Global Evidence on the Relationship between Economic Preferences and Outcomes

Thomas Dohmen

17th EACES Conference 2022
Naples, 16 September 2022

Thomas Dohmen
University of Bonn and IZA
t.dohmen@uni-bonn.de

This presentation is based on work with:

Anke Becker, Benjamin Enke, Armin Falk, Radost Holler, David Huffman, Gerrit Meyerheim & Uwe Sunde

The presentation builds on the following papers:

Thomas Dohmen, Radost Holler, Uwe Sunde (2022). The Effect of Education on Patience – Global Evidence from Compulsory Schooling Reforms. Working Paper. University of Bonn.

Armin Falk, Anke Becker, Thomas Dohmen, David Huffman, Uwe Sunde (2022). The Preference Survey Module: A Validated Instrument for Measuring Risk, Time, and Social Preferences. *Management Science*, forthcoming.

Uwe Sunde, Thomas Dohmen, Benjamin Enke, Armin Falk, David Huffman, Gerrit Meyerheim (2022). Patience and Comparative Development. *Review of Economic Studies*, 89(5): 2806-2840.

Armin Falk, Anke Becker, Thomas Dohmen, Benjamin Enke, David Huffman, Uwe Sunde (2018). Global Evidence on Economic Preferences. *Quarterly Journal of Economics*, 133(4): 1645-1692.

Motivation

- Many theories of human behavior assume that a set of preferences drives individual decision-making, including
  - risk preferences
  - time preferences
  - social preferences (reciprocity, altruism, and trust).
- Empirical literature has documented relationships between these preferences and behavior in certain populations.

Motivation

- Many theories of human behavior assume that a set of preferences drives individual decision-making, including
  - risk preferences
  - time preferences
  - social preferences (reciprocity, altruism, and trust).
- Empirical literature has documented relationships between these preferences and behavior in certain populations.
- Less is known about the global variation in preferences.
  - Do countries differ in their preference endowments?
  - How large is cross-country variation in preferences relative to within country variation?
  - Are country-level preference profiles related to differences in geography, culture, language, or religion?

Motivation

- Many theories of human behavior assume that a set of preferences drives individual decision-making, including
  - risk preferences
  - time preferences
  - social preferences (reciprocity, altruism, and trust).
- Empirical literature has documented relationships between these preferences and behavior in certain populations.
- Less is known about the global variation in preferences.
  - Do countries differ in their preference endowments?
  - How large is cross-country variation in preferences relative to within country variation?
  - Are country-level preference profiles related to differences in geography, culture, language, or religion?
  - Are differences in aggregate preference profiles correlated with the cross-country variation in outcomes such as economic development or violent conflict?

What we do

- Addressing these questions requires data on preferences measured...
  - among representative samples
  - across countries
  - in a standardized way

What we do

- Addressing these questions requires data on preferences measured...
  - among representative samples
  - across countries
  - in a standardized way
- We developed survey measures of preferences
  - using preference measures derived from ex ante validation study
  - selected based on ability to capture behavior in incentivized choice experiments

What we do

- Addressing these questions requires data on preferences measured...
  - among representative samples
  - across countries
  - in a standardized way
- We developed survey measures of preferences
  - using preference measures derived from ex ante validation study
  - selected based on ability to capture behavior in incentivized choice experiments
- We collected data among representative samples in 76 countries (80,000 respondents)

What we do

- Addressing these questions requires data on preferences measured...
  - among representative samples
  - across countries
  - in a standardized way
- We developed survey measures of preferences
  - using preference measures derived from ex ante validation study
  - selected based on ability to capture behavior in incentivized choice experiments
- We collected data among representative samples in 76 countries (80,000 respondents)
- Data available on https://www.briq-institute.org/global-preferences/home

Outline

Data Set

Outline

General Characteristics

- Data collected within framework of the 2012 Gallup World Poll
- Representative samples in 76 countries, N=80,000
- Median sample size: 1000 participants per country
- Countries represent 90% of world population / global income
- Global coverage: all continents, various cultures, different levels of development
  - 15 countries from Americas
  - 25 countries from Europe
  - 22 countries from Asia and Pacific
  - 14 countries from Africa (11 Sub-Saharan)

Preference Measures

- Survey measures regarding
  - Willingness to take risks
  - Patience
  - Positive reciprocity
  - Negative Reciprocity
  - Altruism
  - Trust

Preference Measures – Validation Study

- Underlying items were designed, tested, and selected through rigorous ex-ante experimental validation procedure (Falk et al., forthcoming).

Preference Measures – Validation Study

- Underlying items were designed, tested, and selected through rigorous ex-ante experimental validation procedure (Falk et al., forthcoming).
- Subjects participated in state-of-the-art financially incentivized experimental tasks designed to elicit preference parameters
- Two weeks later, they answered large batteries of survey questions designed to measure preferences

Preference Measures – Validation Study

- Underlying items were designed, tested, and selected through rigorous ex-ante experimental validation procedure (Falk et al., forthcoming).
- Subjects participated in state-of-the-art financially incentivized experimental tasks designed to elicit preference parameters
- Two weeks later, they answered large batteries of survey questions designed to measure preferences
- Those survey items that jointly performed best in explaining observed behavior were selected (best-subset-selection)

Streamlined Preference Module for Gallup World Poll

- Selection from restricted pool of questions (discard "complicated" items and choice lists)
- All items translated back and forth by professionals
- Monetary values adjusted along median household income across countries
- Pretests in 22 countries of various cultural heritage
- Adjust wording where necessary

▸ Wording of Items

Global Preference Survey – Survey Items

For most of the six dimensions, the underlying items comprise a combination of quantitative and qualitative questions

Table 1: Survey items of the GPS

Preference	**Item Description**	Weight
Patience	Intertemporal choice sequence using staircase method	0.712
	Self-assessment: Willingness to wait	0.288
Risk taking	Lottery choice sequence using staircase method	0.473
	Self-assessment: Willingness to take risks in general	0.527
Positive reciprocity	Gift in exchange for help	0.515
	Self-assessment: Willingness to return a favor	0.485
Negative reciprocity	Self-assessment: Willingness to take revenge	0.374
	Self-assessment: Willingness to punish unfair behavior towards self	0.313
	Self-assessment: Willingness to punish unfair behavior towards others	0.313
Altruism	Donation decision	0.635
	Self-assessment: Willingness to give to good causes	0.365
Trust	Self-assessment: People have only the best intentions	1

