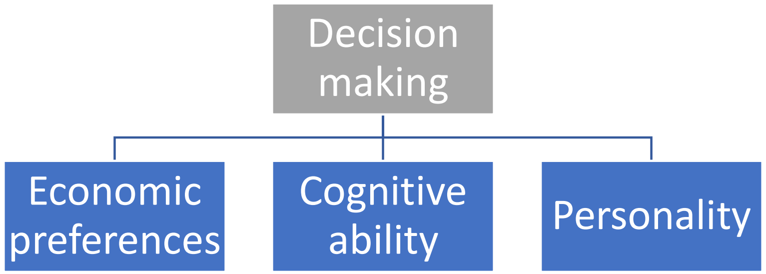
Decision making

Economic preferences

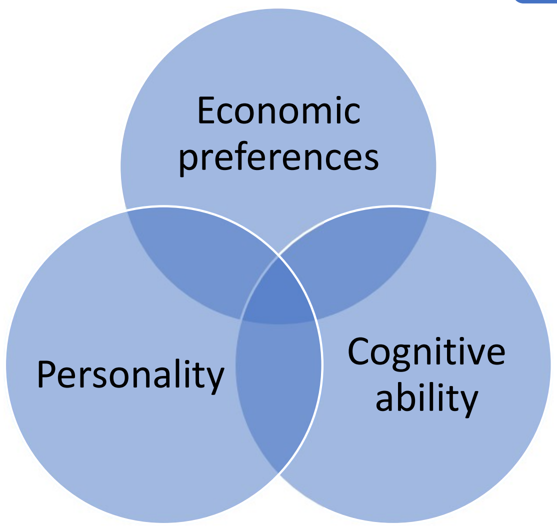
Cognitive ability

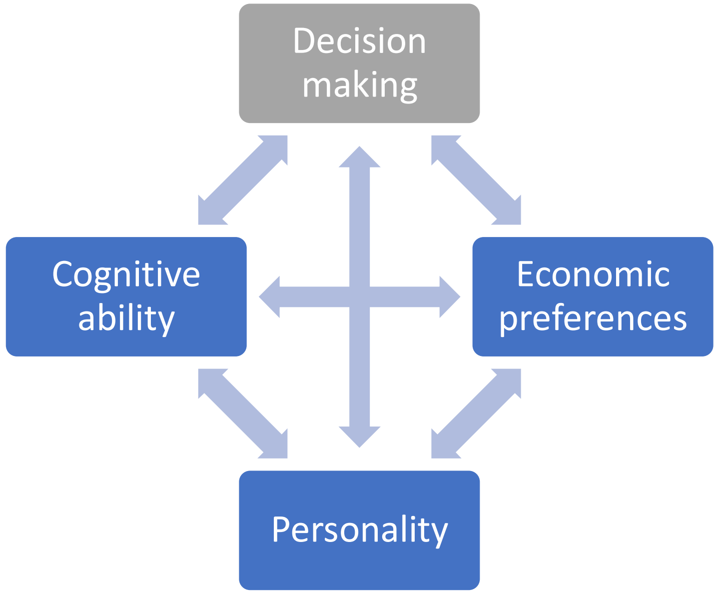
Personality

Relationship between economic preferences, cognitive ability, and personality?



Side by side?





Work through one another?

I propose a method for mapping psychological personality traits to economic preferences. I use factor analysis to extract information on individuals' cognitive ability and personality and embed it within a random preference model to estimate distributions of risk and time preferences and parameters related to choice inconsistency. I explain up to 60% of variation in average risk and time preferences and individuals' capacity to make consistent choices using factors related to cognitive ability and three of the Big Five personality traits. Differences in preferred outcomes are related to personality, whereas mistakes in decisions are related to cognitive skill.

Heterogeneity in preferences

Economic preferences

- Risk aversion
- Discount rate
- Instability in risk aversion
- Instability in discount rate
- Mistakes process

Psychological measures

- Cognitive ability
- Extraversion
- Conscientiousness
- Emotional stability

Characterising “essential human differences” in choices

Key dimensions to characterise essential human differences:

1. Empirical foundation for comprehensive behavioral decision-making theories (Dean and Ortoleva 2019 & Chapman et al. 2023)

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The empirical r
economic beha

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Edited by Shengwu Li, Harvard University, C
December 14, 2018)

We study the joint distribution of 1
a group of 190 laboratory subjects
dictions of existing models as a ste
parsimonious, general model of econ
correlations between most measures
between compound lottery and ambi
loss aversion and the endowment
some, but not all attempts to unify
nomena. Overconfidence and gender
behavioral characteristics.

I. Introduction

Decades of research in economics and psychology has identified a large number of behavioral regularities—specific patterns of behavior present in the choices of a large fraction of decision-makers—that run counter to the standard model of economic decision-making. This has led to an enormous amount of research aimed at understanding each of these behaviors. However, significantly less work has gone into linking these regularities with each other, either theoretically or empirically. Instead, most regularities have been studied in isolation, with specific models developed for each one. This has led to concerns about model proliferation in behavioral economics.[1] As Fudenberg (2006, 698) notes, "[B]efore behavioral theory can be integrated into mainstream economics, the many assumptions that underlie its various models should eventually be reduced to the implications of a smaller set of more primitive assumptions."

