Stability of preferences and personality: New evidence from developing and developed countries.

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Introduction

What do we mean by stability?

- Strict definition: Preferences are stable over time (Schildberg-Hrisch, 2018, JEP)
- Assume we are interested in risk preferences
  - Implies that, in the absence of measurement error, one should observe the same willingness to take risks when measuring an individuals risk preferences repeatedly over time.
  - Conditional or unconditional stability: control for observable characteristics i.e stability conditional on characteristics such as income?

Introduction

A common assumption in economics (psychology, management and marketing) is that preferences are static primitives fixed over time

- Convenient for modeling (tractability)
  - Critical for welfare analysis (*ceteris paribus*) and policy
- Convenient for empirical work (no simultaneity)

  However, preferences could change...
- ... due to events in people's lives
- ... naturally over time
- ... or because they are measured with error (i.e., they only seem to change)

Introduction

- Despite the importance of this topic it is difficult to estimate the dynamic properties of preferences.
  - Difficult with observational data
  - Experimental data is limited
  - Requires panel data with measured preferences
  - Measurement error

Literature

Three main methods of analysing preference stability

1. Levels: $preference_t = f(charasteristics)$

   e.g, Malmendier and Nagel 2011; Dohmen et al., 2011, 2012

   - Method better suited to analysing heterogenity of preferences
   - Method is silent about stability

Literature

2. Changes: $\Delta preference_t = f(charasteristics)$

    e.g., Cobb-Clark and Schurer, 2012, 2013; Carlsson et al, 2014; Guiso et al., (forthcoming)

    - Model examines the characteristics that impact change.
    - Not the same as stability especially in models with bad fit (e.g., $R^2 < 0.05$)
    - Cannot differentiate unexplained variance in preference from noise
    - Does not formally test stability

Literature

3 Test-retest (psychology): $preference_t = f(preference_{t-k})$

e.g., Fraley and Roberts, 2005; Meier and Sprenger, 2015; Chuang and Schechter, 2015

- Measures the amount preferences in the past explain current preferences.
- Current models do not clearly define a null hypothesis to test against
- Not able to separate changes due to measurement error
- Results could reflect both measurement error and predictable changes due to background characteristics
- Mostly small non-representative datasets measuring short term changes e.g, Meier and Sprenger, (2015) use data from 2007-2008

Literature

Measurement Error

- Meier and Sprenger, 2015 find "a high correlation at the individual level, (but) there remains instability....largely independent of demographics and situational changes, potentially attributable to error"
- Similarly, Chuang and Schechter, 2015 argue that variability in preferences maybe mostly due to noise- 'data seems too noisy to estimate stability"
- Frederick, Loewenstein, and ODonoghue 2002 review the time preference literature
- Discount rates ranging from 0 percent to thousands of percent per annum.
  - They argue that differences may be due to measurement error.

What do we do?

We contribute to this literature in the following ways:

- We develop a model to test stability of preferences
- The model can
  1. Formally test for the time stability of preferences
     - Empirically confirm or reject the stability assumption
  2. Estimate the variance of idiosyncratic shocks
  3. Estimate and account for measurement error
     - **Can select measures with lowest measurement error**

What do we do?

- Using this model we test risk and time preferences, the Big Five personality traits, trust and locus of control
- In Australia, Germany, Netherlands, United States, Thailand, Vietnam and Kyrgyzstan
  - i Use nationally representative panel datasets
  - ii Over 140,000 individuals
  - iii Over 4-20 years
  - iiii **Most comprehensive analysis on the topic**

What do we do?

- Important contribution is the analysis of both developed and developing countries
  - Stability could differ between these two groups for a number of reasons- more shocks in developing countries
  - Many program in developing countries attempt to change preferences (either explicitly or implicitly)
  - Its important to understand the malleability of preferences

The Model

Model

$$P_{it} = P^*_{it} + \varepsilon_{it} \tag{1}$$

$$P^*_{it} = \alpha P^*_{i,t-1} + g(X_{it}) + \eta_{it} \tag{2}$$

where

$P_{it} \equiv$ person i's measured level of preference at time t

$P^*_{it} \equiv$ latent preferences

$g(X_{it}) \equiv$ observable characteristics

$\eta_{it} \equiv$ idiosyncratic shocks to preferences

$\varepsilon_{it} \equiv$ measurement error

Eq 2 defines the evolution of latent preferences P^*_{it} as an AR(1) autoregressive process with a drift $g(X_{it})$

Model

First, replace (2) into (1)

$$P_{it} = \alpha P_{i,t-1} + g(X_{it}) + \{\eta_{it} + \varepsilon_{it} - \alpha\varepsilon_{i,t-1}\} \tag{3}$$

All elements are observable

1. The autoregressive parameter α shows the intra-individual stability of P_{it} i.e past to present
2. $g(X_{it})$ (drift) allows preferences to tend towards a conditional mean level determined by observables
    - Think of this as the level to which preferences tend to once autocorrelation has been accounted.