Complement to Existing Surveys

Distribution of Preferences Around the Globe

Outline

World Map of Patience

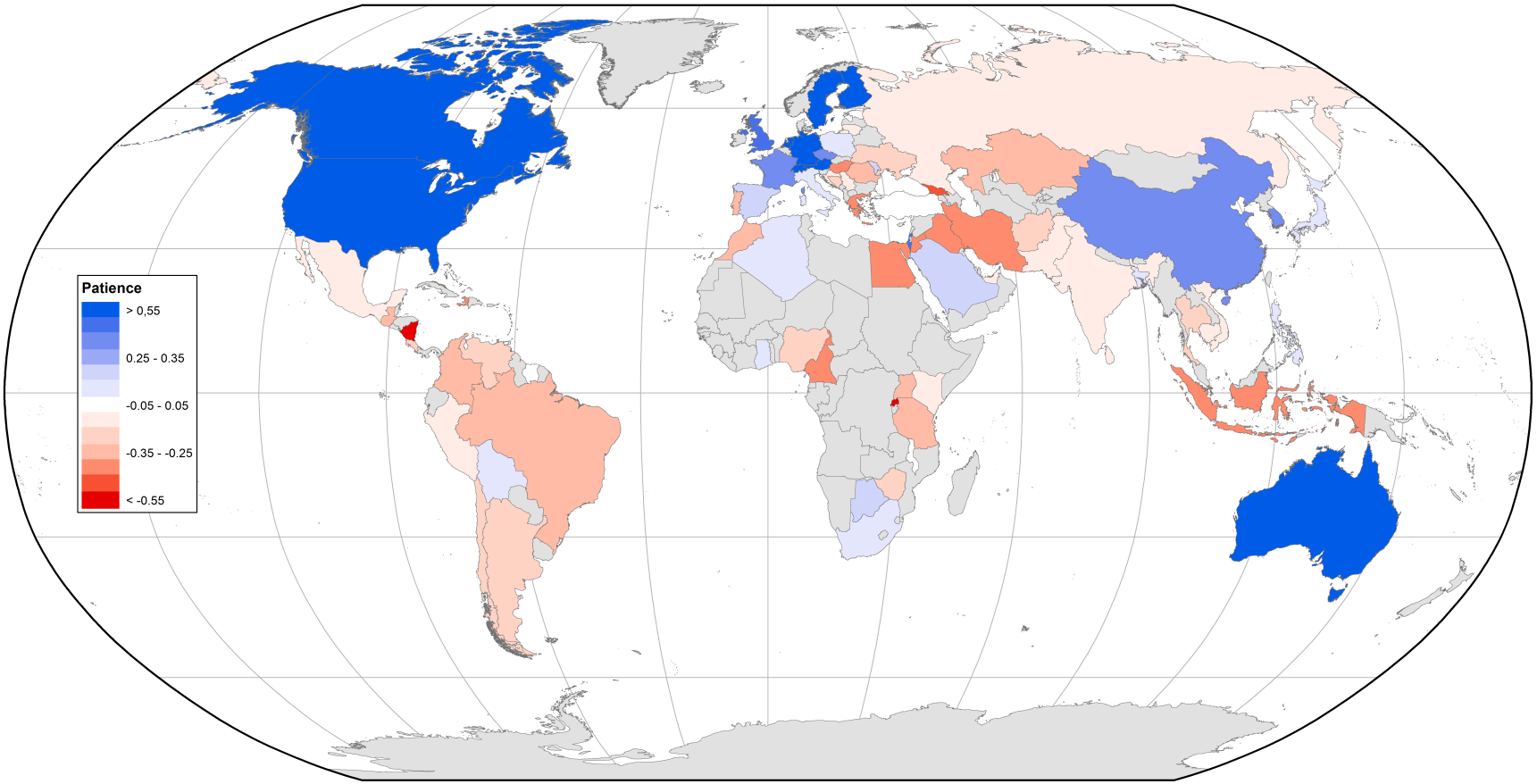


Figure 1: World map of patience

World Map of Risk Taking

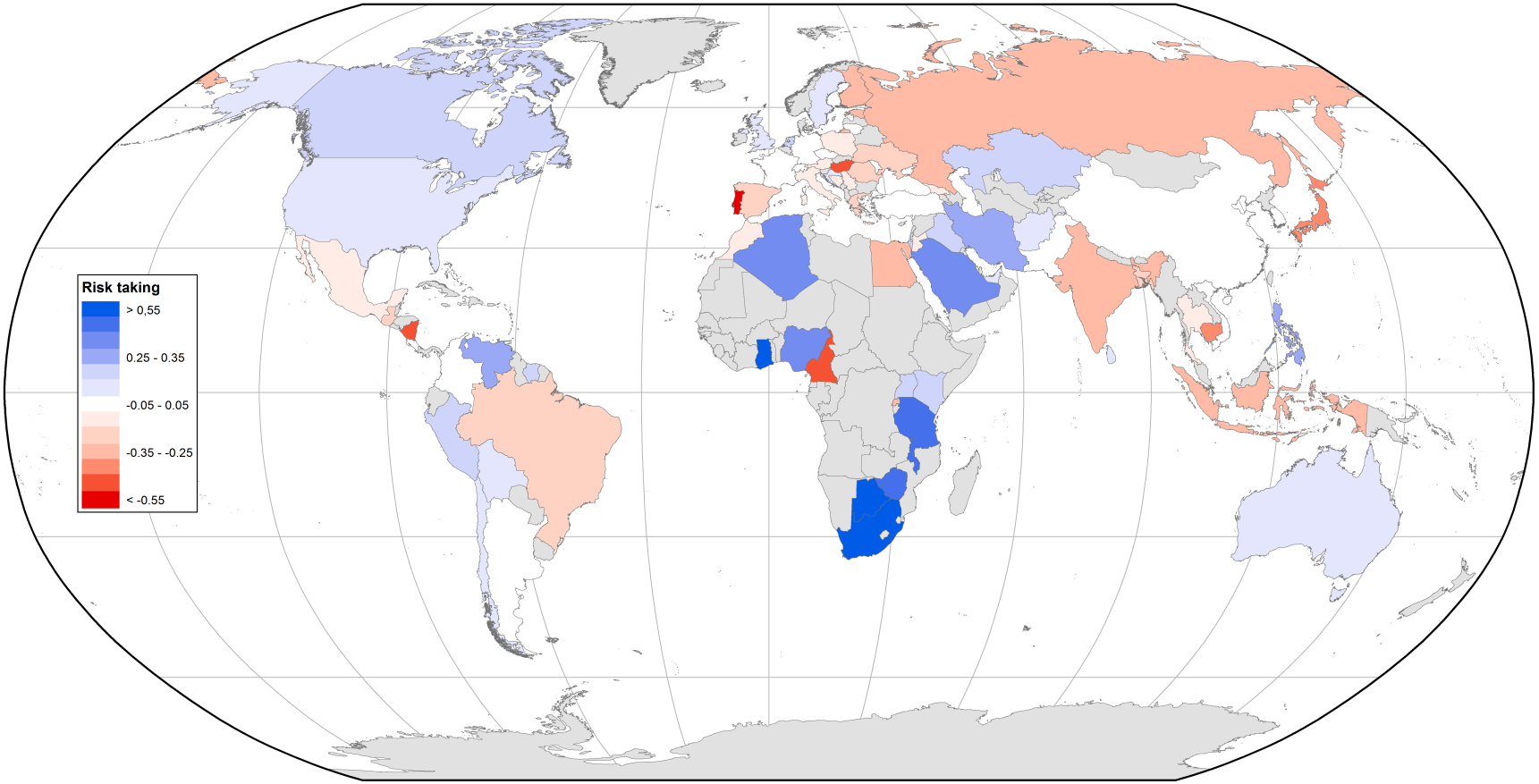


Figure 2: World map of risk taking

World Map of Positive Reciprocity

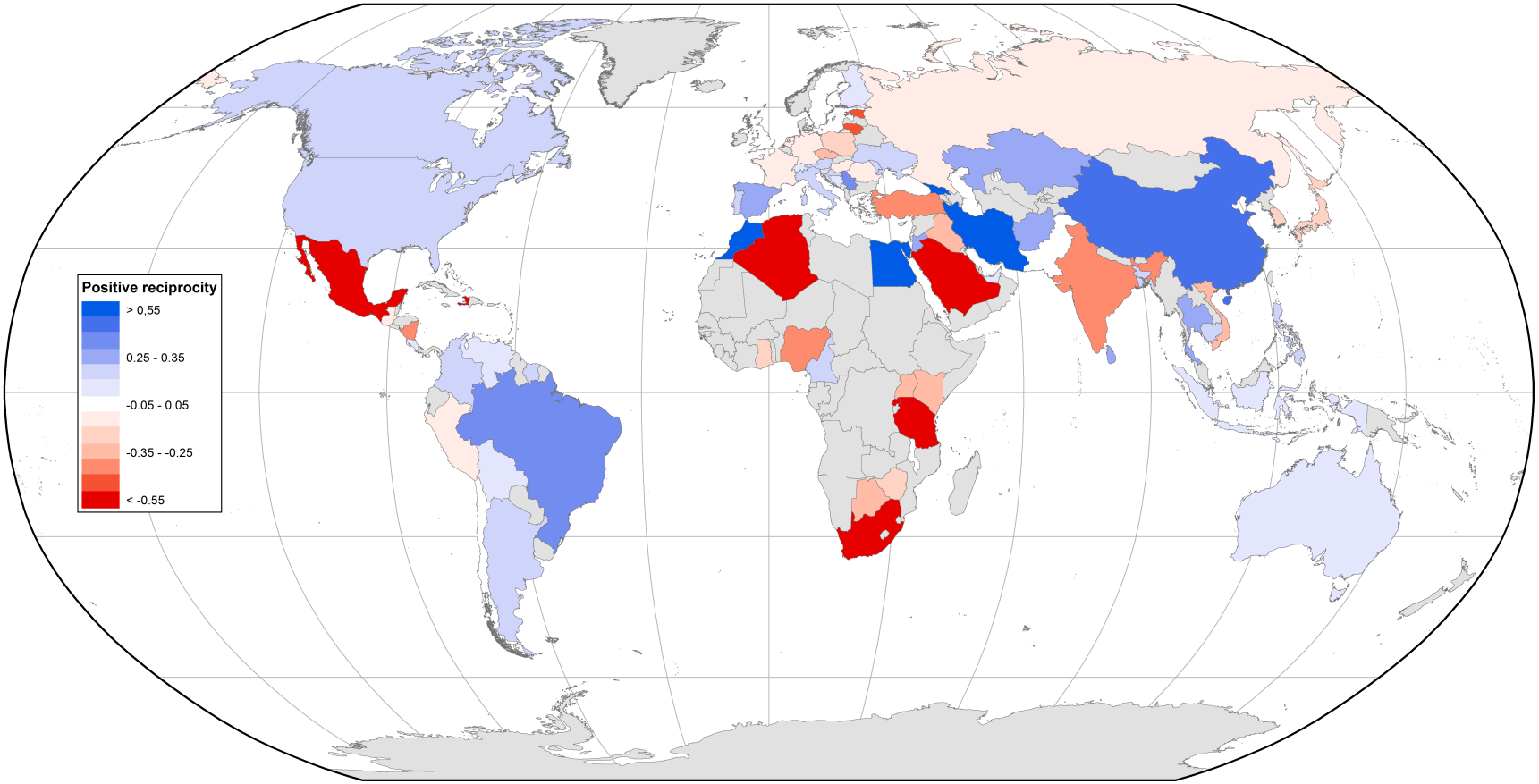


Figure 3: World map of positive reciprocity

World Map of Negative Reciprocity

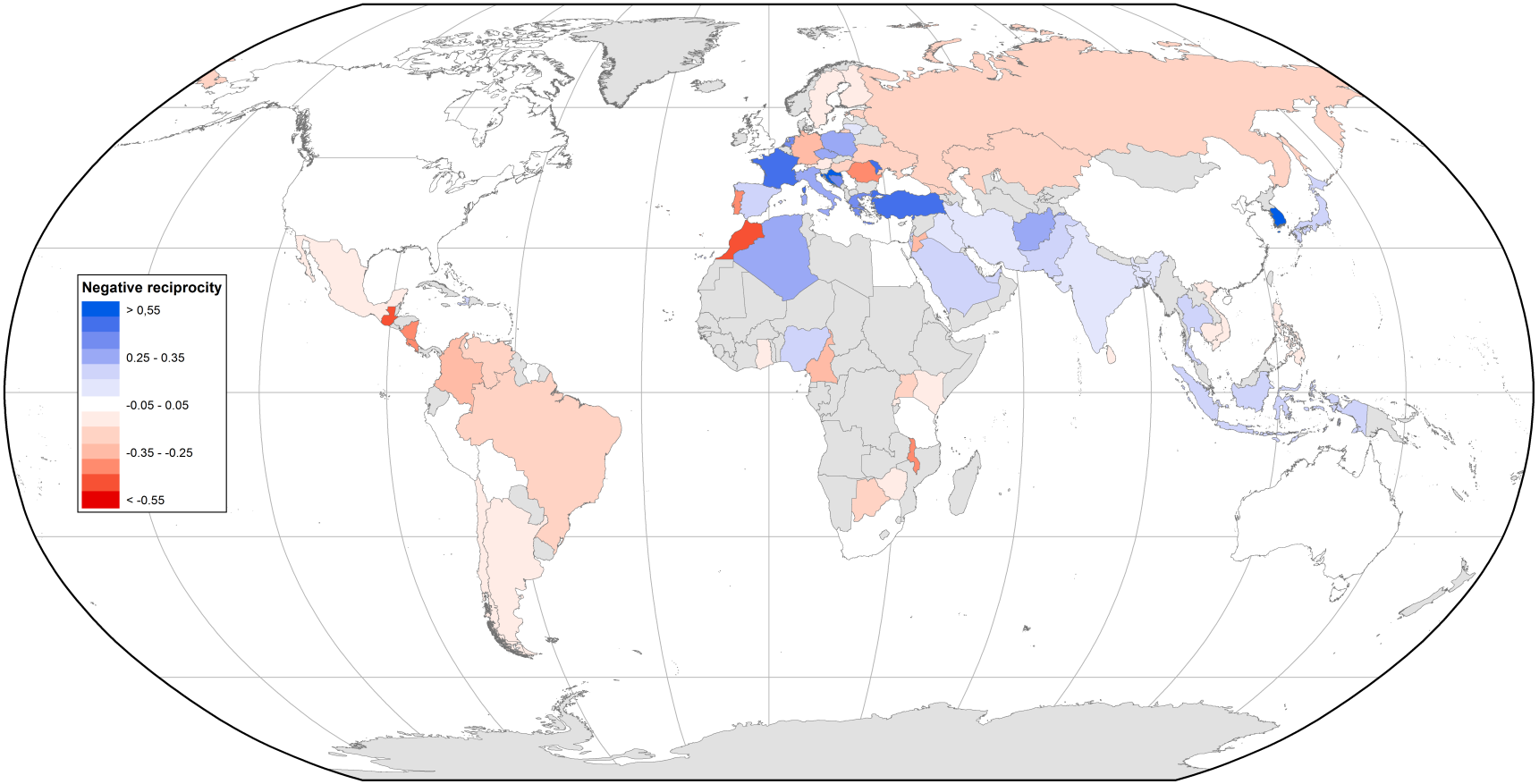


Figure 4: World map of negative reciprocity

World Map of Altruism

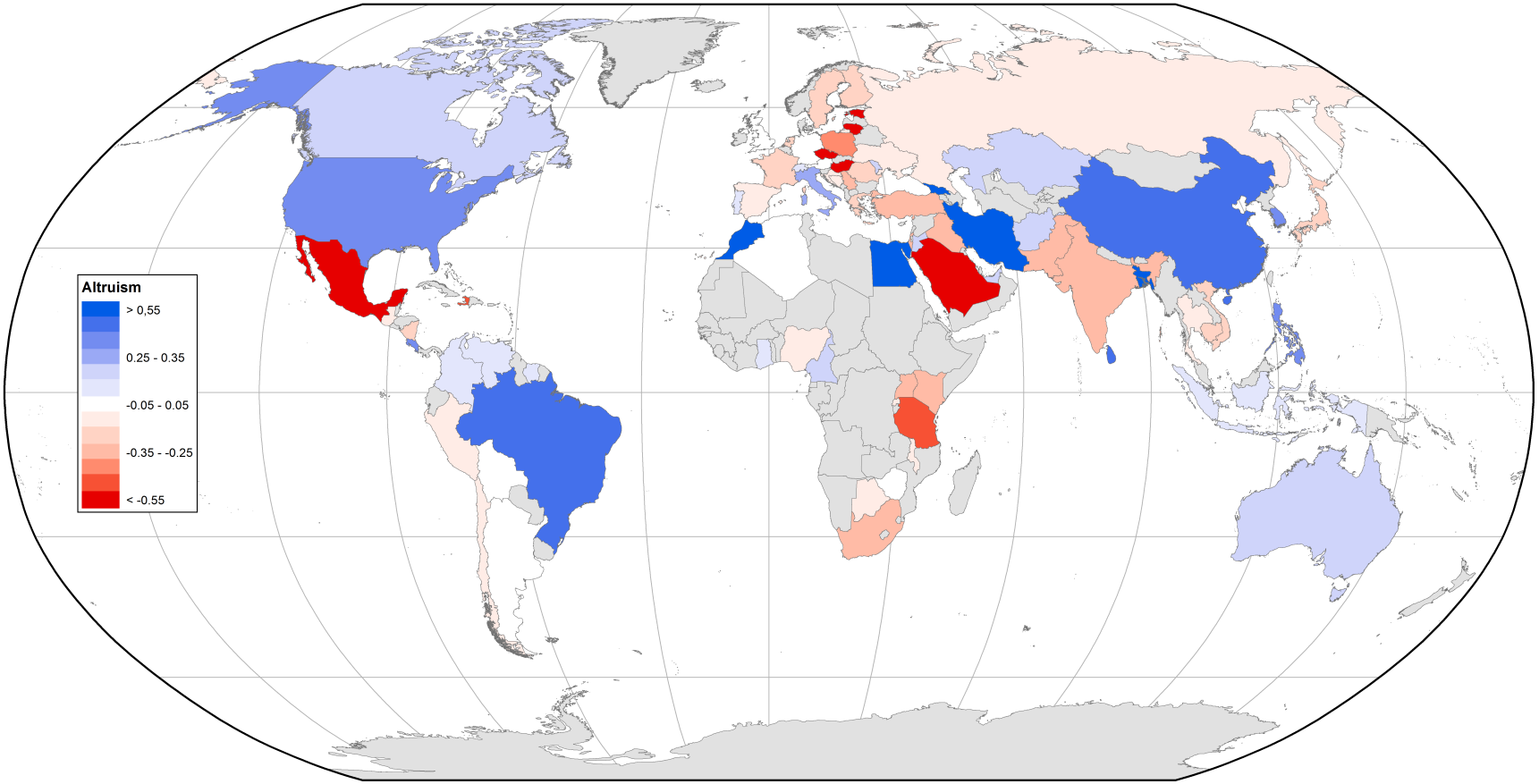


Figure 5: World map of altruism

World Map of Trust

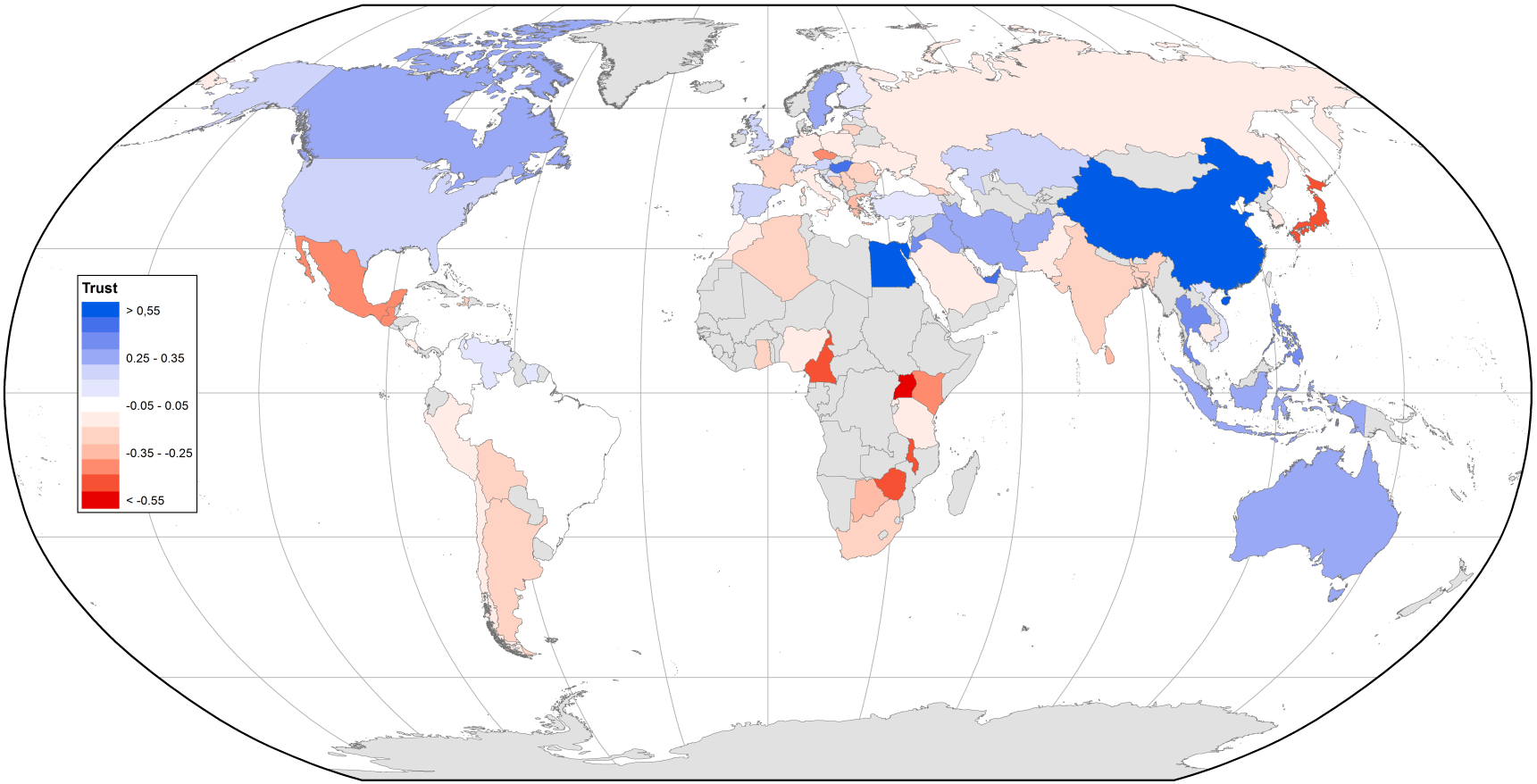


Figure 6: World map of trust

Country-Level Analysis

Table 2: Regional averages and variance decomposition

	Patience	Risk taking	Pos. recip.	Neg. recip.	Altruism	Trust	# Obs.
Western Europe	0.49	-0.11	0.06	0.04	-0.04	0.10	11
Eastern Europe	-0.12	-0.12	-0.02	0.10	-0.22	-0.07	16
Neo Europe	0.73	0.15	0.16	0.02	0.26	0.23	3
South and East Asia	-0.01	-0.10	0.07	0.11	0.13	0.04	13
North Africa & ME	-0.14	0.16	0.07	0.08	0.13	0.23	9
Sub-Saharan Africa	-0.16	0.34	-0.34	-0.11	-0.15	-0.33	11
South America	-0.21	-0.03	-0.08	-0.16	-0.05	-0.10	13
% between-country variation	13.5	9.0	12.0	7.0	12.3	8.2	

Country-Level Analysis

Table 3: Pairwise correlations between preferences at country level

	Patience	Risk taking	Pos. reciprocity	Neg. reciprocity	Altruism	Trust
Patience	1					
Risk taking	0.230**	1				
Pos. reciprocity	0.016	-0.256**	1			
Neg. reciprocity	0.258**	0.193*	-0.154	1		
Altruism	-0.010	-0.015	0.711***	-0.132	1	
Trust	0.190	-0.062	0.363***	0.160	0.273**	1

$\Rightarrow$ Patience and risk taking moderately correlated; high correlations among "prosocial" traits altruism, positive reciprocity, and trust

Preferences and Country-Level Characteristics

Table 4: Pairwise correlations between preferences and geographic and cultural variables

	Patience	Risk taking	Pos. recip.	Neg. recip.	Altruism	Trust	# Obs.
(Bio-) geography							
Geographic conditions (O-H)	0.45***	-0.31**	0.20	0.39***	-0.10	0.39***	51
Absolute latitude	0.48***	-0.19	0.13	0.25**	-0.13	0.26**	76
Agricultural suitability (aa)	-0.02	-0.14	0.03	0.03	-0.22*	-0.47***	73
Crop suitability (aa)	0.11	-0.18	-0.11	0.08	-0.22*	-0.37***	73
Biological conditions (O-H)	0.37***	-0.37***	0.30**	0.30**	-0.00	0.44***	51
Culture							
Weak future time reference	0.32***	-0.13	0.13	-0.04	0.07	0.21*	68
Pronoun drop not allowed	0.57***	0.08	0.04	0.06	0.01	0.18	67
Share Protestants	0.45***	0.10	-0.20*	-0.17	-0.14	-0.01	76
Individualism	0.65***	-0.01	-0.05	0.14	-0.14	0.16	62
Family ties	-0.57***	0.34**	0.11	-0.02	0.27*	0.09	49

Notes. Pairwise Pearson correlations between average preferences and other geographic and climatic variables at country level. (aa) = ancestry-adjusted. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Determinants of Preferences

Outline

Preferences and Individual Characteristics

- Investigate relationship of preferences to age, gender, and (self-reported) cognitive ability
- Some of these characteristics arguably exogenous to preferences
- Representative nature of data across countries allows investigation of how general or culturally specific certain relationships are (e.g., between gender and risk aversion)

Preferences and Individual Characteristics

Table 5: Correlates of preferences at individual level. Age is divided by 100.