In this paper, we study the pattern of correlations across a large number of behavioral regularities, with the goal of creating an empirical basis for more comprehensive theories of decision-making. We use an incentivized survey to elicit 21 behaviors from a representative sample of the US population (n = 1,000). These *econographics*—a neologism describing measures of trait-like behaviors related to economic decision-making—cover broad areas of social preferences (eight measures), attitudes toward risk and uncertainty (nine measures), overconfidence (three measures), and time preferences (one measure). Whenever possible, our elicitations

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ue (Gillen,

	Social Components			Risk Components			
Components	*Generosity*	*Punishment (Impulsivity)*	*Inequality Aversion/WTP*		*WTA*	*Uncertainty*	*Overconfidence*
Econographics	Reciprocity: High	Anti-social Punishment	Dislike Having More	WTP	WTA	Ambiguity Aversion	Overestimation
	Reciprocity: Low	Pro-social Punishment	Dislike Having Less	Risk Aversion: CR Certain	Risk Aversion: Gains	Compound Lottery Aversion	Overplacement
	Altruism	(Patience)		Risk Aversion: CR Lottery	Risk Aversion: Losses		Overprecision
	Trust		Components combine in joint analysis		Risk Aversion: Gain/Loss		

Econographics

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We study the pattern of correlations across a large number of behavioral regularities, with the goal of creating an empirical basis for more comprehensive theories of decision-making. We elicit 21 behaviors, using an incentivized survey on a representative sample (n = 1,000) of the US population. Our data show a clear and relatively simple structure underlying the correlations between these measures. Using principal components analysis, we reduce the 21 variables to six components corresponding to clear clusters of high correlations. We examine the relationship between these components, cognitive ability, and demographics. Common extant theories are not compatible with all the patterns in our data.

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Characterising "essential human differences" in choices, *personality and preferences*?

Schildberg-Hörisch (2017, 1) note that "research on preferences and personality traits is a blossoming field in economic and psychological science. Economic preferences and personality traits are related concepts in the sense that both are characteristics of an individual that have been shown to predict individual decision making and life outcomes across a wide variety of domains."

Despite the "intuitive mapping of preferences to traits, the empirical evidence supporting such mappings is weak. The few studies investigating empirical links typically report only simple regressions or correlations without discussing any underlying model" (Almlund et al. 2011, 70).[7] This paper is the first attempt to establish such a mapping in a full structural framework of decision-making under risk and delay.

Found strong relationship using fancy methods

- Factor model embedded within a full structural model of decision-making rather than correlational averages
  - Reducing attenuation bias (measurement errors that usually underestimates strength of relationships)
  - Reducing decision error bias (inconsistencies in decision-making that reduces the accuracy of estimates of the relationship)

Key dimensions to characterise essential human differences:

1. Empirical foundation for comprehensive behavioral decision-making theories (Dean and Ortoleva 2019 & Chapman et al. 2023)
2. Summarise various documented behavioral tendencies into simpler measures:
   - Sufficient statistic (e.g., Chetty 2015)
   - Sparsity model (e.g., Gabaix 2014)
   - B-counts (e.g. Stango and Zinman 2023)

How to model inconsistency in repeated choices (random choice model)

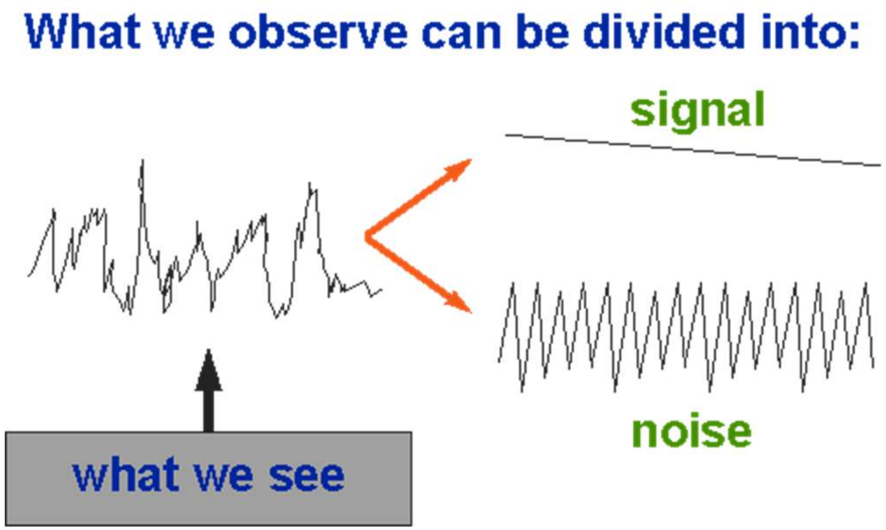
	aRUM (Random Utility Model with Additive independent and identically distributed errors)	**RPM (Random Preference Model)**
Where error is added	Add error to utility	Add error to preference parameter
Choose x	$U_{\omega}(x) + \epsilon(x)$ is greater than $U_{\omega}(y) + \epsilon(y)$	$U_{\omega+\epsilon}(x)$ is greater than $U_{\omega+\epsilon}(y)$
Probability of choosing x	$e^{\lambda U_{\omega}^{\text{crra}}(x)} / [e^{\lambda U_{\omega}^{\text{crra}}(x)} + e^{\lambda U_{\omega}^{\text{crra}}(y)}]$ *CRRA: constant relative risk aversion*	$U_{\omega^{(x,y)}}^{\text{crra}}(x) = U_{\omega^{(x,y)}}^{\text{crra}}(y)$ $e^{\lambda \omega^{(x,y)}} / [e^{\lambda \omega^{(x,y)}} + e^{\lambda \omega}]$

Apesteguia, J., & Ballester, M. A. (2018). Monotone stochastic choice models: The case of risk and time preferences. *Journal of Political Economy*, *126*(1), 74-106.