Model

First, replace (2) into (1)

$$P_{it} = \alpha P_{i,t-1} + g(X_{it}) + \{\eta_{it} + \varepsilon_{it} - \alpha\varepsilon_{i,t-1}\} \qquad (3)$$

- X_{it} will capture factors that impact the conditional level to which preferences tend

3 η_{it} are the idiosyncratic shocks i.e the importance of conditional variation in latent preferences

4 ε_{it} will quantify the measurement error

Model

To find variance of idiosyncratic shocks (σ_η^2), and of measurement error (σ_ε^2):

1. It is easier to work with $\tilde{P}_{it}$, which is P^*_{it} net of $g(X_{it})$
2. With some algebra

$$Var(\tilde{P}_{i,t+k} - (\hat{\alpha}^k)\tilde{P}_{it}|\tilde{X}_i, t+k) = \sigma_\eta^2 \sum_{j=0}^{k} \hat{\alpha}^{2j} + \sigma_\varepsilon^2(\hat{\alpha}^{2k}+1); k = 1, ..., K \quad (4)$$

   - Working Click

3. Then solve a 2-unknown, $K \geq$ equation system

Estimation

- Estimation in a two-step process:
  1. GMM IV: $P_{it} = \alpha P_{i,t-1} + g(X_{it}) + e_{it}$
     - **OLS is biased** since $P_{i,t-1}$ and $\varepsilon_{i,t-1}$ are correlated
     - To obtain consistent estimates of the parameters we use the moment conditions implied in a Generalised Method of Moments (GMM) IV approach
     - $P_{i,t-1}$ is instrumented by further lags
     - Similar to a test retest correlation, but is not attenuated by measurement error and nets out predictable variation due to observable characteristics
     - Standardise all measures

Estimation

- Test whether $\alpha = 1$ i.e stability

  Interpretation of $\alpha = 1$

  - If compared to a test-retest correlation $\alpha = 1$ would imply perfect correlation over time and full stability.

Estimation

To estimate the variance of the errors:

2 Non-linear regression:

$$Var(\tilde{P}_{i,t+k} - (\hat{\alpha}^{k})\tilde{P}_{it} | X_i, t+k) = e^{\ln(\sigma^2_\eta)} \sum_{j=0}^{k} \hat{\alpha}^{2j} + e^{\ln(\sigma^2_\varepsilon)} (\hat{\alpha}^{2k} + 1) + v_k; \quad (5)$$

$k = 1, ..., K$

with nonparametric bootstrap standard errors

Estimation

We also estimate a noise to signal ratio following Cameron and Trivedi, 2005, p903.

- A comparable metric of the amount of measurement error in preferences across models
- Since P_{it} can be standardised to have unit variance we can estimate

$$s = \frac{\sigma_{\varepsilon}^{2}}{(1 - \sigma_{\varepsilon}^{2})} \tag{6}$$

Data

1. **Household, Income and Labour Dynamics in Australia (HILDA)**
   - Unbalanced yearly representative panel of Australian households
   - Use data from 2001 to 2016. Approx 5,000 individuals per wave.
   - **Risk**
   - Question on financial risk.
     - Risk elicited 13 times

Data

2 **Dutch National Bank Household Survey**

- Unbalanced representative yearly panel of Dutch households since 1993
- **Risk aversion index**
  - 6 items, 1994-2015, 2,894 individuals

Data

3 **German Socio-Economic Panel study**

- Unbalanced representative panel of German households since 1984
- Use data from 2004-2015, approx 4,400 individuals per year.
- **Risk:**
  - Question “Are you generally a person who is fully prepared to take risks, or do you try to avoid taking risks?”
  - Response on a scale 0 (unwilling)-10 (fully prepared)
  - Experimentally validated by Dohmen et al (2011)
- **Trust**
- Q: "One can trust other people”
- 5 point scale
- Measured in 2003, 2008, 2013