	Dependent variable:					
	Patience	Risk taking	Pos. reciprocity	Neg. reciprocity	Altruism	Trust
	(1)	(2)	(3)	(4)	(5)	(6)
Age	0.72***	-0.083	1.02***	-0.36*	-0.0060	0.37*
	(0.17)	(0.20)	(0.17)	(0.19)	(0.14)	(0.21)
Age squared	-1.45***	-1.20***	-1.17***	-0.45**	0.015	0.032
	(0.20)	(0.21)	(0.18)	(0.18)	(0.15)	(0.20)
1 if female	-0.056***	-0.17***	0.049***	-0.13***	0.10***	0.066***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Subj. math skills	0.028***	0.046***	0.038***	0.040***	0.044***	0.056***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	-0.37***	0.21***	-0.079**	0.37***	-0.064**	-0.078**
	(0.04)	(0.04)	(0.04)	(0.05)	(0.03)	(0.04)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	78501	78445	78869	77521	78632	77814
R^2	0.165	0.167	0.128	0.112	0.135	0.111

Preferences and Age

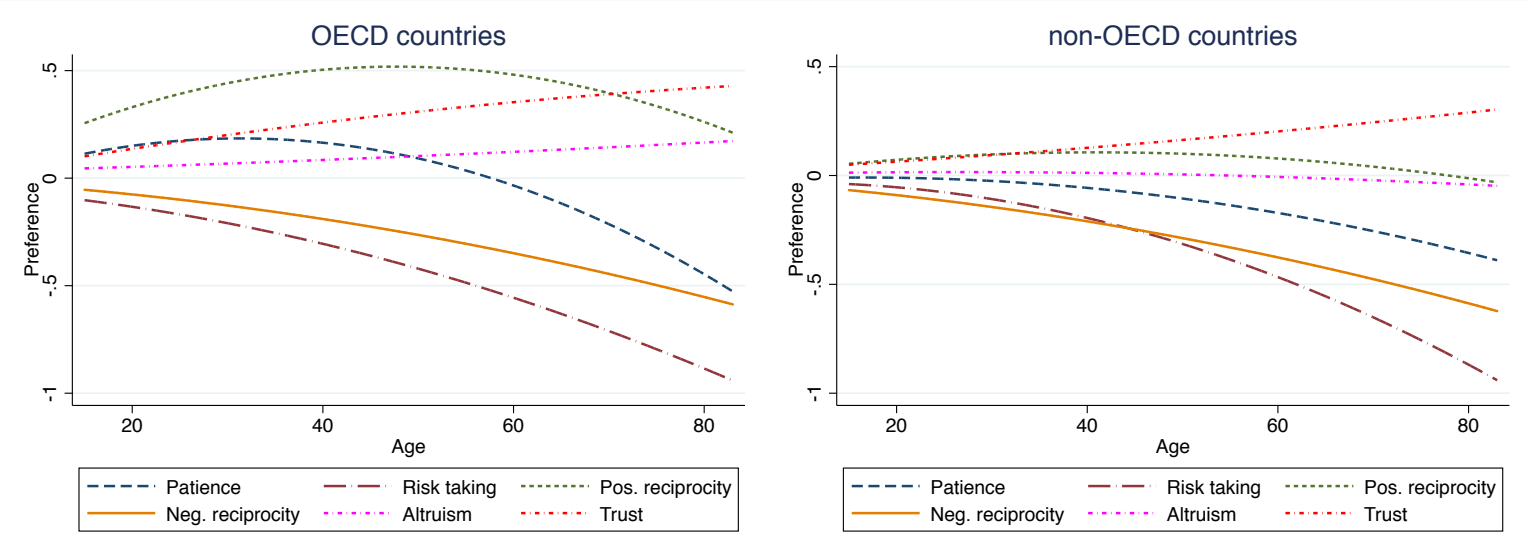


Figure 7: Age profiles by OECD membership.

The figures depict the relationship between preferences and age conditional on country fixed effects, gender, and subjective math skills. Age is winsorized at 83 (99th percentile).

Preferences and Gender

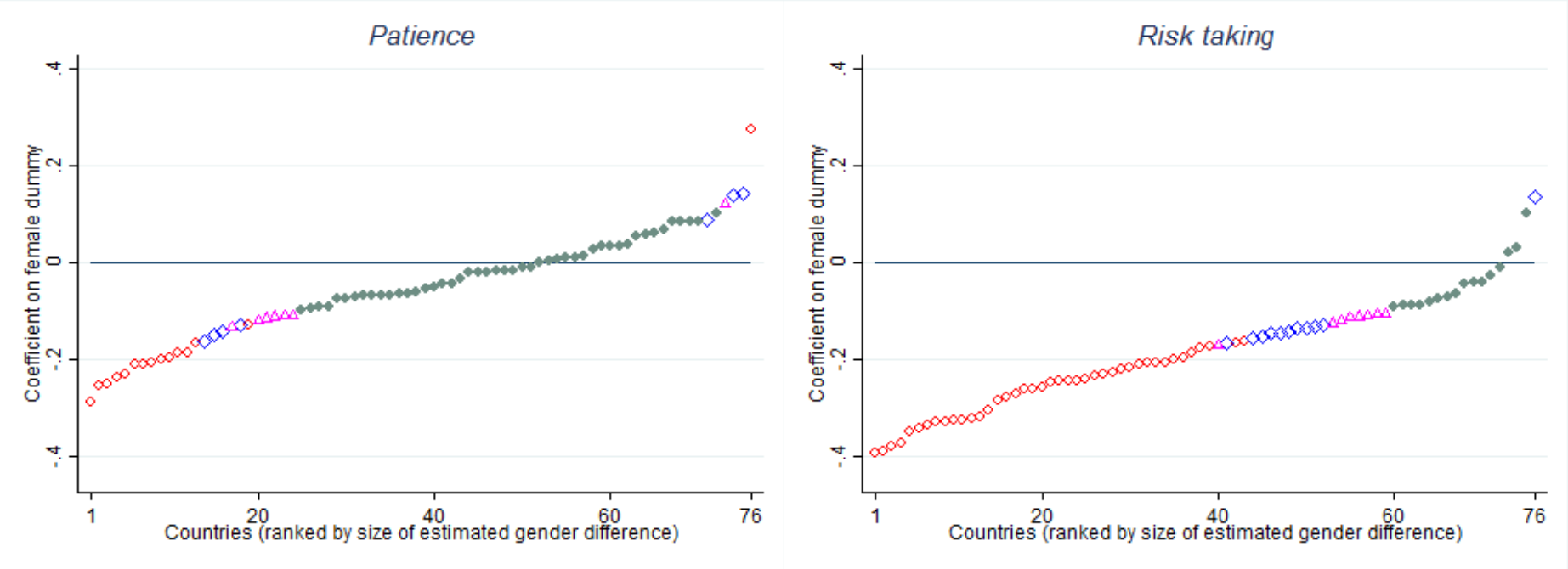


Figure 8: Gender correlations separately by country.

Green dots: not statistically different from zero at the 10% level, while red / blue / pink dots denote countries in which the effect is significant at the 1% / 5% / 10% level, respectively. Positive coefficients imply that women have higher values in the respective preference.

Preferences and Gender

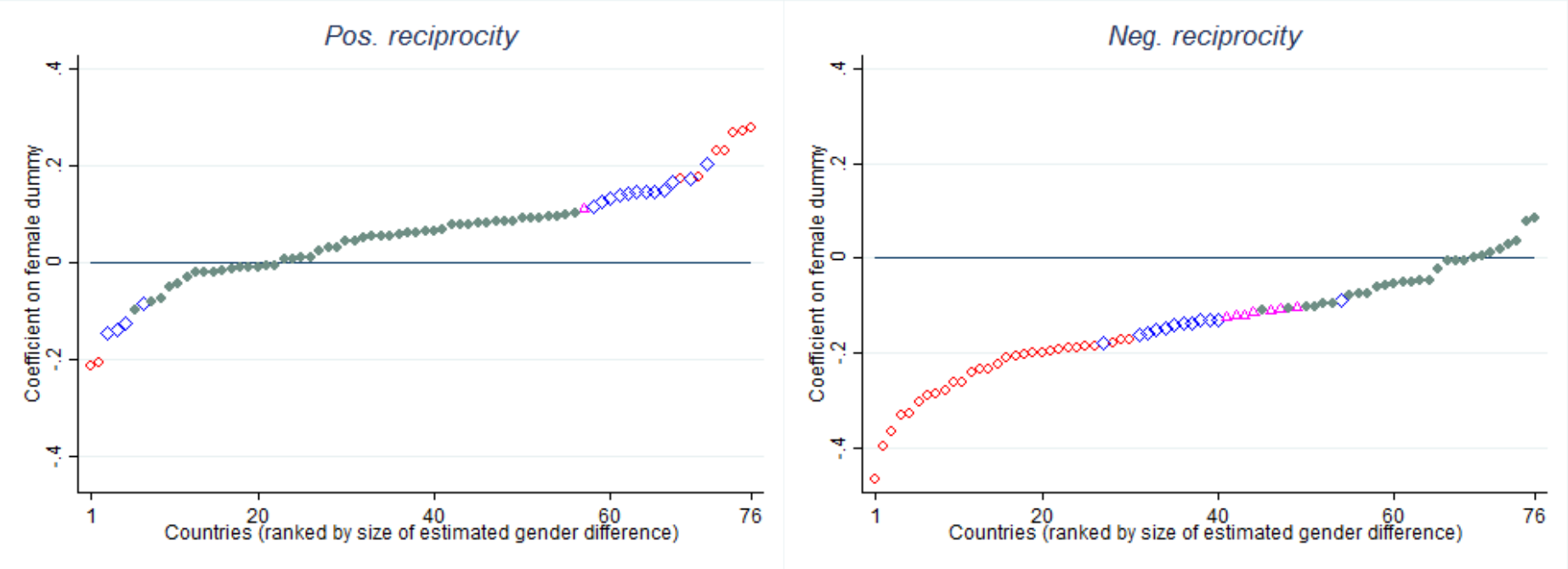


Figure 9: Gender correlations separately by country.

Green dots: not statistically different from zero at the 10% level, while red / blue / pink dots denote countries in which the effect is significant at the 1% / 5% / 10% level, respectively. Positive coefficients imply that women have higher values in the respective preference.

Preferences and Gender

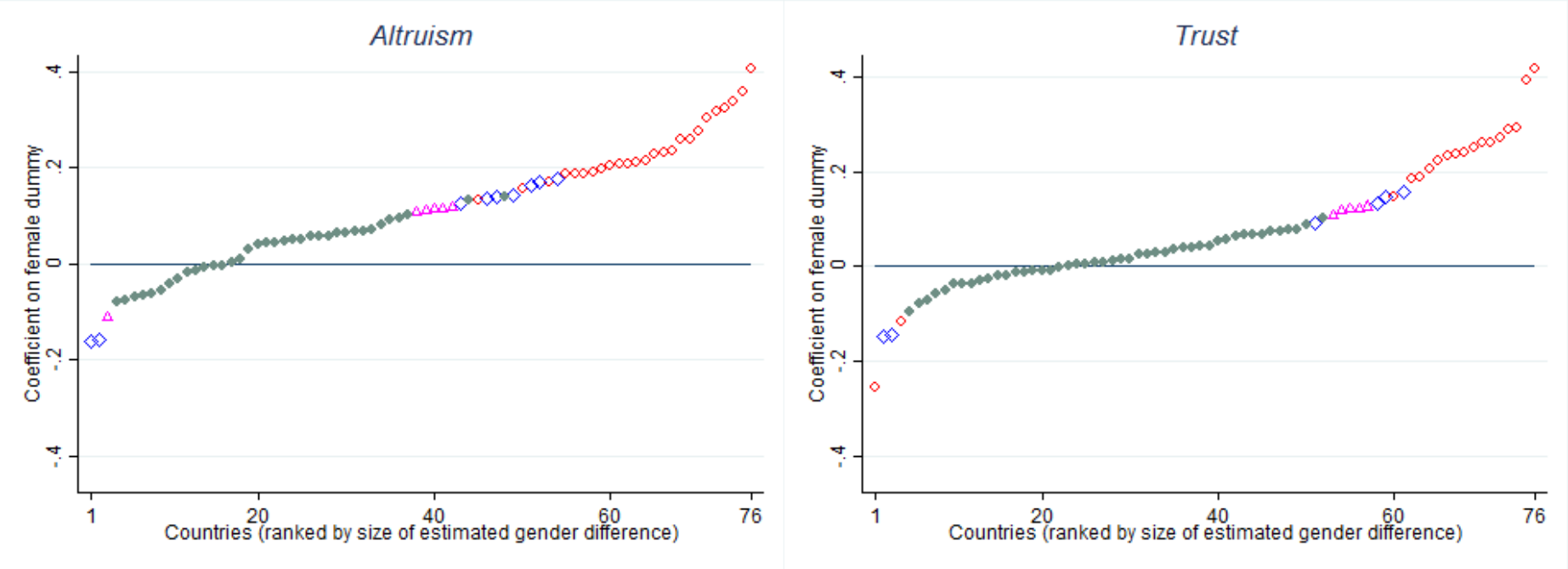


Figure 10: Gender correlations separately by country.

Green dots: not statistically different from zero at the 10% level, while red / blue / pink dots denote countries in which the effect is significant at the 1% / 5% / 10% level, respectively. Positive coefficients imply that women have higher values in the respective preference.

Preferences and Cognitive Skills

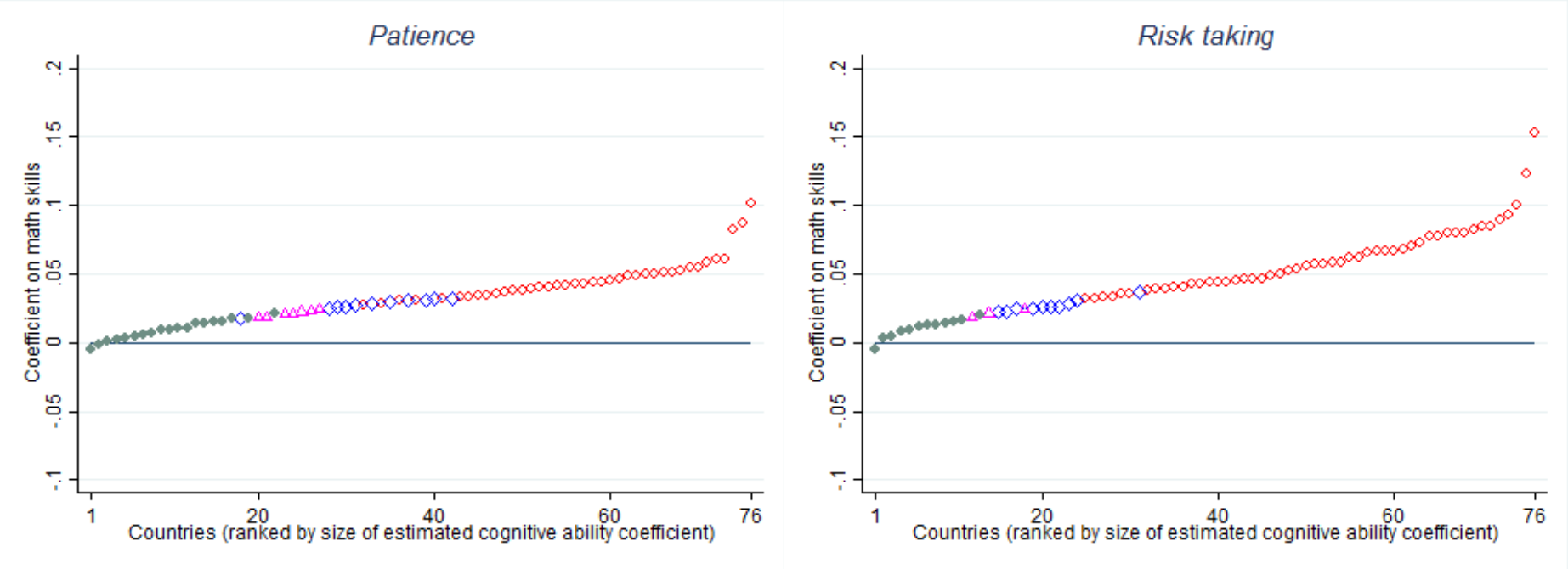


Figure 11: Cognitive ability coefficients by country.