Random choice model (where to place the error)

	aRUM (add error to utility)	**RPM (add error to preference parameter)**
Part of utility function subject to randomness?	Agnostic	Assumption
Separate choice inconsistency?	Does not separate (can explain lots of types of inconsistencies)	Separate (produce distinct patterns/channels of choice inconsistency)
Closed-form choice probabilities?	Easy to derive	Hard to estimate (no general closed-form and requires simulation for estimation)
Dominated options?	Able to explain	Need to pair with a tremble parameter (for "processing error")
Monotonicity?	Breaks for high risk aversion	Okay for high risk aversion
Use?	Largely favored by experimentalists doing structural research	Newer kid on the block

Separating signal from noise in observed measures



- Improves on imperfect self knowledge/preference stability/ measurement error, decision error

Empirical evidence on the inherent randomness of choices may seem at odds with the existence of enduring traits and preferences that predict life outcomes. The apparent paradox is resolved once one considers the myriad situational influences that may impact a *given* decision but do not preclude the existence of an *overarching tendency* driven by a person's stable attributes. Coming back to the marshmallow experiment, a person who is normally able to delay gratification as evidenced by a lifetime pattern of patient behavior may nevertheless succumb to the temptation of a box of chocolates laying in front of him after a sleepless night. Furthermore, one may simply be unsure of what exactly he wants. Indeed, recent research provides evidence that imperfect self-knowledge is an important driver of inconsistent decisions (e.g., Falk, Neuber, and Strack 2021; Enke and Graeber 2023; Dohmen and Jagelka, forthcoming). Such an individual may thus randomize within his interval of uncertainty, which would lead to inconsistent choices. Assuming that he has at least some self-knowledge, his choices will nevertheless display a pattern that allows the econometrician to identify his underlying preferences. I find evidence consistent with the importance of stable preferences that drive behavior but are obscured by random noise: average observed choices in the analyzed dataset are very well predicted by true (or average) economic preferences, whereas choice inconsistencies are well predicted by imperfect self-knowledge (apparent preference instability) and random mistakes.

My econometric approach offers a comprehensive treatment of random errors in observed choices on both incentivized experimental tasks designed to elicit economic preferences and self-reported personality questionnaires. While the addition of various types of stochastic components to models of decision-making is not new, my approach is unique in that it combines factor analysis with a model of decision-making under risk and delay, which allows both for imperfect self-knowledge (apparent preference instability) and for individuals to make random mistakes that further depend on both observed and unobserved heterogeneity.

Data

- Millennium Foundation *Field* Experiment on Education Financing (representative sample of 1,248 Canadian citizens who were full-time students in their last year of high school)
- 103 binary choice tasks designed to elicit risk and time preferences (IC):
  - 55 risk aversion tasks (30 are Holt and Laury (H&L) type, 25 Binswanger's Ordered Lottery Selection Design)
  - 48 time preferences tasks (Coller and Williams, 1999 design)
- Background information → approximate cognitive ability and three of the Big Five traits
  - Cognitive ability: grades, a numeracy test, and self-reports of skills: oral, written, mathematical, and so on
  - Conscientiousness: self-reported ambition, ability to delay gratification, and diligence
  - Extraversion: self-reported tendencies toward active, sociable behavior and excitement-seeking
  - Emotional stability: questions related to confidence, self-esteem, and self-efficacy
  - Data do not contain good proxies for the remaining Big Five personality traits (agreeableness and openness to experience)
  - [HL: seems sus] but chosen indicators were validated through a follow-up study [interesting paragraphs justifying magnitudes of correlations]

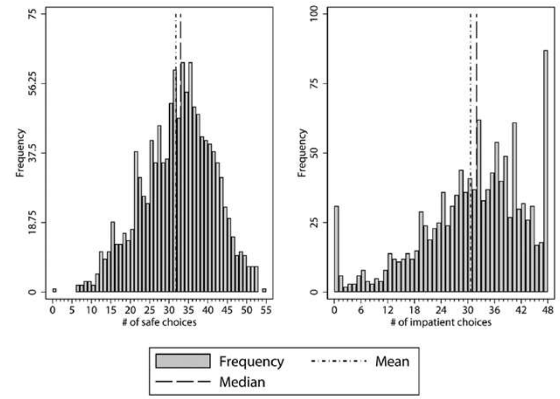


FIG. 1.—Distribution of individual choices on lottery and temporal tasks.

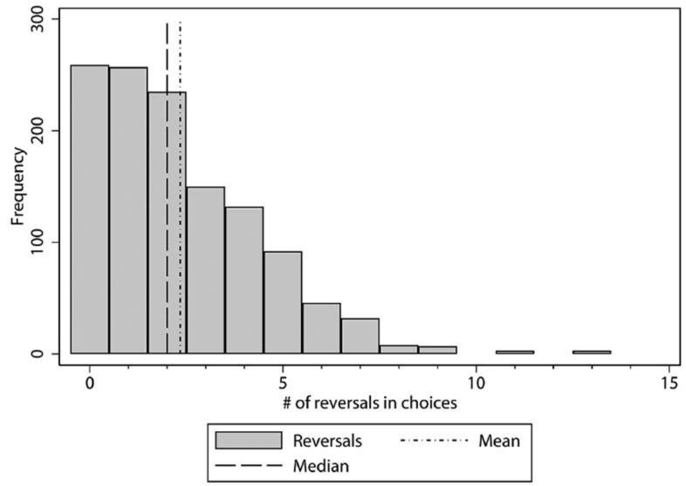


FIG. 2.—Observed reversals per individual on lottery and temporal choice tasks.