Data

4 **US: American Life Panel**

- Unbalanced representative panel of US households collected by RAND
- Use data from 2008-2011, 3 waves, approx 1,252 individuals per year
- **Risk:**
  - Same question as GSOEP

Data

5 **Thailand Socio Economic Panel**

- Panel representative of rural Thailand, 4 waves (2008, 2010, 2013, 2016), 1738 individuals per wave.
- Funded by the German government and run by Leibniz University Hannover
- **Risk:**
  - Same question as GSOEP

6 **Vietnamese Socio Economic Panel**

- Panel representative of rural Vietnam, 4 waves (2008, 2010, 2013, 2016), 1764 individuals per wave.
- **Risk:**
  - Same question as GSOEP

7 **Life in Kyrgyzstan**

- Panel representative of Kyrgyzstan, 4 waves (2010-2013), 3000 households and 8000 individuals per wave.
- Low income country (World Bank)
- Collected by DIW Berlin and Humboldt
- **Risk and Trust:**
  - Same questions as GSOEP

Data: Summary

	Risk	Patience	Trust	Big 5	Locus of Control	Alturism
Australia	Y			Y	Y	
Netherlands	Y	Y				
Germany	Y		Y	Y		Y
US	Y					
Thailand	Y					
Vietnam	Y					
Kyrgyzstan	Y		Y			

- Controls for all data include: gender, age, income, education, employment and marital status

Risk

Risk: Developed Countries, GMM IV

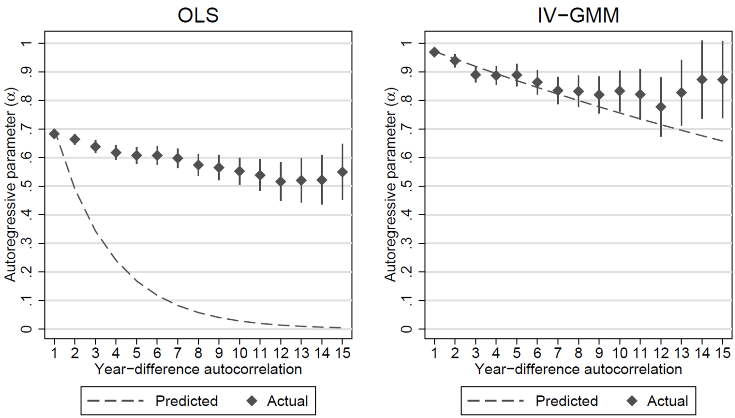
	Aus Risk (1)	Aus Risk (2)
Lagged risk aversion (α)	0.963	0.949
	(0.007)	(0.008)
$H_0 : \alpha = 1$	[0.000]	[0.000]
Corrected risk aversion (α)	0.963	0.949
	(0.007)	(0.008)
$H_0 : \alpha = 1$	[0.000]	[0.000]
Idiosyncratic var. (σ_η^2)	0.080	0.083
	(0.000)	(0.000)
Measurement error var.	0.391	0.390
(σ_ε^2)	(0.000)	(0.000)
Noise to signal ratio	0.643	0.640
	(0.000)	(0.000)
Controls	No	Yes
Ho: joint sig. controls		[0.000]
Obs.	67,378	67,378

Risk: Developed Countries, GMM IV

	Aus Risk		Dutch Risk		German Risk		US Risk	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged risk aversion	0.963	0.949	0.970	0.966	0.992	0.992	1.027	0.944
(α)	(0.007)	(0.008)	(0.011)	(0.010)	(0.007)	(0.008)	(0.058)	(0.059)
$H_0 : \alpha = 1$	[0.000]	[0.000]	[0.012]	[0.018]	[0.176]	[0.217]	[0.636]	[0.346]
Corrected risk aversion	0.963	0.949	0.970	0.966	0.992	0.992	1.027	0.944
(α)	(0.007)	(0.008)	(0.008)	(0.011)	(0.007)	(0.008)	(0.058)	(0.059)
$H_0 : \alpha = 1$	[0.000]	[0.000]	[0.012]	[0.018]	[0.176]	[0.217]	[0.636]	[0.346]
Idiosyncratic var. (σ^2_η)	0.080	0.083	0.047	0.048	0.071	0.057	0.000	0.000
	(0.000)	(0.000)	(0.012)	(0.012)	(0.000)	(0.000)	(0.000)	(0.000)
Measurement err. var.	0.391	0.390	0.296	0.296	0.378	0.378	0.476	0.480
(σ^2_ε)	(0.000)	(0.000)	(0.012)	(0.012)	(0.000)	(0.000)	(0.025)	(0.003)
Noise to signal ratio	0.643	0.640	0.418	0.418	0.607	0.607	0.909	0.923
	(0.000)	(0.000)	(0.023)	(0.023)	(0.000)	(0.000)	(0.091)	(0.011)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Ho: joint sig. controls		[0.000]		[0.433]	[0.000]	[0.433]	[0.000]	
Obs.	67,378	67,378	10,404	10,404	44,386	44,386	1,252	1,252