Green dots: not statistically different from zero at the 10% level, while red / blue / pink dots denote countries in which the effect is significant at the 1% / 5% / 10% level, respectively. Positive coefficients imply that higher cognitive ability is associated with higher values in the respective preference.

Preferences and Cognitive Skills

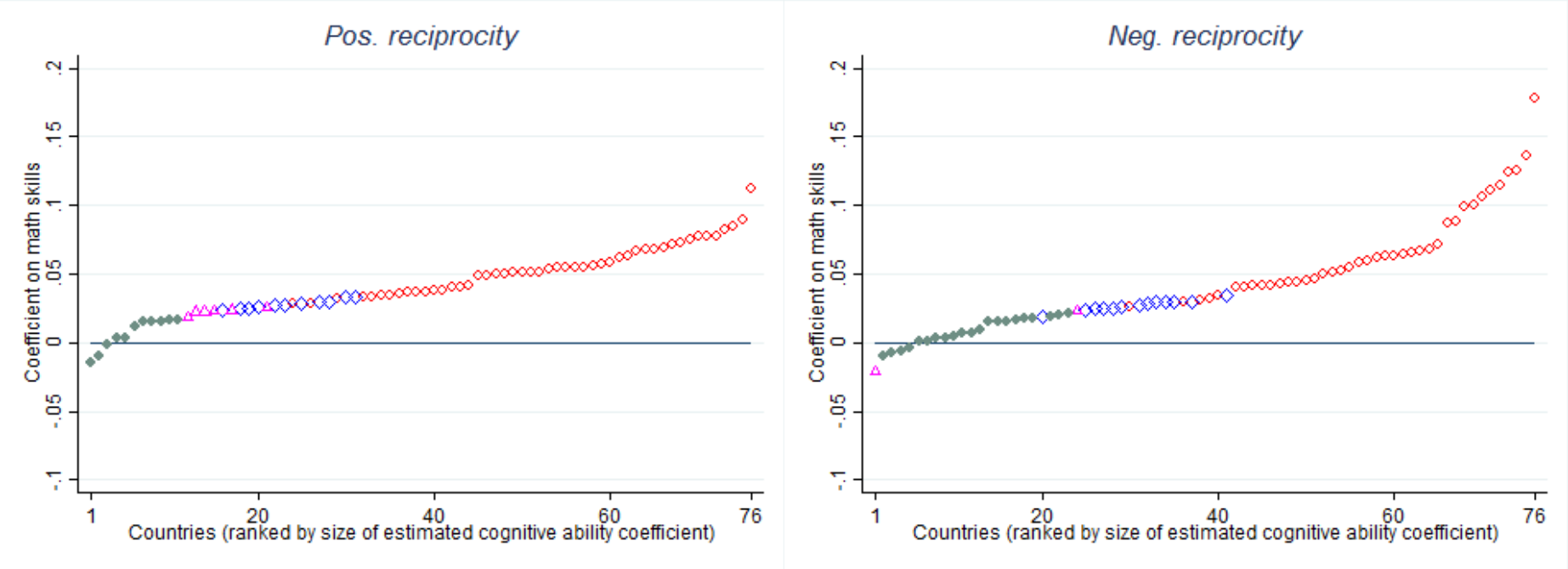


Figure 12: Cognitive ability coefficients by country.

Green dots: not statistically different from zero at the 10% level, while red / blue / pink dots denote countries in which the effect is significant at the 1% / 5% / 10% level, respectively. Positive coefficients imply that higher cognitive ability is associated with higher values in the respective preference.

Preferences and Cognitive Skills

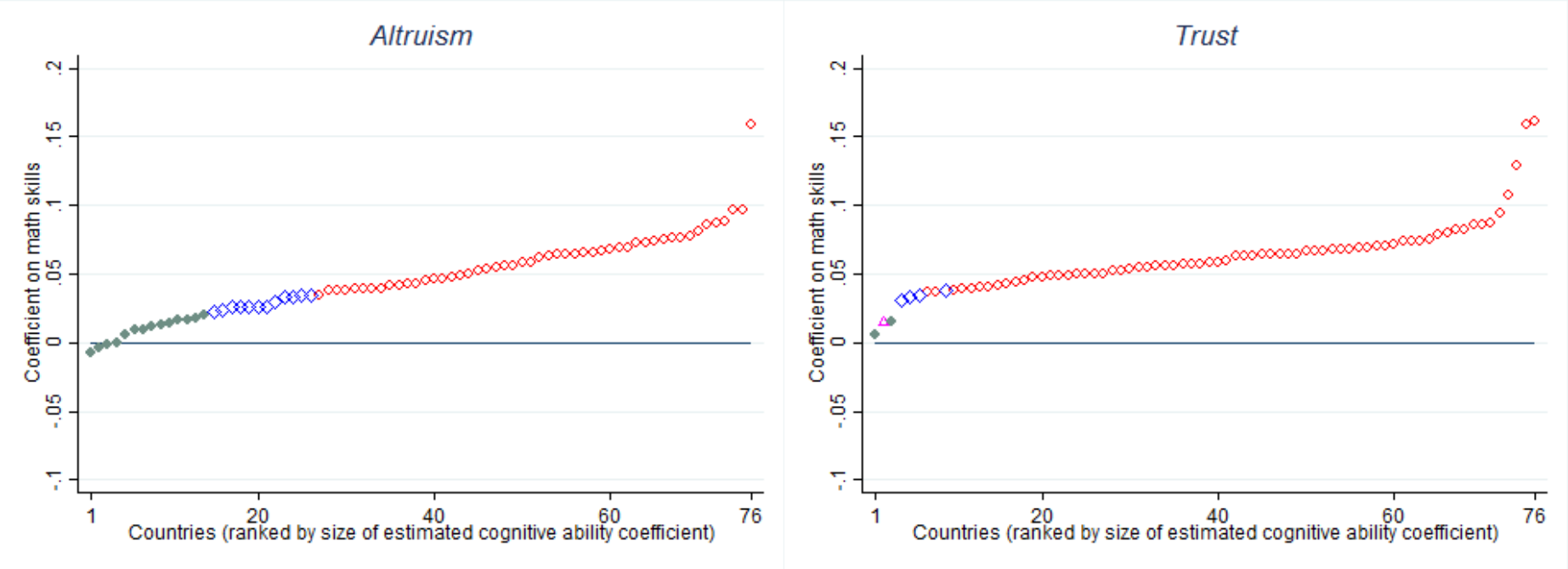


Figure 13: Cognitive ability coefficients by country.

Green dots: not statistically different from zero at the 10% level, while red / blue / pink dots denote countries in which the effect is significant at the 1% / 5% / 10% level, respectively. Positive coefficients imply that higher cognitive ability is associated with higher values in the respective preference.

Preferences and Individual Outcomes

Outline

Preferences and Individual Outcomes

- Investigate predictive power of preferences for economic and social behaviors, around the world
  - Social preferences and social interactions
  - Risk taking and risky choices
  - Patience and accumulation decisions
- Important to understand role of preferences in generating observed variation in choice behavior...
- ... but also to provide an out-of-sample validation check on the meaningfulness of the survey measures in culturally and economically highly heterogeneous samples

Social Preferences and Social Interactions

Table 6: Social preferences and social interactions

	Dependent variable:						
	Donated money (1)	Volunteered time (2)	Helped stranger (3)	Sent money to other individual (4)	Voiced opinion (5)	Have friends I can count on (6)	In a relationship (7)
Altruism	0.059***	0.038***	0.052***	0.032***	0.023***	0.017***	0.0032
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Positive reciprocity	0.0049	0.0031	0.034***	0.020***	-0.0016	0.016***	0.0085***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Negative reciprocity	-0.0024	-0.00058	-0.0024	0.0032	0.017***	0.0016	0.00041
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	0.30***	0.030	0.33***	-0.25***	0.016	0.32***	-0.38***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.05)
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	52686	52677	52473	52812	52421	58479	67420
R^2	0.241	0.138	0.148	0.179	0.105	0.170	0.237

Social Preferences and Behavior – Universality and Country-Specificity

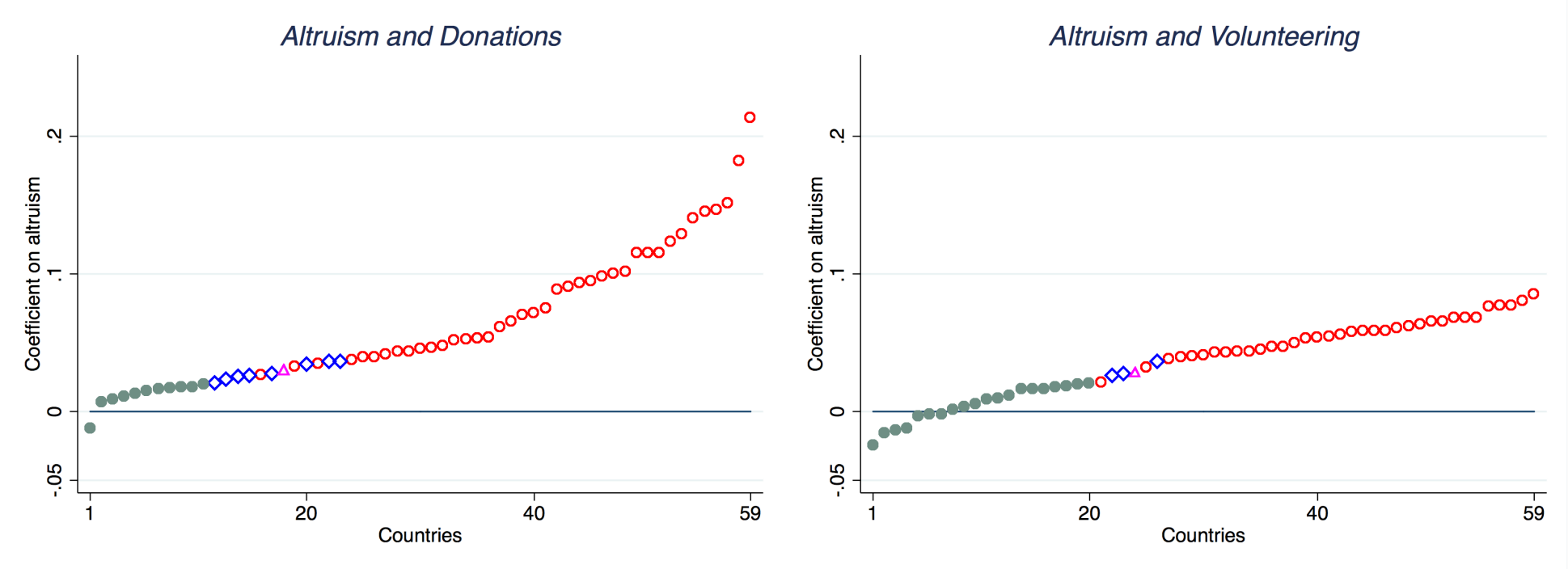


Figure 14: Relationship between social preferences and behavior and separately by country.

Green dots: not statistically different from zero at the 10% level, while red / blue / pink dots denote countries in which the effect is significant at the 1% / 5% / 10% level, respectively.

Social Preferences and Behavior – Universality and Country-Specificity

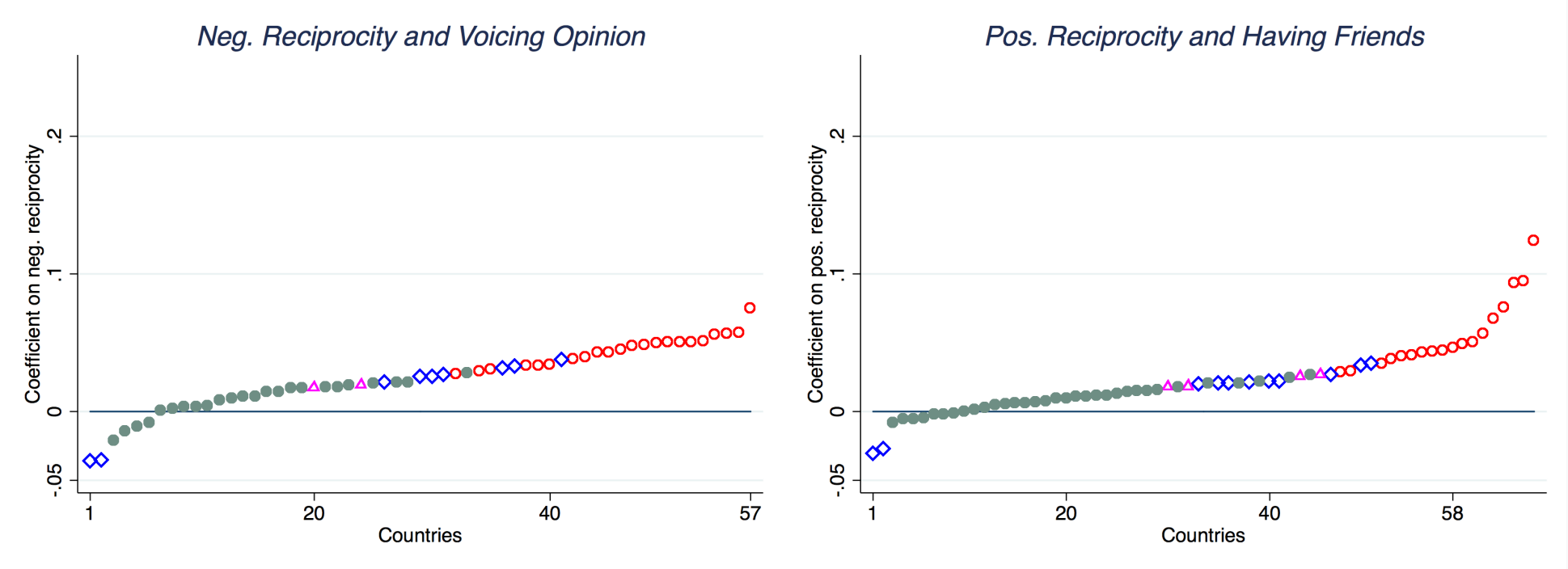


Figure 15: Relationship between social preferences and behavior and separately by country.

Green dots: not statistically different from zero at the 10% level, while red / blue / pink dots denote countries in which the effect is significant at the 1% / 5% / 10% level, respectively.