Data (replicated null results)

- [HL: Fun that the correlational evidence was in the data section rather than results or model :P]
- Replicated null results using reduced-form analysis, construct variables for each individual:
  - Total number of times of choosing riskier lottery (a proxy for risk aversion)
  - Total number of times of choosing later of two payments (a proxy for impatience)
  - Normalised sum of proxies measures for cognitive ability and the three personality traits obtained

TABLE 1
CORRELATIONAL EVIDENCE ON THE LINK BETWEEN RISKY AND IMPATIENT CHOICES AND PERSONALITY

	SAFE CHOICES			IMPATIENT CHOICES		
	Becker et al. (2012)			Becker et al. (2012)		
	Table 2	Table 3	Current Dataset	Table 2	Table 3	Current Dataset
Neuroticism	.12	−.03	.02	.05	.06	−.02
Extraversion	−.08	−.08	−.10	.01	.07	.04
Conscientiousness	.06	.07	.02	−.01	.07	−.11
Cognitive ability	NA	NA	−.05	NA	NA	−.17

SOURCE.—Becker et al. (2012), tables 2 and 3; author's estimates.
NOTE.—NA = not applicable.

Model

$$P(\mathrm{YC}_{i,l} = 1) = P(\mathrm{YP}_{i,l} = 1) \times (1 - K_i) + [1 - P(\mathrm{YP}_{i,l} = 1)] \times K_i, \quad (12)$$

If $\Theta_i \neq 1$,

$$\mathrm{EU}_i(X) = p_{x_i} \times \frac{x_1^{(1-\Theta_i)}}{1 - \Theta_i} + (1 - p_{x_i}) \times \frac{x_2^{(1-\Theta_i)}}{1 - \Theta_i}. \quad (3)$$

If $\Theta_i = 1$,

$$\mathrm{EU}_i(X) = p_{x_i} \times \ln(x_1) + (1 - p_{x_i}) \times \ln(x_2), \quad (4)$$

where $\Theta_i \in (-\infty; +\infty)$ gives individual i's coefficient of risk aversion.[31]

$$\begin{aligned}\mathrm{EU}_i(X) &= p_{x_i} \times \frac{x_1^{1-(\Theta_i+\varepsilon_i)}}{1 - (\Theta_i + \varepsilon_i)} + (1 - p_{x_i}) \times \frac{x_2^{1-(\Theta_i+\varepsilon_i)}}{1 - (\Theta_i + \varepsilon_i)} \\ &= \mathrm{EU}(X; \Theta_i + \varepsilon_i)\end{aligned} \quad (5)$$

and

$$\begin{aligned}\mathrm{EU}_i(Y) &= p_{y_i} \times \frac{y_1^{1-(\Theta_i+\varepsilon_i)}}{1 - (\Theta_i + \varepsilon_i)} + (1 - p_{y_i}) \times \frac{y_2^{1-(\Theta_i+\varepsilon_i)}}{1 - (\Theta_i + \varepsilon_i)} \\ &= \mathrm{EU}(Y; \Theta_i + \varepsilon_i).\end{aligned} \quad (6)$$

$$P(\mathrm{LP}_{i,t} = 1) = \Phi\left[\frac{\ln(R_{i,t}^{\mathrm{eq}}) - \ln\left(R_i^2 / \left(\sqrt{(\sigma_{R,i})^2 + R_i^2}\right)\right)}{\sqrt{\ln(1 + (\sigma_{R,i})^2 / R_i^2)}}\right], \quad (15)$$

$$L_i = \prod_{l=1}^{55} P(\mathrm{YC}_{i,l} = \mathrm{yc}_{i,l}) \times \prod_{t=1}^{48} P(\mathrm{LC}_{i,t} = \mathrm{lc}_{i,t}). \quad (19)$$

$$\Theta_i = \Theta_0 + \Theta_1' X_i + \Theta_2' F_i, \quad (20)$$

$$\sigma_{\Theta,i} = \Phi(s_{\Theta,0} + s_{\Theta,1}' X_i + s_{\Theta,2}' F_i), \quad (21)$$

$$R_i = \Phi(r_0 + r_1' X_i + r_2' F_i), \quad (22)$$

$$\sigma_{R,i} = \Phi(s_{R,0} + s_{R,1}' X_i + s_{R,2}' F_i), \quad (23)$$

$$K_i = 0.5 \times \Phi(\kappa_0 + \kappa_1' X_i + \kappa_2' F_i). \quad (24)$$

$$M_{i,j,f} = \gamma_{0,j,f} + \gamma_{1,j,f} \times F_{i,f} + \epsilon_{i,j,f}, \quad (25)$$

$$F_{i,f} = \alpha_0 + \alpha_f' X_i + \tilde{F}_{i,f}, \quad (26)$$

Model: Preference and consistency parameters

"*assuming that both risk aversion and the discount rate are random variables from whose distributions a particular realization is drawn every time a choice needs to be made*"

- Use expected payoffs and variances in individual's binary choices to estimate risk aversion parameter and discount rate parameter
- Introduce two random shocks (one for each preference)
  - Assume preference is hit by one possible realization of shocks in every task performance measured (assumes shocks are independent across tasks)
  - Reflects imperfect self-knowledge, actual preference instability, or measurement error
  - Use RPM (add error to preference parameter for monotonicity), add in trembling hand (mistakenly picked less preferred option), identification of consistency parameters (choice reversals *within* an ordered list of choice tasks and inconsistent switching points *between* lists)
  - Parametrically identified from different moments of the noise distribution