OLS

Risk: Dutch Data



Risk: Developing Countries, GMM IV

	Thai Risk		Viet Risk		Kyrg Risk	
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged risk aversion (α)	0.385	0.350	0.117	0.137	0.867	0.857
	(0.208)	(0.234)	(0.079)	(0.128)	(0.036)	(0.044)
$H_0 : \alpha = 1$	[0.001]	[0.003]	[0.000]	[0.000]	[0.000]	[0.001]
Corrected risk aversion (α)	0.727	0.705	0.490	0.516	0.867	0.857
	(0.131)	(0.157)	(0.079)	(0.132)	(0.036)	(0.044)
$H_0 : \alpha = 1$	[0.001]	[0.003]	[0.000]	[0.000]	[0.000]	[0.001]
Idiosyncratic var. (σ_η^2)	1.215	2.289	55.523	48.628	0.511	0.578
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Measurement error var. (σ_ε^2)	0.785	0.684	0.224	0.005	0.328	0.287
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Noise to signal ratio	3.645	2.164	0.289	0.005	0.487	0.402
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Controls	No	Yes	No	Yes	No	Yes
Ho: joint sig. controls		[0.002]				
Obs.	1,738	1,738	1,764	1,764	6,781	6,781

Results

Trust

Trust

	German Trust		Kyrg Trust	
	(1)	(2)	(3)	(4)
Lagged trust (α)	0.909	0.906	1.154	1.149
	(0.045)	(0.050)	(0.093)	(0.096)
$H_0 : \alpha = 1$	[0.000]	[0.062]	[0.097]	[0.122]
Corrected trust (α)	0.981	0.981	1.154	1.149
	(0.010)	(0.011)	(0.093)	(0.096)
$H_0 : \alpha = 1$	[0.000]	[0.062]	[0.097]	[0.122]
Idiosyncratic var. (σ_η^2)	0.196	0.173	0.255	0.291
	(0.000)	(0.000)	(0.000)	(0.000)
Measurement error var. (σ_ε^2)	0.512	0.511	0.591	0.565
	(0.000)	(0.000)	(0.000)	(0.000)
Noise to signal ratio	1.049	1.044	1.448	1.300
	(0.000)	(0.000)	(0.000)	(0.000)
Controls	No	Yes	No	Yes
Ho: joint sig. controls		[0.896]		
Obs.	4,662	4,662	6,430	6,430

Robustness

- **Two important questions:**

1. What if we assume stability when preferences are not stable?
   - For instance correlate risk at a point in time with outcomes later
2. What is the severity of the bias when $\alpha != 1$

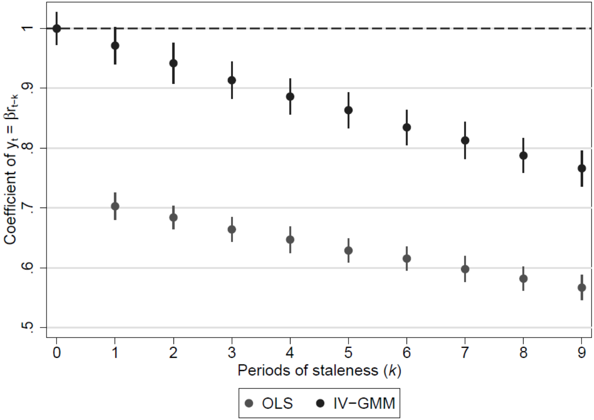
Robustness

To estimate severity of bias from extrapolation of preferences

- Simulate a contemporaneous relation between an outcomes y_t and preference P_t
  - Simulate preferences using the data generating process evolving in equation 3 and 2
  - Examine what happens when we increasingly use 'stale" measures of preferences to predict outcomes y_t
- As we increasingly use stale preferences (move further away from the initial measure), estimates drift from the true effect.
- We can also simulate different rates of α in eq. 3 for each model and then estimate the extent of the bias over years.