Patience, Risk Taking, and Behaviors

Table 7: Patience and accumulation decisions, risk preferences and risky choices

	Dependent variable:				
	Accumulation decisions		Risky choices		
	Saved last year	Education level	Own business	Plan to start business	Smoking intensity
	(1)	(2)	(3)	(4)	(5)
Patience	0.027***	0.033***			
	(0.01)	(0.00)			
Risk taking			0.024***	0.019***	0.032**
			(0.00)	(0.00)	(0.01)
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	-0.38***	0.16**	-0.37***	0.094***	0.067
	(0.09)	(0.07)	(0.04)	(0.03)	(0.11)
Region FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	14459	68409	62125	50687	14490
R^2	0.183	0.359	0.137	0.167	0.229

Risk Preferences and Self-employment – Universality and Country-Specificity

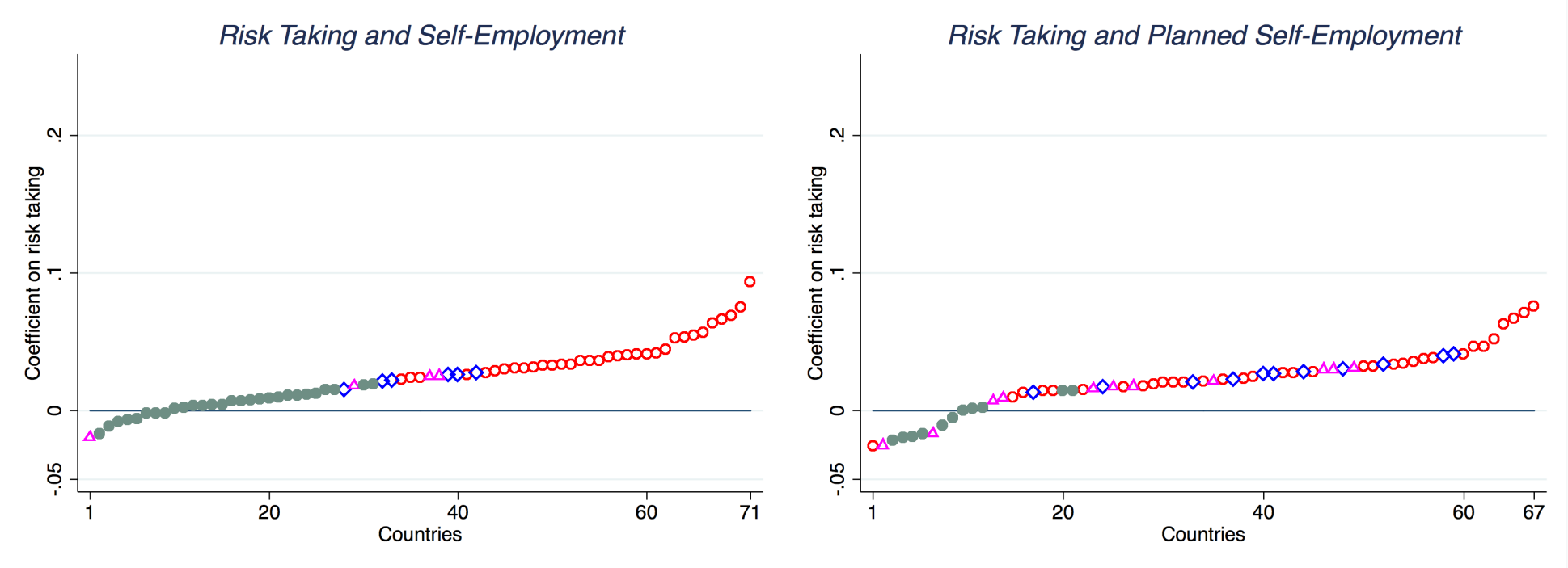


Figure 16: Relationship between risk preference and self-employment decision separately by country.

Green dots: not statistically different from zero at the 10% level, while red / blue / pink dots denote countries in which the effect is significant at the 1% / 5% / 10% level, respectively.

Patience and Accumulation – Universality and Country-Specificity

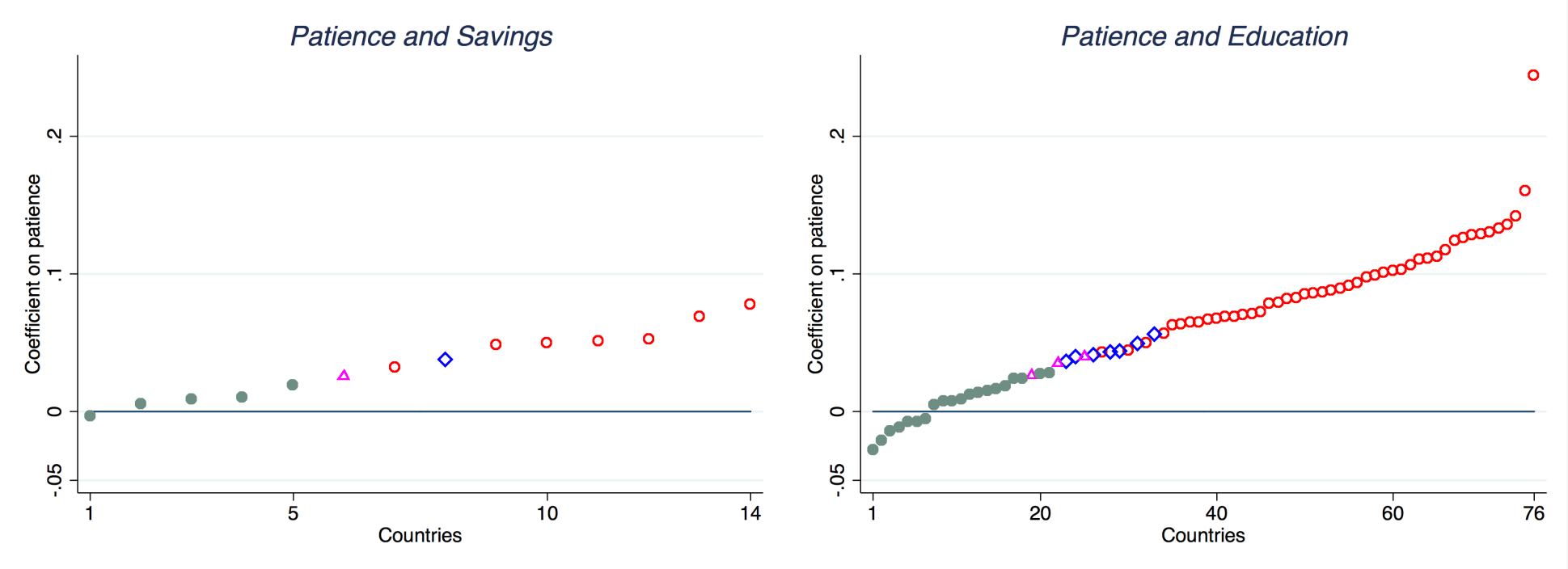


Figure 17: Relationship between patience and accumulation decisions separately by country.

Green dots: not statistically different from zero at the 10% level, while red / blue / pink dots denote countries in which the effect is significant at the 1% / 5% / 10% level, respectively.

Preferences and Country-Level Outcomes

Preferences and Country-Level Outcomes

Table 8: Country-level outcomes and preferences

	Dependent variable:									
	Entrepreneurship						Social outcomes			
	Patent applic. p/c		Scientific articles p/c		TFP		Volunt. & donat.		Armed conflicts	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Risk taking	-0.031	0.28	-0.013	0.094**	0.11	0.22**				
	(0.98)	(0.43)	(0.05)	(0.05)	(0.10)	(0.09)				
Prosociality							0.85	1.23**		
							(0.57)	(0.48)		
Negative reciprocity									1.59***	1.20***
									(0.41)	(0.41)
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	64	61	69	67	60	59	32	32	76	73
R^2	0.00	0.66	0.00	0.44	0.02	0.49	0.06	0.42	0.13	0.32

OLS estimates, robust standard errors in parentheses. The dependent variables in columns (1)–(2) and (3)–(4) are the logs of the number of patent applications p/c and the number of scientific articles p/c, respectively. In columns (7)–(8), the dependent variable is volunteering and donation as a fraction of GDP. Frequency of conflicts is measured by the log of conflicts according to PRIO, in the Quality of Government dataset. Prosociality is the first principal component of altruism, positive reciprocity, and trust. Controls include distance to equator, average temperature, average precipitation, the share of the population living in (sub-)tropical zones, terrain ruggedness, average distance to nearest waterway, and an island dummy.

Preferences and Economic Development

Table 9: Economic development and preferences

	Dependent variable: Log [GDP p/c]									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Patience	2.63***	1.73***							2.67***	1.92***
	(0.26)	(0.27)							(0.29)	(0.31)
Trust			1.58**	0.56					0.73	0.31
			(0.68)	(0.48)					(0.56)	(0.45)
Risk taking					-0.53	0.59*			-1.34***	-0.53
					(0.56)	(0.33)			(0.50)	(0.39)
Neg. reciprocity							1.30**	0.51	0.54	0.092
							(0.51)	(0.50)	(0.52)	(0.45)
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	76	73	76	73	76	73	76	73	76	73
R^2	0.39	0.70	0.08	0.59	0.01	0.59	0.05	0.59	0.48	0.71

OLS estimates, robust standard errors in parentheses. Controls include distance to equator, average temperature, average precipitation, the share of the population living in (sub-)tropical zones, terrain ruggedness, average distance to nearest waterway, and an island dummy.

Patience and Contemporary Income

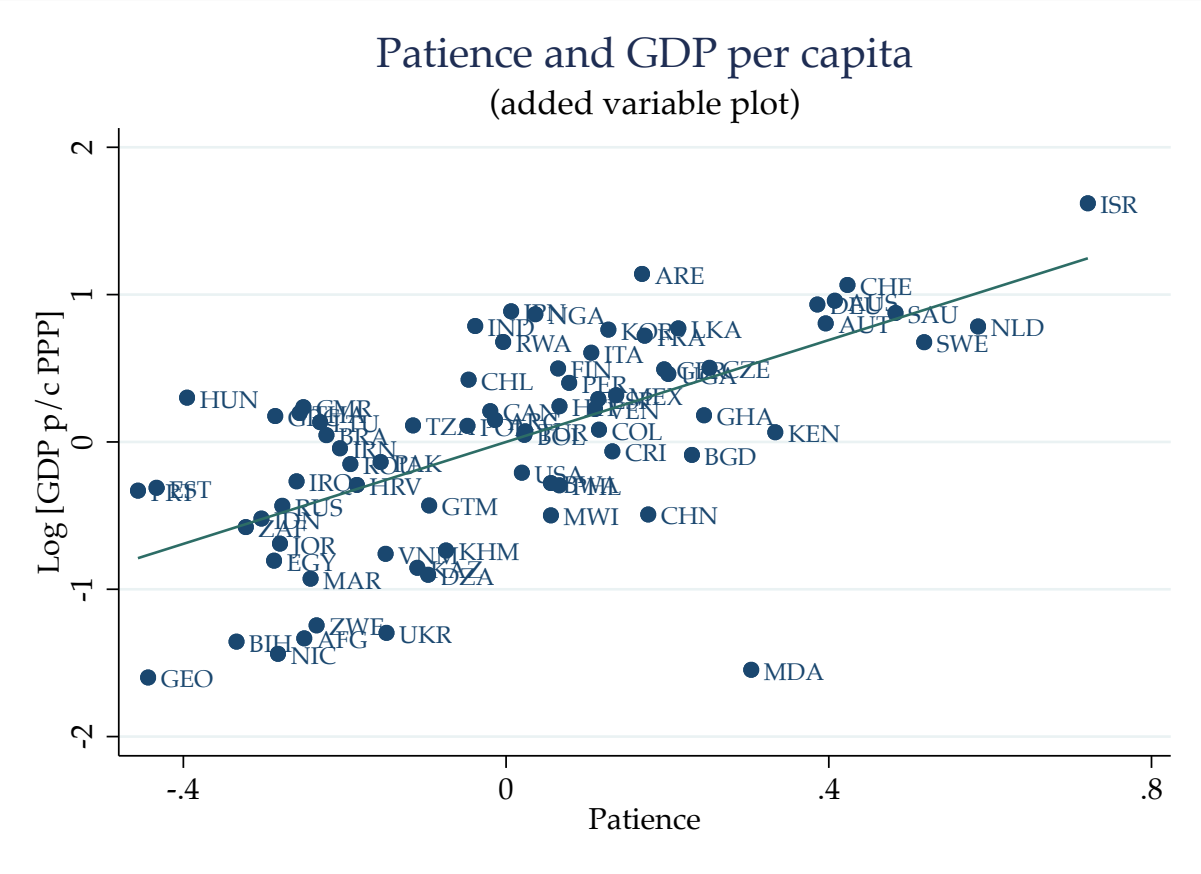


Figure 18: Patience and per capita income.

Added variable plot conditional on geography (distance to equator, longitude, percentage of arable land, land suitability for agriculture), climate (average precipitation, average temperature), percentage living in (sub-)tropical zones, percentage at risk of malaria, continent FE, predicted genetic diversity, trust. Similar results with short- and long-run growth rates since 1800, 1900, 1950

Patience and Comparative Development

Patience and Comparative Development

- Why are some countries so much richer than others?

Patience and Comparative Development

- Why are some countries so much richer than others?
- Development accounting framework (Hall and Jones, 1999; Caselli, 2005; Hsieh and Klenow, 2010)
  - Decomposition into stock of production factors (e.g., physical and human capital) and productivity (e.g.residual TFP) ("proximate determinants")

Patience and Comparative Development

- Why are some countries so much richer than others?
- Development accounting framework (Hall and Jones, 1999; Caselli, 2005; Hsieh and Klenow, 2010)
  - Decomposition into stock of production factors (e.g., physical and human capital) and productivity (e.g.residual TFP) ("proximate determinants")
- But how do differences in proximate determinants arise in the first place ("deep determinants")?

Patience and Comparative Development

- Why are some countries so much richer than others?
- Development accounting framework (Hall and Jones, 1999; Caselli, 2005; Hsieh and Klenow, 2010)
  - Decomposition into stock of production factors (e.g., physical and human capital) and productivity (e.g.residual TFP) ("proximate determinants")
- But how do differences in proximate determinants arise in the first place ("deep determinants")?
- Potentially many candidates
  - history
  - geography
  - climate

Patience and Comparative Development

- Why are some countries so much richer than others?
- Development accounting framework (Hall and Jones, 1999; Caselli, 2005; Hsieh and Klenow, 2010)
  - Decomposition into stock of production factors (e.g., physical and human capital) and productivity (e.g.residual TFP) ("proximate determinants")
- But how do differences in proximate determinants arise in the first place ("deep determinants")?
- Potentially many candidates
  - history
  - geography
  - climate
  - "culture" (e.g., Doepke and Zilibotti, 2008, 2014)

Patience and Comparative Development

Literature on deep determinants has pointed to long-run origins of variation in patience (Weber, 1930; Chen, 2013; Galor and Özak, 2016; Galor et al., 2016)

Patience and Comparative Development

Literature on deep determinants has pointed to long-run origins of variation in patience (Weber, 1930; Chen, 2013; Galor and Özak, 2016; Galor et al., 2016)

The role of patience:

Patience and Comparative Development

Literature on deep determinants has pointed to long-run origins of variation in patience (Weber, 1930; Chen, 2013; Galor and Özak, 2016; Galor et al., 2016)

The role of patience:

- Dynamic neoclasssical models: production factors and productivity arise from accumulation processes (e.g., Becker, 1962; Ben- Porath, 1967; Romer, 1990; Aghion and Howitt, 1992)

Patience and Comparative Development

Literature on deep determinants has pointed to long-run origins of variation in patience (Weber, 1930; Chen, 2013; Galor and Özak, 2016; Galor et al., 2016)

The role of patience:

- Dynamic neoclasssical models: production factors and productivity arise from accumulation processes (e.g., Becker, 1962; Ben- Porath, 1967; Romer, 1990; Aghion and Howitt, 1992)
  - Aggregate level: More patient populations accumulate more physical and human capital, invest more into R&D, have higher per capita income