Model: Preference and consistency parameters as function of observed characteristics, latent factors, and pure unobserved heterogeneity

$$\Theta_i = \Theta_0 + \Theta_1' X_i + \Theta_2' F_i, \quad (20)$$

$$\sigma_{\Theta,i} = \Phi(s_{\Theta,0} + s_{\Theta,1}' X_i + s_{\Theta,2}' F_i), \quad (21)$$

$$R_i = \Phi(r_0 + r_1' X_i + r_2' F_i), \quad (22)$$

$$\sigma_{R,i} = \Phi(s_{R,0} + s_{R,1}' X_i + s_{R,2}' F_i), \quad (23)$$

$$K_i = 0.5 \times \Phi(\kappa_0 + \kappa_1' X_i + \kappa_2' F_i). \quad (24)$$

TABLE 2
SUMMARY: STRUCTURAL PARAMETERS OF INTEREST

	Risk	Time
Preference parameters	Coefficient of relative risk aversion (Θ)	Discount rate (R)
Consistency parameters:		
Stability	Standard deviation of the coefficient of relative risk aversion (σ_Θ)	Standard deviation of the discount rate (σ_R)
Mistakes	Trembling hand parameter (K)	

1. Pure unobserved heterogeneity captured by the parameter’s respective population intercept Θ_0 through k_0
2. A vector of directly observed characteristics X_i
3. A vector of latent factors F_i that have observed proxy indicators in the data
   - Cognitive ability and the psychological traits (refer to as “factors” are themselves unobserved. They are, however, noisily measured by observed indicators proper to each individual)

Estimation

Take the example of a binary measure. Combining equations (25) and (26), the probability of observing value 1 on binary measure $M_{i,j,f}$ using factor $F_{i,f}$ as a random effect is

$$P(M_{i,j,f} = 1|\tilde{F}_{i,f}) = P(\epsilon_{i,j,f} < \gamma_{0,j,f} + \gamma_{1,j,f} \times (\alpha_0 + \alpha_f' X_i) + \gamma_{1,j,f} \times \tilde{F}_{i,f}|\tilde{F}_{i,f}))$$
$$= \Phi(\gamma_{0,j,f} + \gamma_{1,j,f} \times (\alpha_0 + \alpha_f' X_i) + \gamma_{1,j,f} \times \tilde{F}_{i,f}|\tilde{F}_{i,f})). \quad (28)$$

The unconditional probability of observing the binary measure is obtained by integrating out the unobserved factor:

$$P(M_{i,j,f} = 1) = \int_{-\infty}^{+\infty} \Phi(\gamma_{0,j,f} + \gamma_{1,j,f} \times (\alpha_0 + \alpha_f' X_i) + \gamma_{1,j,f} \times \tilde{F} \dots$$
$$\times \frac{1}{\sigma_{F_f}} \phi\left(\frac{\tilde{F}_{i,f}}{\sigma_{F_f}}\right) d\tilde{F}_{i,f}.$$

The joint individual lik… choices given a particular dr… type of individual i is

$$L_i| \dots \prod_{f=1}\prod_{j=1} P(M_{i,j,f} = m_{i,j,f}|\tilde{F}_{i,f})$$
$$\times \prod_{l=1}^{55} P(\mathrm{YC}_{i,l} = \mathrm{yc}_{i,l}|\tilde{F}_i, \mathrm{UT}_i) \quad (30)$$
$$\times \prod_{t=1}^{48} P(\mathrm{LC}_{i,t} = \mathrm{lc}_{i,t}|\tilde{F}_i, \mathrm{UT}_i),$$

where $L_i|(\tilde{F}_i, \mathrm{UT}_i)$ represents the individual likelihood of jointly observing $j = 1, \dots, J$ measures of each factor $f = 1, \dots, 4$, $l = 1, \dots, 55$ lottery choice task decisions, and $t = 1, \dots, 48$ temporal choice task decisions

I next integrate out the unobserved f…

$$L_i|(\mathrm{UT}_i = \mathrm{ut}_i) = \int_{\tilde{F}_i} \cdots \int \prod^{F} \prod^{J} \dots {}_{i,l}|\tilde{F}_i, \mathrm{UT}_i) \quad (31)$$
$$\dots {}_f(F_1, \dots, F_F)\, d\tilde{F}_i,$$

…nts the joint probability of observing the full …tor values $\tilde{F}_i$ for individual i. Because the factor draws … to be independent, I can write

$$L_i|(\mathrm{UT}_i = \mathrm{ut}_i) = \int_{\tilde{F}_i} \cdots \int \prod_{f=1}^{F} \prod_{j=1}^{J} P(M_{i,j,f} = m_{i,j,f}|\tilde{F}_{i,f}) \times \prod_{l=1}^{55} P(\mathrm{YC}_{i,l} = \mathrm{yc}_{i,l}|\tilde{F}_i, \mathrm{UT}_i) \quad (32)$$
$$\times \prod_{t=1}^{48} P(\mathrm{LC}_{i,t} = \mathrm{lc}_{i,t}|\tilde{F}_i, \mathrm{UT}_i) \times \frac{1}{\sigma_{F_1}} \phi\left(\frac{\tilde{F}_{i,1}}{\sigma_{F_1}}\right) \times \cdots \times \frac{1}{\sigma_{F_F}} \phi\left(\frac{\tilde{F}_{i,F}}{\sigma_{F_F}}\right) d\tilde{F}_i.$$