Stale Preferences

Simulation of OLS and IV-GMM estimates of a causal effect between an outcome and preferences with an increasingly stale preference.



Conclusion

- We estimate a new model that
  - Explicitly tests for stability
  - Addresses endogenity
  - Estimate the impact of changes in observable characteristics, the variation due to idiosyncratic shocks and measurement error
- We test stability of risk and time preferences, the Big Five personality traits, altruism, trust and locus of control
- Across large, representative household panel datasets from around the world
- Generally find that preferences and traits have strong autoregressive components essentially rendering them time-invariant
- This is not true for risk in developing countries.

Model

From equation 3, take the k^{th} difference of $\tilde{P}_{it}$ and replacing recursively yielding

$$\begin{aligned}
\tilde{P}_{i,t+k} - \tilde{P}_{it} &= \tilde{P}^*_{i,t+k} + \varepsilon_{i,t+k} - \tilde{P}^*_{it} - \varepsilon_{it} \\
&= \alpha \tilde{P}^*_{i,t+k-1} + \eta_{i,t+k} + \varepsilon_{i,t+k} - \tilde{P}^*_{it} - \varepsilon_{it} \\
&\vdots \\
&= (\alpha^k - 1)\tilde{P}^*_{it} + \sum_{j=0}^{k} \alpha^j \eta_{i,t+k-j} + \varepsilon_{i,t+k} - \varepsilon_{it}
\end{aligned}$$

Model

Replacing for $\tilde{P}^*_{it}$ and rearranging terms and simplifying, results in:

$$\tilde{P}_{i,t+k} - (\alpha^k)\tilde{P}_{it} = \sum_{j=0}^{k} \alpha^j \eta_{i,t+k-j} - \alpha^k \varepsilon_{it} + \varepsilon_{i,t+k} \tag{7}$$

$$= \upsilon_{i,t+k}$$

$\upsilon_{i,t+k}$ represents the collection of all error and noise terms. The LHS is expressed in terms of observable measures of $\tilde{P}_{i,t}$ and the parameter α which we have a consistent estimator

Model

To calculate the variance take the variance of both sides of equation 7

$$Var(\tilde{P}_{i,t+k} - (\alpha^k)\tilde{P}_{it}) = Var(\sum_{j=0}^{k} \alpha^j \eta_{i,t+k-j} - \alpha^k \varepsilon_{it} + \varepsilon_{i,t+k})$$

$$\sigma^2_{\upsilon,k} = \sigma^2_\eta \sum_{j=0}^{k} \alpha^{2j} + \sigma^2_\varepsilon(\alpha^{2k} + 1)$$

We can identify σ^2_η and σ^2_ε by taking two different k-lengths

Model

Working

$$Var(\tilde{P}_{i,t+k} - (\alpha^k)\tilde{P}_{it}) = \sigma_\eta^2 \sum_{j=0}^{k} \alpha^{2j} + \sigma_\varepsilon^2(\alpha^{2k}+1); k = 1, ..., K \quad (4)$$

For $k = 1$ and $k = 2$

$$\sigma_{\upsilon,1}^2 = (\alpha^2+1)(\sigma_\eta^2 + \sigma_\varepsilon^2)$$

$$\sigma_{\upsilon,2}^2 = \sum_{j=0}^{2} \alpha^2 \sigma_\eta^2 + (\alpha^4+1)\sigma_\varepsilon^2$$

- Back Click

OLS Risk: Developed Countries

	Aus OLS Risk		Dutch OLS Risk		German OLS Risk		US OLS Risk	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged risk aversion (α)	0.571	0.530	0.653	0.641	0.585	0.561	0.498	0.441
	(0.005)	(0.005)	(0.017)	(0.017)	(0.005)	(0.005)	(0.026)	(0.025)
$H_0 : \alpha = 1$	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]		
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Ho: joint sig. controls		[0.000]		[0.000]		[0.000]		[0.000]
Obs.	67,378	67,378	10,404	10,404	44,386	44,386	1,252	1,252