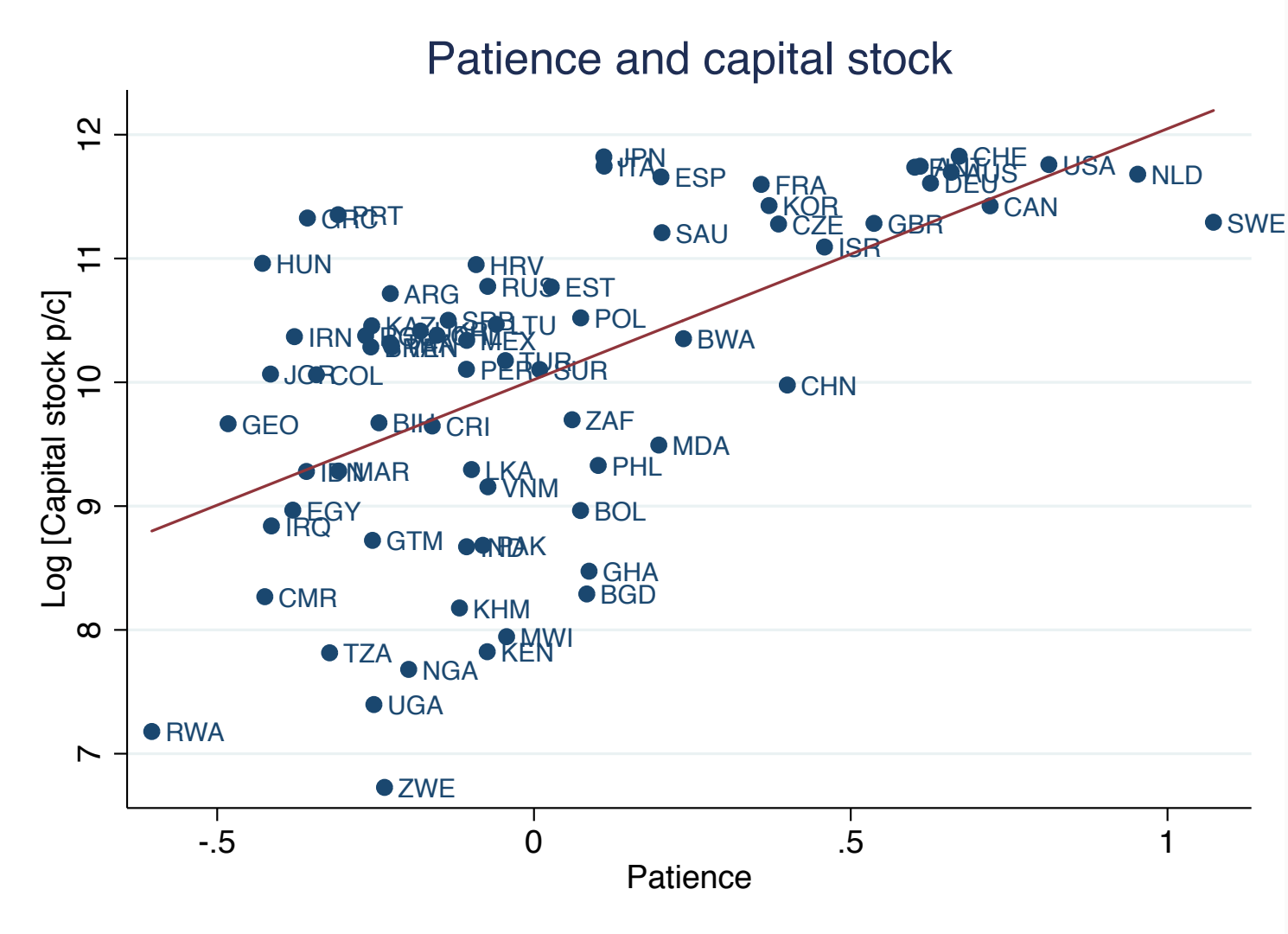
Patience and Comparative Development

Literature on deep determinants has pointed to long-run origins of variation in patience (Weber, 1930; Chen, 2013; Galor and Özak, 2016; Galor et al., 2016)

The role of patience:

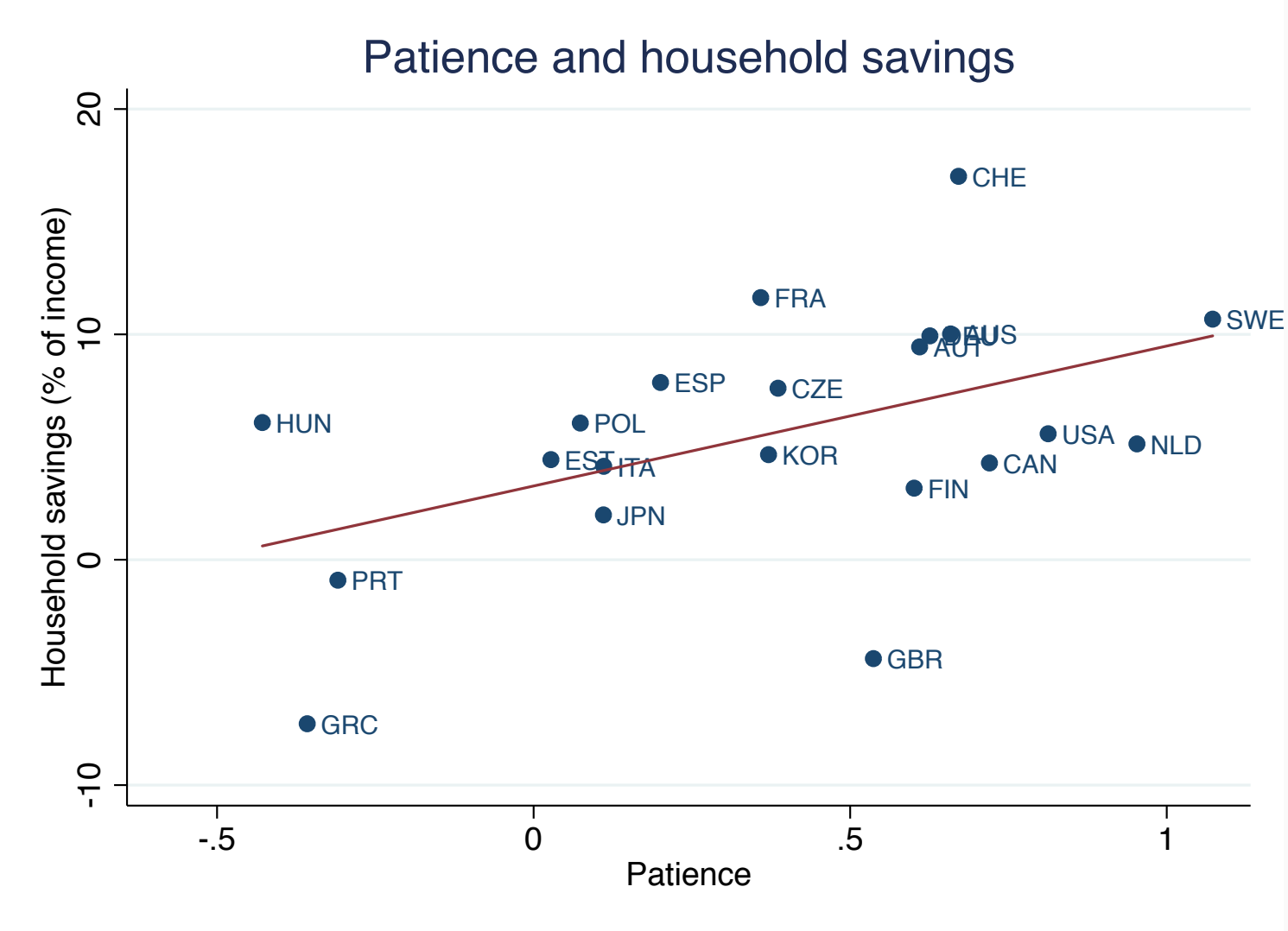
- Dynamic neoclasssical models: production factors and productivity arise from accumulation processes (e.g., Becker, 1962; Ben- Porath, 1967; Romer, 1990; Aghion and Howitt, 1992)
  - Aggregate level: More patient populations accumulate more physical and human capital, invest more into R&D, have higher per capita income
  - Individual level: More patient individuals save more, acquire more human capital, invest more into entrepreneurial activities, and have higher income.

Patience and Accumulation: Physical Capital



Patience Measure

Patience and Accumulation: Physical Capital



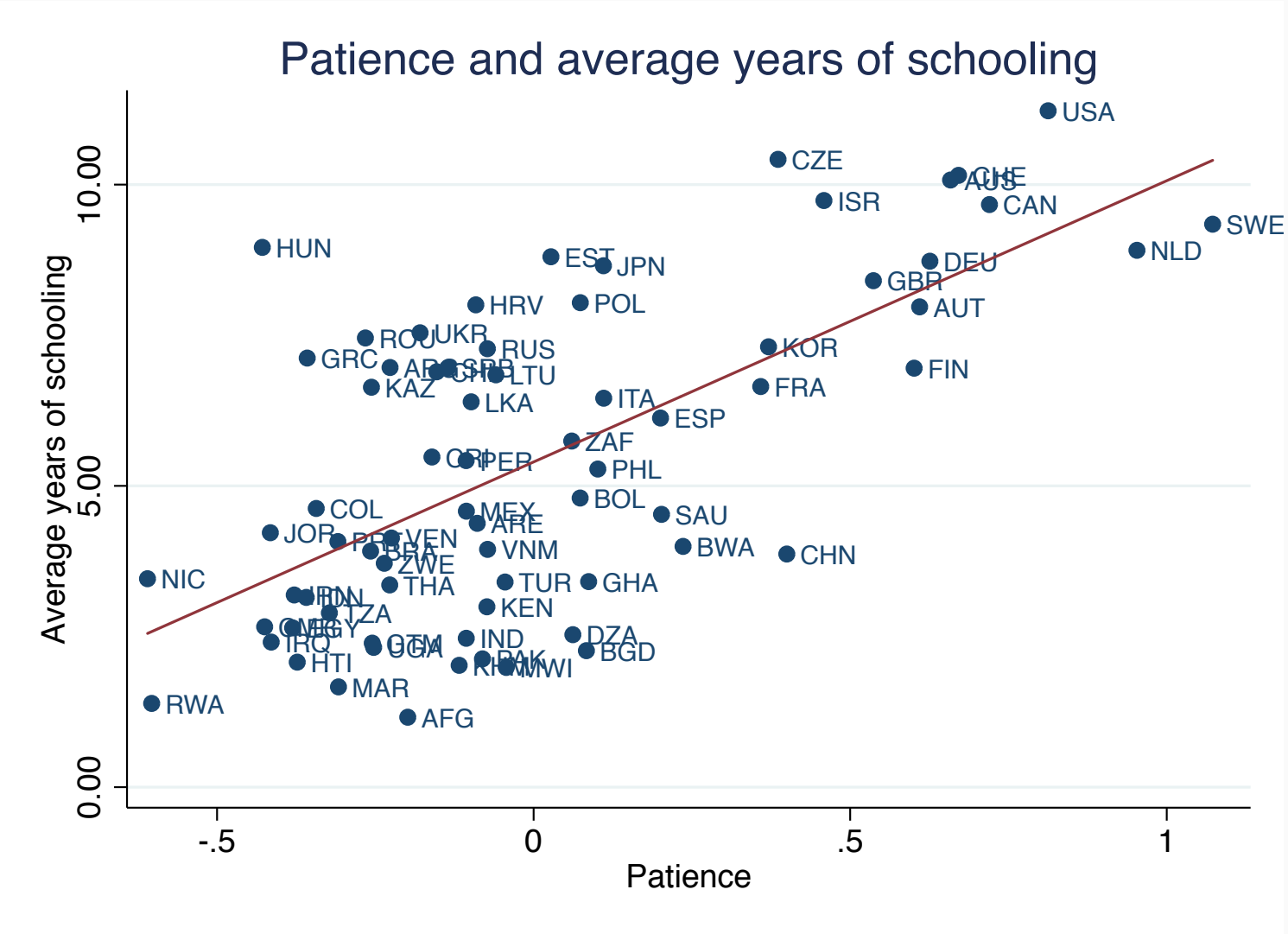
Patience and Accumulation

Table 10: Patience, physical capital, and savings

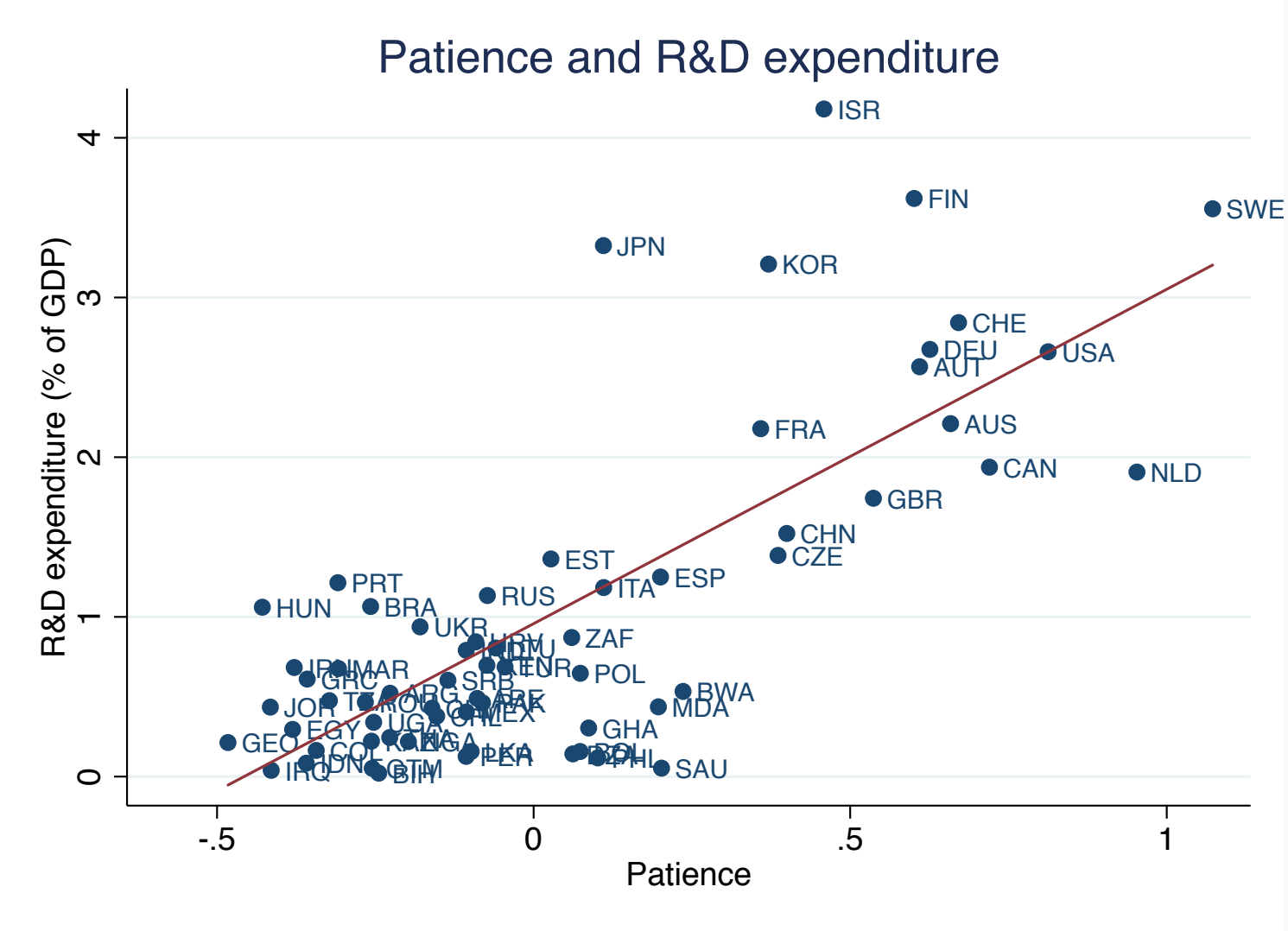
	Dependent variable:							
	Log [Capital stock p/c]		Gross savings (% of GNI)		Net adj. savings (% of GNI)		HH savings (% of disposable inc.)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Patience	1.94***	1.17***	7.43***	8.91***	6.08**	7.16*	8.52***	9.80***
	(0.27)	(0.29)	(2.41)	(3.27)	(2.34)	(3.62)	(2.72)	(3.31)
Continent FE	No	Yes	No	Yes	No	Yes	No	Yes
Additional controls	No	Yes	No	Yes	No	Yes	No	No
Observations	71	69	75	73	73	71	26	26
R^2	0.32	0.83	0.07	0.36	0.04	0.38	0.15	0.32