The above is implemented through simulation by averaging over the 200 factor draws for each individual. The unconditional individual likelihood is obtained by integrating out the unobserved types:

$$L_i = \sum_{\mathrm{ut}=1}^{\mathrm{UT}} (L_i|\mathrm{ut}) \times p_{\mathrm{ut}}, \quad (33)$$

where p_{ut} represents the prevalence of unobserved type "ut" in the overall population. Since this is pure unobserved heterogeneity, a person is as likely to be any of the unobserved types as another person and thus p_{ut}

** Magic **

(consisting of maximum likelihood, random effects, simulation, integration …)

Results (model check)

- Fixed effects: observing each individual's choices the lottery and temporal choice tasks
  - Point estimates of the preference and consistency parameters
  - Direct MLE estimation
- Full model: MLE of observing each individual's choices + responses to questions that measure cognitive ability and personality (simulated MLE)
  - Map economists' preference parameters onto psychologists' personality traits
  - Simulation MLE based on estimated values of the structural parameters
- Checked that two models give similar distributions

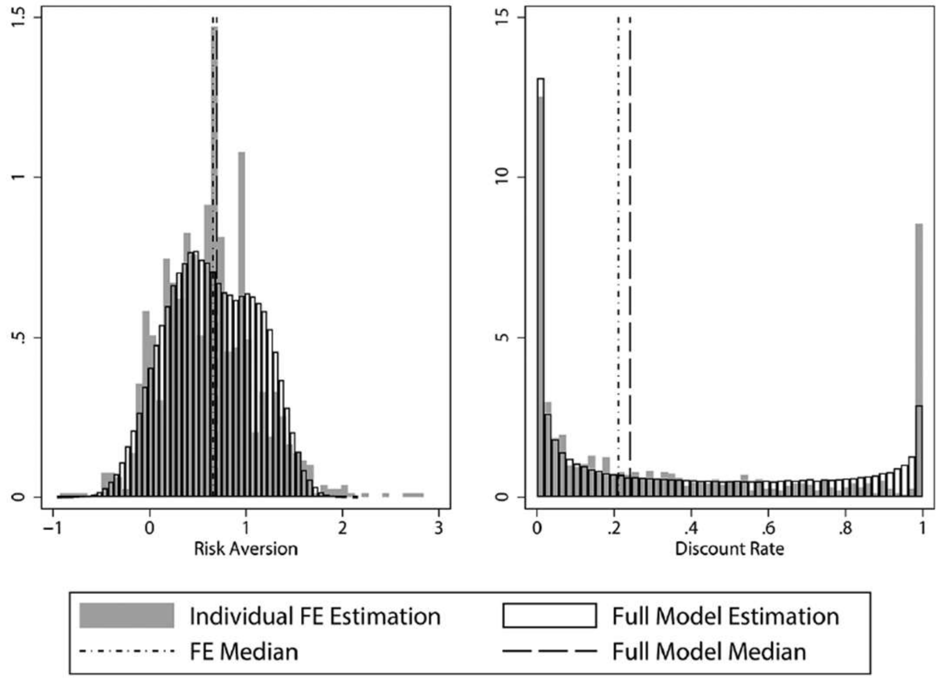


FIG. 3.—Sample distributions of risk and time preferences. FE = fixed effect.

Results (preference parameters full model)

- Average: Risk averse, 22% discount rate
- Average woman is more risk averse and patient [HL: Mmhm, more on this later]
- Type 1: risk averse and very patient
- Type 4: risk neutral and very impatient ("daredevils")
- Type 5: very risk averse and very patient ("opposite of Type 4")

TABLE 3
PARAMETER VALUES FOR THE AVERAGE PERSON

	Prevalence	Risk Aversion	Discount Rate	Risk Aversion Standard Deviation	Discount Rate Standard Deviation	% Hand Trembles
Simulated average		1.01	.22	.52	.21	.04
Female average		1.05	.16	.50	.14	.04
Male average		.96	.30	.55	.30	.03
Type 1 average	.31	1.14	.01	.73	.01	.03
Type 2 average	.25	.64	.50	.48	.46	.01
Type 3 average	.23	.33	.45	.65	.57	.11
Type 4 average	.12	.03	.60	.36	.75	.02
Type 5 average	.08	5.17	.02	.20	.01	.06

Results (what do you think?)

	Gender (female)	**Emotional stability**	**Cognitive ability**	**Extraversion**	**Conscientiousness**
Risk aversion					
Risk aversion consistency					
Discount rate (impatience)					
Discount rate consistency					
Mistakes					

Results

Link with personality traits.—Results from the structural model quantify the long-supposed relationship between preferences, cognitive ability, and personality. The a priori expectations on the signs of the coefficients are confirmed: risk aversion decreases with the factor related to extraversion (a measure of self-reported excitement-seeking and active behavior), discount rates decrease with the factor related to conscientiousness (a measure of self-reported discipline and ability to delay gratification), and the propensity to make mistakes decreases with cognitive ability. Furthermore, factors related to personality traits and cognitive ability explain a nonnegligible part of the variation in preference and consistency parameters. While these findings may seem intuitive, they should not be taken for granted as existing empirical evidence is tenuous even for the most intuitive relationships between personality and preferences.[47]