OLS estimates, robust standard errors in parentheses. Due to the small number of observations, in column (8), the controls are restricted to continent dummies. See column (5) of Table **??** for a complete list of the additional controls. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$)

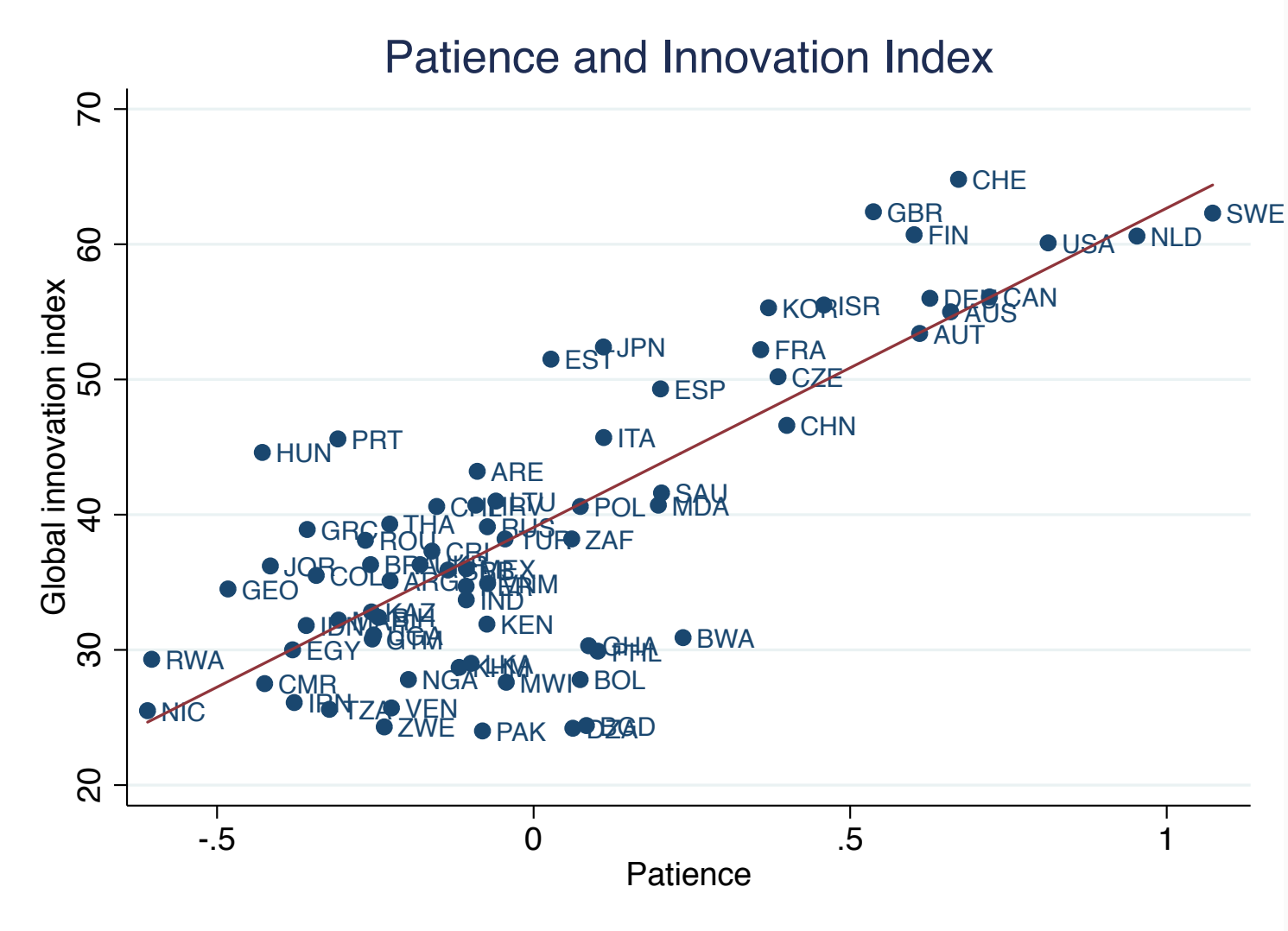
Patience and Accumulation: Human Captial



Patience and Accumulation: Knowledge and Productivity



Patience and Accumulation: Knowledge and Productivity



Patience and Accumulation: Physical Capital

Table 11: Patience, human capital and productivity

	Human capital				Productivity			
	Dependent variable:							
	% Skilled		Yrs. of schooling		TFP		Log [# Researchers in R&D]	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Patience	38.5***	20.1***	4.34***	2.47***	0.29***	0.17**	2.70***	1.49***
	(5.45)	(7.20)	(0.58)	(0.86)	(0.05)	(0.07)	(0.35)	(0.50)
Continent FE	No	Yes	No	Yes	No	Yes	No	Yes
Additional controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	72	71	72	71	59	58	69	68
R^2	0.30	0.73	0.34	0.76	0.29	0.70	0.35	0.83

OLS estimates, robust standard errors in parentheses. The percentage skilled is the percentage of individuals aged 25+ that has at least secondary education Barro and Lee (2013). Number of researchers in R & D are per 1,000 population. Columns (5) – (6) exclude Zimbabwe because it is an extreme *upward* outlier in the TFP data from the Penn World Tables, which is likely due to measurement error. See column (5) of Table **??** for a complete list of the additional controls. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$)

Assessing endogeneity concerns

- While standard models presume a causal role of patience for accumulation processes and income, a causal interpretation of our reduced form empirical results is subject to criticisms
  - patience variable might not only measure patience but also other features of the environment (e.g., institutions, inflation, interest rates)
  - OLS estimates could be driven by omitted variables or reverse causality
- We cannot rule out all potential endogeneity concerns, but can investigate the extent to which the correlation between patience and per capita income is driven by omitted variable bias, measurement issues, or reverse causality.

Assessing endogeneity concerns

- Correlation is not driven by Estimation results
  - Borrowing constraints
  - Living in an environment with high inflation or high nominal interest rates
  - Subjective uncertainty (objective and subjective measures of institutional quality, life expectance, property rights, democracy index)
  - Cognitive skills and education
  - Reverse causality

Patience, Accumulation, and Income Across Regions

Table 12: Regional patience, human capital, and income

	Dependent variable:					
	Log [Regional GDP p/c]			Avg. years of education		
	(1)	(2)	(3)	(4)	(5)	(6)
Patience	1.40***	0.19***	0.17***	3.64***	0.51***	0.47***
	(0.24)	(0.06)	(0.06)	(0.62)	(0.16)	(0.16)
Temperature			-0.025**			-0.055***
			(0.01)			(0.01)
Inverse distance to coast			0.41			0.88
			(0.25)			(0.58)
Log [Oil production p/c]			0.30***			0.044
			(0.07)			(0.06)
# Ethnic groups			-0.10*			-0.25*
			(0.06)			(0.13)
Log [Population density]			0.071**			0.19***
			(0.03)			(0.06)
Country FE	No	Yes	Yes	No	Yes	Yes
Observations	648	648	631	637	637	620
R^2	0.20	0.93	0.94	0.29	0.94	0.95

Regional-level OLS estimates, standard errors (clustered at the country level) in parentheses.
* ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$)

Individual patience, savings, human capital, and income

Table 13: Individual patience, savings, human capital, and income

	Dependent variable:											
	Log [HH income p/c]				Saved last year				1 if at least secondary educ.			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Patience	0.34***	0.056***	0.049***	0.040***	0.051***	0.038***	0.038***	0.032***	0.061***	0.035***	0.033***	0.012***
	(0.05)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
Age				0.58***				-0.059				0.20
				(0.20)				(0.32)				(0.24)
Age squared				-0.38				-0.056				-0.94***
				(0.23)				(0.30)				(0.22)
1 if female				-0.086***				-0.0057				-0.028***
				(0.02)				(0.01)				(0.01)
Subj. math skills				0.035***				0.017***				0.028***
				(0.00)				(0.00)				(0.00)
Subjective institutional quality				-0.042*				0.046				-0.062***
				(0.02)				(0.03)				(0.01)
Confidence in financial institutions				4.22***				5.15***				0.76
				(1.17)				(1.24)				(0.67)
Subjective law and order index				0.058**				0.012				0.00018
				(0.02)				(0.03)				(0.01)
Country FE	No	Yes	No	No	No	Yes	No	No	No	Yes	No	No
Subnational region FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Religion FE	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Observations	79245	79245	78271	46383	15260	15260	15260	10438	79357	79357	78403	46550
R^2	0.05	0.61	0.64	0.64	0.01	0.07	0.13	0.14	0.02	0.18	0.23	0.29

Individual-level OLS estimates, standard errors (clustered at the country level) in parentheses. The dependent variable in (1) – (4) is ln household income per capita; the dependent variable in (5) – (8) is a binary indicator for whether the individual saved in the previous year; and the dependent variable in (9) – (12) is 1 if the individual has at least secondary education. Age is divided by 100. All results in columns (5) – (12) are robust to estimating probit models. See Appendix B for a detailed description of all dependent variables. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$)

Aggregations effects

- across levels of aggregation, patience is systematically linked to accumulation of productive factors, and to income
- data reveal strong aggregation effects
- not driven by measurement error, nor by omitted variables
- in the paper we develop a simple OLG model that can account for aggregation effect ▸ Model Setup
- simulating a parameterized version shows: magnitude of aggregation effects is consistent with the model, particular if variation in TFP is incorporated ▸ Results
- the difference in magnitude of coefficients across levels of aggregation is partly driven by general equilibrium effects and human capital externalities

Parameter Calibration

Table 14: Calibrated parameters

Parameter	Value	Calibration Details
$1-\psi$	0.2	Fraction of young age required to become skilled (five additional years) (Caselli, 2017)
ρ	1.75[a]	Corresponds to a (private) Mincerian return of 7% (Card, 2001; Psacharopoulos and Patrinos, 2018)
σ	0.62	CES (inverse): labor/capital compound (Duffy et al., 2004)
θ	0.38	CES (inverse): physical/human capital (Duffy et al., 2004)

Calibrated parameters. [a] With the Mincerian human capital production function, a return of $x = 0.07$ for five years of schooling during a 25-year period of youth corresponds to $\rho = \frac{\ln\left(e^{0.07 \cdot 5}\right)}{0.2} = 1.75$.

Model Specification

- Baseline version: two model economies that only differ in their patience distribution, but without a human capital externality on TFP
  - patience only affects economic performance through the accumulation of physical capital and human capital
  - think of this specification as conceptual analogue to the within-country-across-region regressions
  - patience might affect the formation of physical and human capital, but the broader productivity environment is effectively held constant
- HC Externality (estimated)
  - extended version of the model that accounts for the observed differences in TFP across countries.
  - estimate γ while keeping $\bar{A}$ fixed across both economies.

Model Specification

- HC Externality (calibrated)
  - check sensitivity by calibrating $\gamma = \frac{\rho}{2}$.
  - conservative approach that complements an approach of directly estimating γ in light of the difficulties associated with disentangling social returns to human capital from private returns
- Development Accounting: TFP variable, patience fixed
  - concern with our empirical analyses is the presence of omitted variables.
  - estimate a model variant in which average patience χ is held fixed across the two economies under consideration.
  - estimate two separate levels for $\bar{A}_1$ and $\bar{A}_2$, as is commonly done in the development accounting literature.
  - analysis sheds light on two aspects: whether exogenous variation in TFP alone is sufficient to rationalize the patterns in the data, and the potential value added of a patience-related amplification mechanism.

Estimation Results

Table 15: Estimated parameters

Model	Baseline	Extensions		Dev. Acc.
		HC-Externality (estimated)	HC-Externality (calibrated)	
χ_1, χ_2	0.16, [0.25]^a	0.16, [0.25]^a	0.12, [0.19]^a	0.16, [0.16]^c
ϵ	0.16	0.16	0.12	0.16^c
$\frac{\bar{A}_1}{\bar{A}_2}$	1	1	1	2.55
γ	0	1.98	0.88^b	0^c

Parameters in brackets [ ] are derived from estimated parameters. ^{a} Level of χ_2 as implied by the estimated values of χ_1 and ε. ^{b} Calibrated to $0.88 = \frac{\rho}{2}$. ^{c} Values fixed as in baseline model.

Model vs. data

Table 16: Quantified model vs. data

	Effect of one SD increase of patience				Fixed χ
	Data	Model			Model
	(Baseline Controls)	Baseline	Extensions		Dev. Acc.
			HC Externality (estimated)	HC Externality (calibrated)	
	(1)	(2)	(3)	(4)	(5)
	Individual level				
Income	0.05	0.05	0.05	0.05	0.05[a]
Education	0.03	0.03	0.03	0.02	0.03[a]
	Country level				
Income	1.73	0.11	1.74	0.80	1.79[b]
Fraction skilled	0.20	0.16	0.18	0.16	0.02[b]

The effect sizes in the simulated model are obtained after estimating the parameters through indirect inference as reported in Table 15. In the baseline, estimated parameters are χ_1, ε, and $\bar{A}$ by matching as moments the effects of patience on individual income, individual propensity to become skilled, aggregate income and aggregate skill share. For details on the target moments from the data see Table **??**. [a] Effect of one

Effect of Education on Patience

Can patience be learned?

- While patience is a critical trait for individuals' intertemporal decisions and life success, little is known about the sources of heterogeneity in patience
  - cultural factors, religion, geography or mortality might play a role, but affect societies over long periods of time $\Rightarrow$ limited relevance for policy interventions
  - skill formation literature suggests that preferences and attitudes are malleable during childhood and adolescence

Can patience be learned?

- While patience is a critical trait for individuals' intertemporal decisions and life success, little is known about the sources of heterogeneity in patience
  - cultural factors, religion, geography or mortality might play a role, but affect societies over long periods of time $\Rightarrow$ limited relevance for policy interventions
  - skill formation literature suggests that preferences and attitudes are malleable during childhood and adolescence
- Can patience be "learned" or acquired?

Can patience be learned?

- While patience is a critical trait for individuals' intertemporal decisions and life success, little is known about the sources of heterogeneity in patience
  - cultural factors, religion, geography or mortality might play a role, but affect societies over long periods of time $\Rightarrow$ limited relevance for policy interventions
  - skill formation literature suggests that preferences and attitudes are malleable during childhood and adolescence
- Can patience be "learned" or acquired?
- Does eduction affect patience?