Results

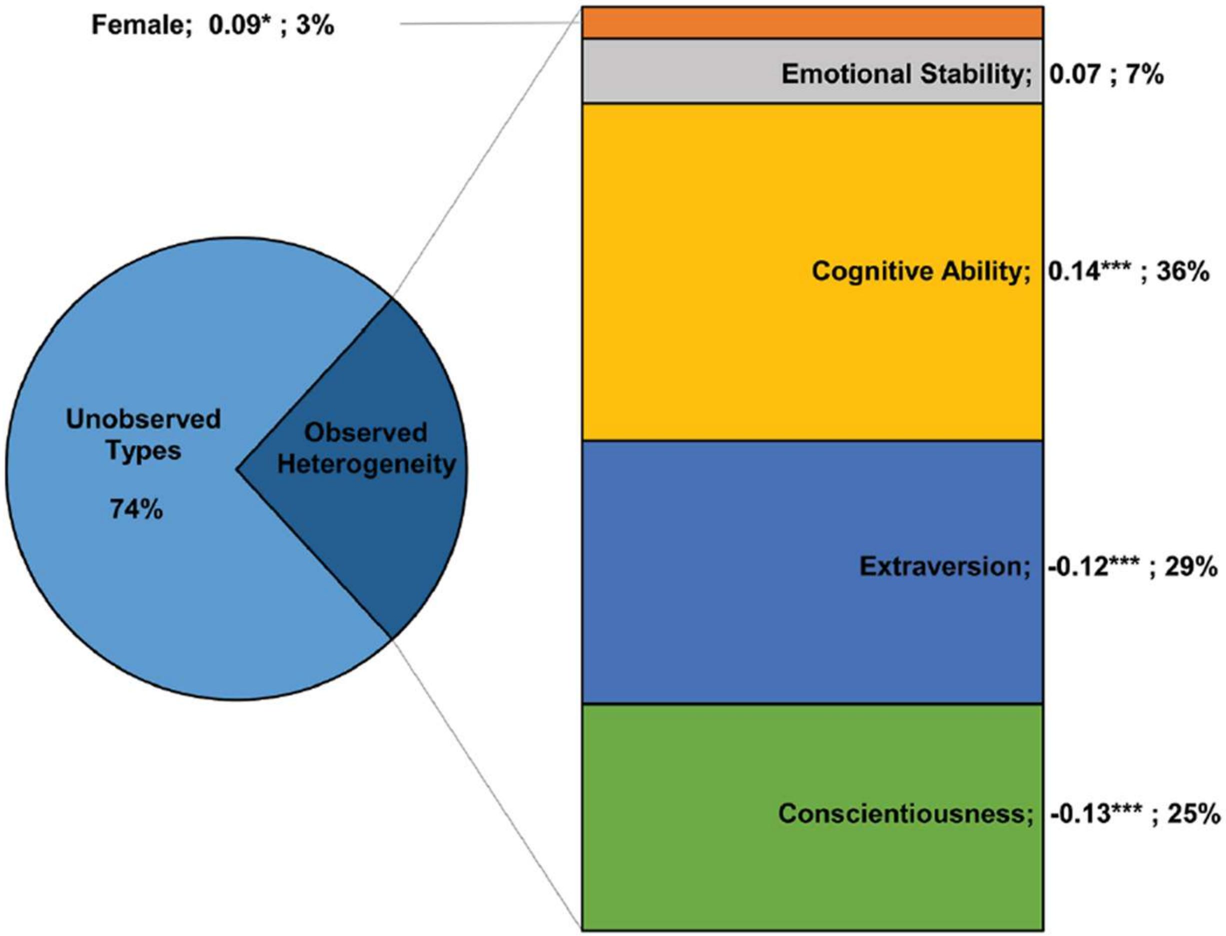
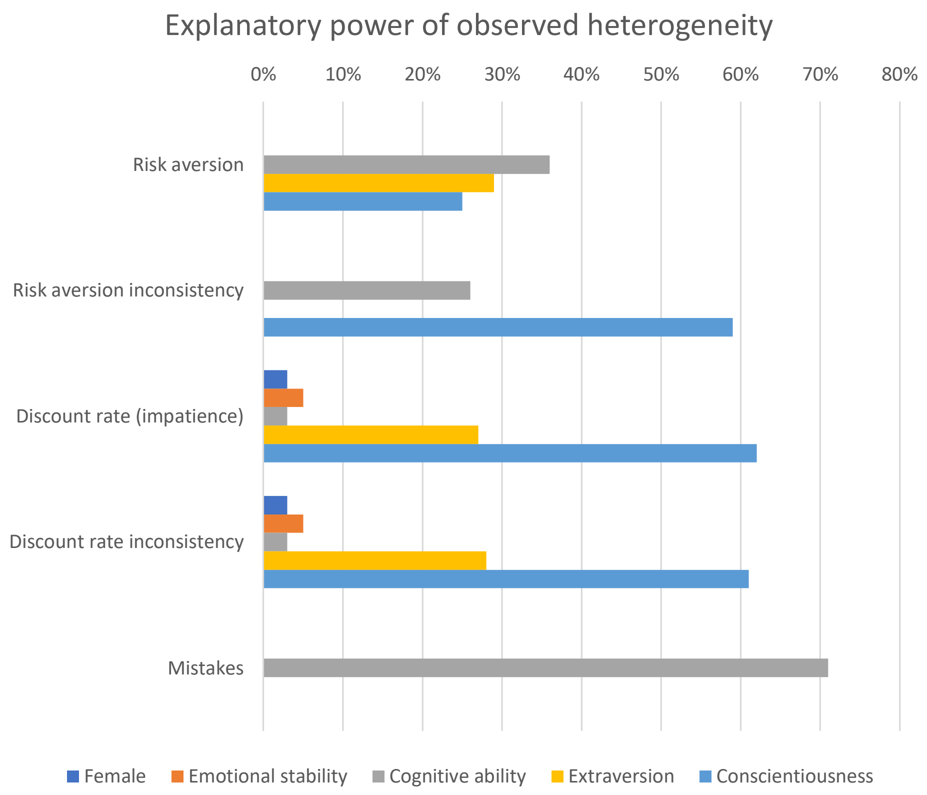


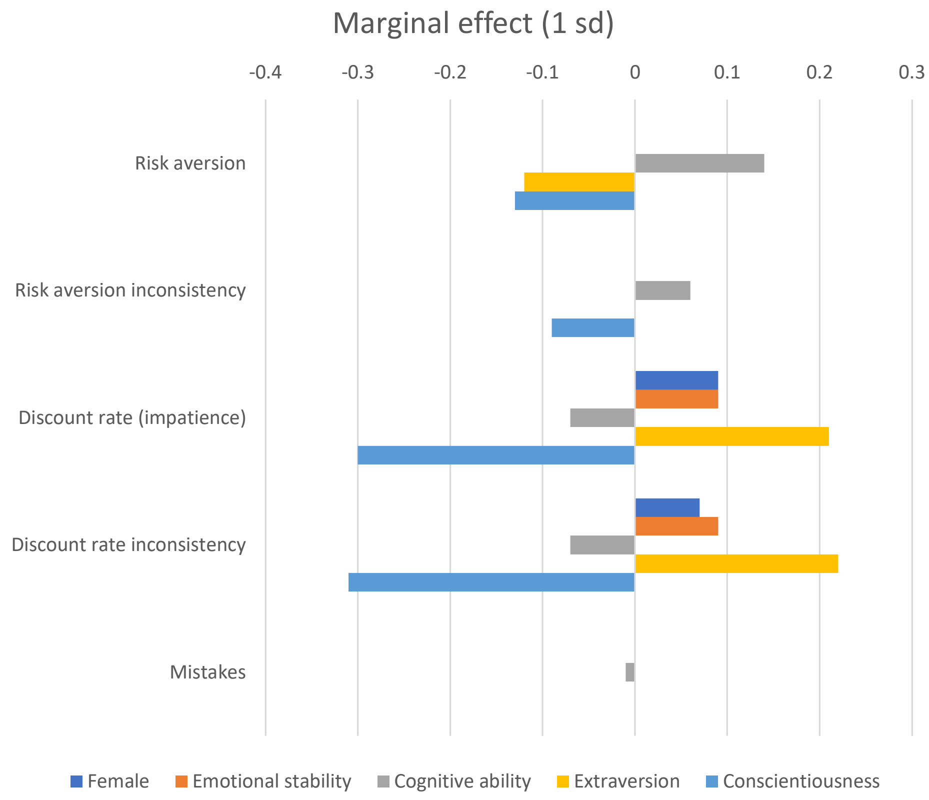
FIG. 4.—Heterogeneity in the coefficient of risk aversion. For observed heterogeneity, the first value corresponds to the marginal effect of changing each factor by 1 standard deviation (and sex from male to female) on risk aversion; the second value gives the percentage contribution of each heterogeneity component to the overall explanatory power of observed heterogeneity.

Results

[HL: Weirdly female and emotional stability results was not mentioned, even though it's significant for some results and]

[36] To keep the model tractable, sex was chosen as the observed characteristic for the main specification because its influence on economic preferences is hotly debated. The latent factors are cognitive ability and three factors related to emotional stability, extraversion, and conscientiousness.





Other results

- Robustness: results consistent using subsets of the sample, adjusting parameters, and assuming different utility functions
- Checked that preference and consistency parameters in **observed** choices

TABLE 5
EXPLANATORY POWER ON OBSERVED CHOICES OF PREFERENCE AND CONSISTENCY PARAMETERS VERSUS DEMOGRAPHIC AND SOCIOECONOMIC VARIABLES

	Number of Safe Choices	Number of Impatient Choices	Number of Risk Reversals	Number of Time Reversals	Risk Switch Standard Deviation	Time Switch Standard Deviation
Demographic and socioeconomic variables (R^2)	.06	.07	.02	.02	.03	.02
All parameters (R^2)	.86	.63	.59	.04	.11	.16
Preference parameters (%)	91.7	98.6	.2	8.1	2.0	29.8
Consistency parameters (%)	8.3	1.4	99.8	91.9	98.0	70.2
Stability (%)	82.8	76.2	2.3	18.0	80.7	96.2
Mistakes (%)	17.2	23.8	97.7	82.0	19.3	3.8

- Factors vs observable characteristics

TABLE 6
ESTIMATED COEFFICIENTS ON FACTOR COMPONENTS

	Female	English	Age = 17	Age = 18	Age ≥19	R^2	Standard Deviation	Implied Sample Average
Internal locus of control	−.07	−.01	.06	.06	.01	.01	.35	−.10
Cognitive ability	.02	.01	.08	.00	−.05	.03	.28	1.60
Extraversion	−.13	.03	.12	.16	.14	.05	.35	.13
Conscientiousness	.30	.14	.19	.21	.26	.05	.81	.13

Key takeaways

- Empirical evidence on the link between economic preferences and psychological personality traits
  - Blueprint for linking parameters of economic models with systems measuring human differences
  - Up to 60% of the variation in risk aversion, discount rates, and choice consistency parameters can be explained by factors related to cognitive ability and personality
- Precision in parameter estimation and decision-making models (observed and unobserved heterogeneity of individuals, noise vs different aspects of choice inconsistency, mapping to personality)
  - Towards unified framework for understanding human behavior and observed outcomes
  - Control for personality traits (in addition to sociodemographic measures) for increased explanatory ability (practical solution in contexts where preference information is unavailable?)
  - More research, standardisation in measurement, and random choice models needed to understand unobserved heterogeneity
  - Addressing inequality at its human capital roots and informing policy interventions targeting competencies through education?