Empirical Approach

- We need exogenous variation in education
- Use compulsory schooling reforms

Reform Data Set

- Constructed novel data set on compulsory schooling reforms for the 76 countries covered by the GPS
- Information from research papers, books, UNESCO reports, and other official government information, such as laws and reports
- only consider reforms that where passed between 1947 and 2003
- Covering individuals born between 1923 and 1991
  - no reforms in 12 countries during the relevant time period
  - in 5 countries, reforms were not implemented
  - for 5 countries, lack of information on timing and implementation
  - in 6 countries, samples are too small because of regional reforms

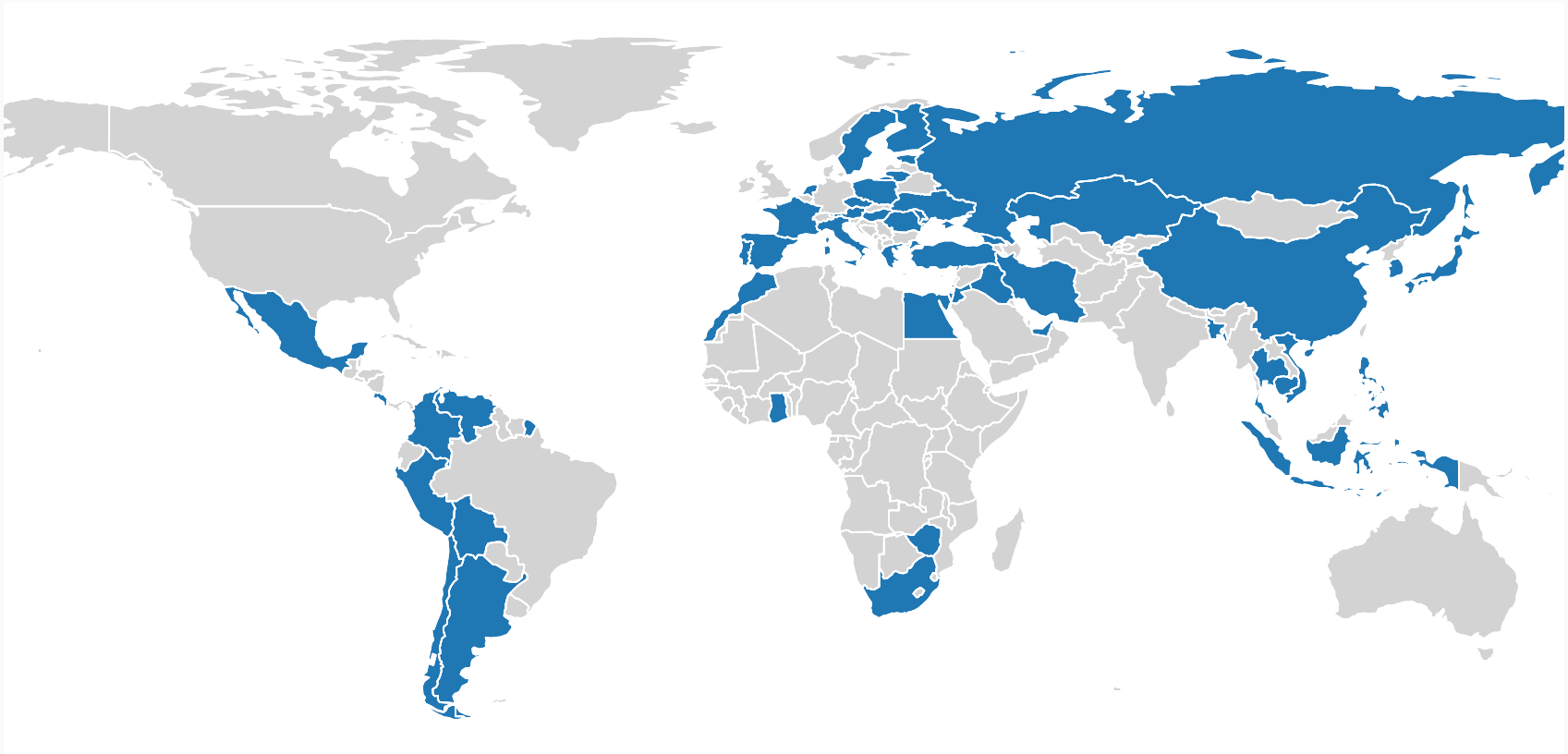
Sample Construction

- Use only cohorts born within at most 10 years of the pivotal cohort of a reform
- 16 countries + Soviet Union (now 7 countries) display multiple reforms between 1947 and 2003
- In 10 countries + Soviet Union we had to exclude one or multiple reforms:
  - in three of these countries one of the reforms was not enforced or was only binding for a small subset of the population
  - in five countries + Soviet Union, one of the reform was passed between 1949 and 1955 and there were too few observations before the reform (less than 30)
  - in two countries reforms were passed within 10-12 years, so we kept only one, to ensure non-overlapping treatment and control groups while keeping number of observations large enough.
  - in the Soviet Union one reform was only imprecisely recovered.
- In eight countries, we use variation from two reforms

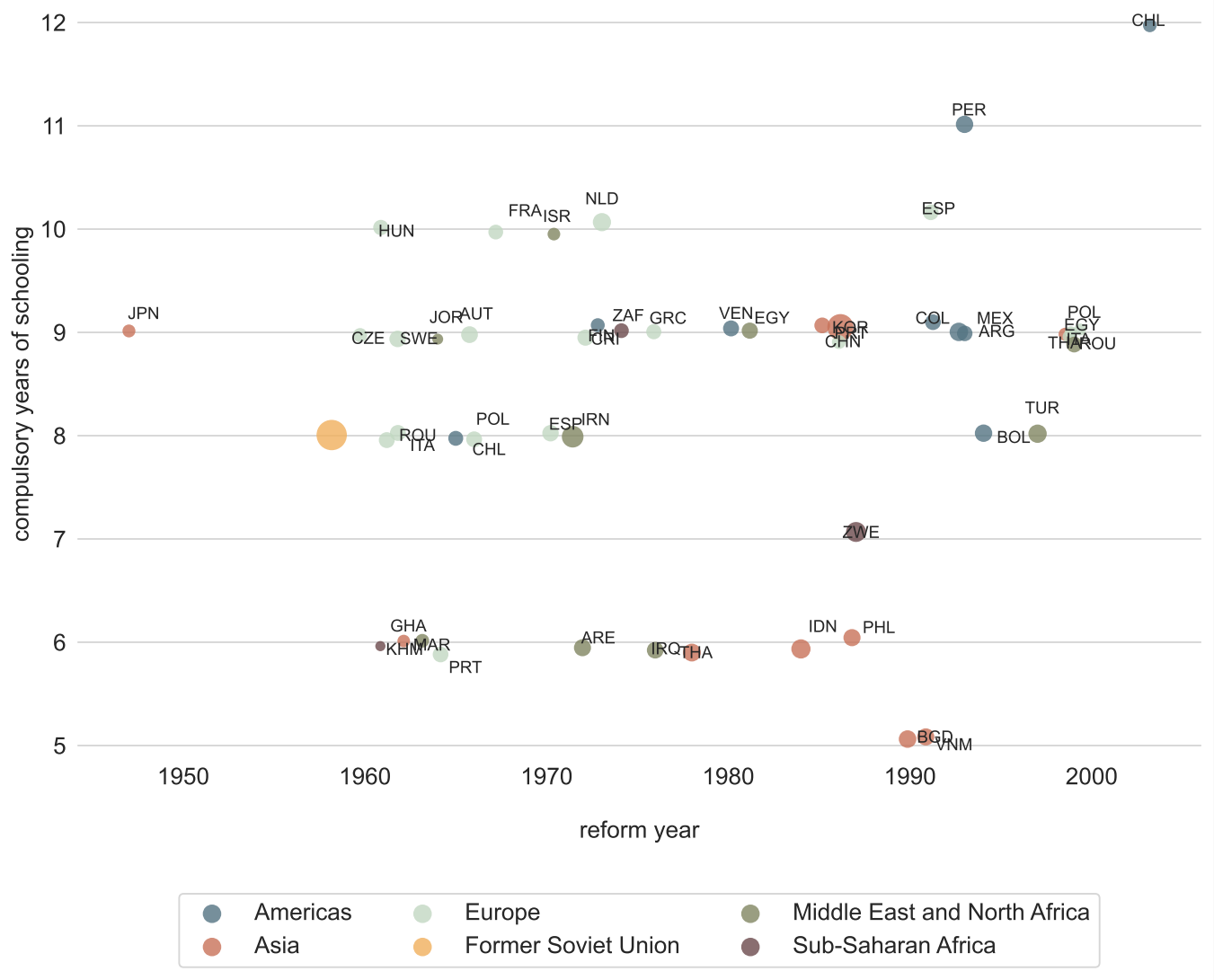
Reform Data Set

- 50 reforms in 48 countries between 1947 and 2003
- Covering individuals born between 1923 and 1991
  - keep individuals who are older than 20 years of age
  - drop individuals who moved to the current country within the last 5 years
- Leaves 19,680 observations

Countries Covered



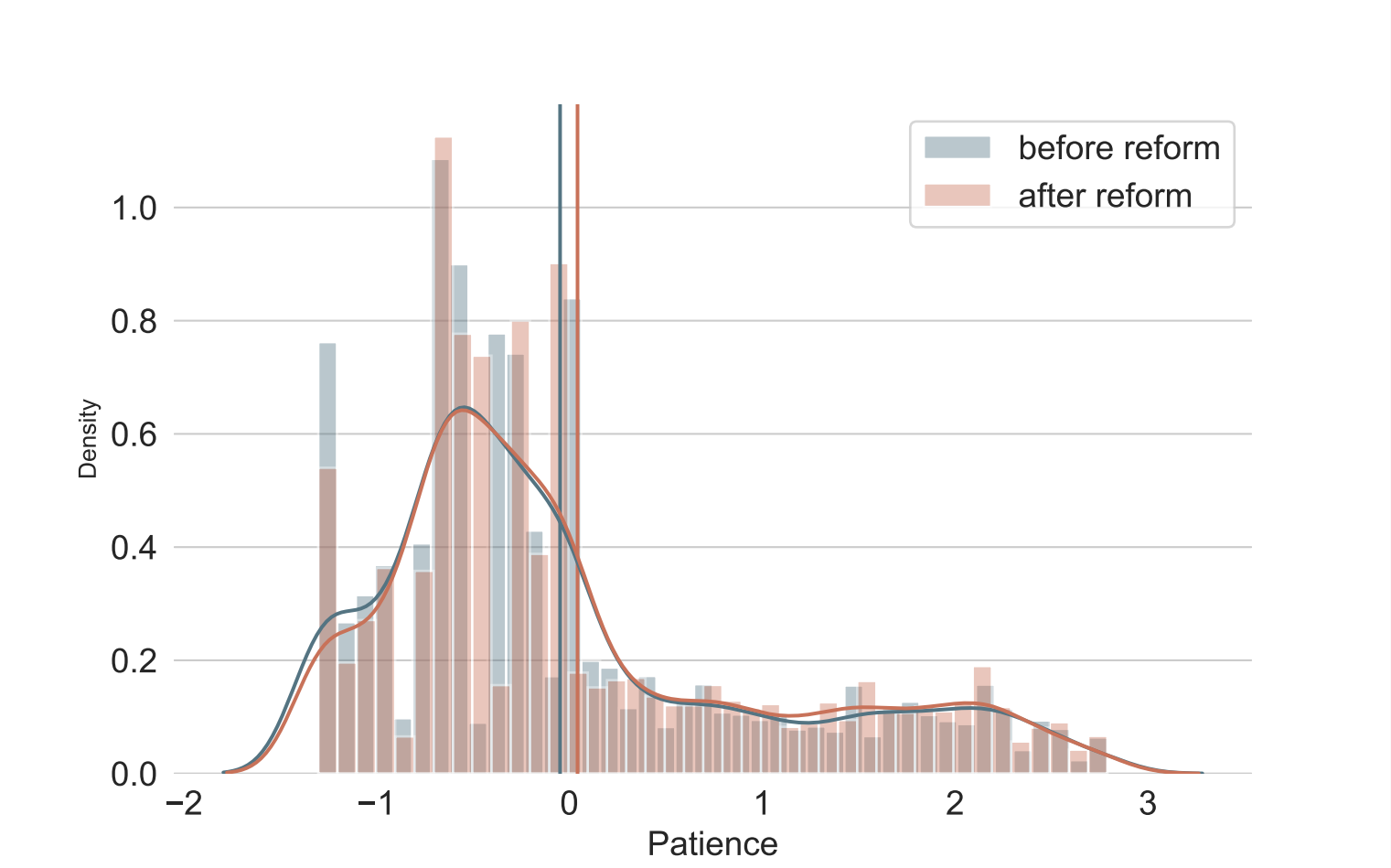
Distribution of Compulsory Education Reforms Across Time and Space



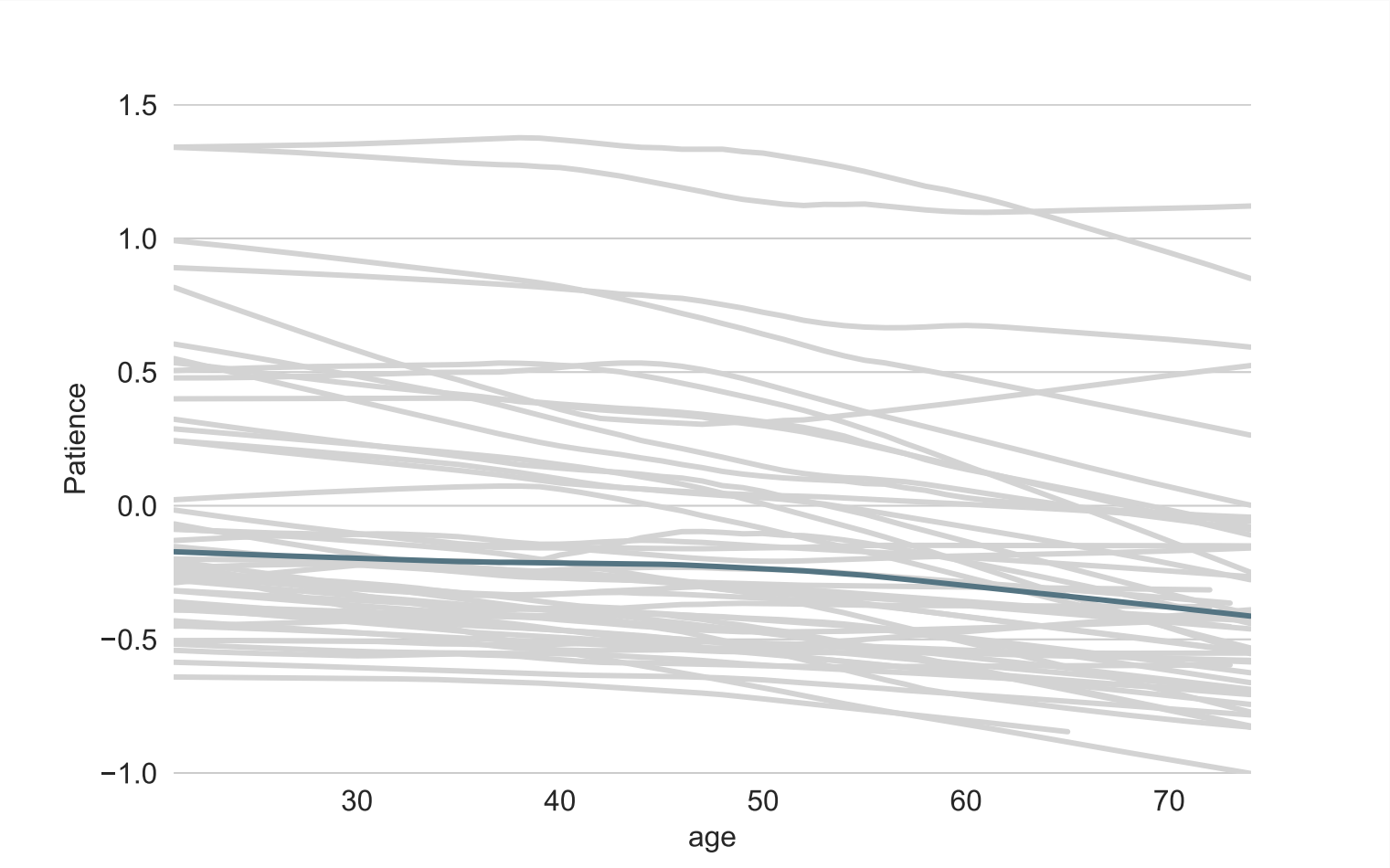
Dealing with large variations in sample size

- resulting sample is highly unbalanced within and across reforms
  - GPS oversamples China and Russia
  - number of observations depend on demographic structure and timing of the reforms
  - resulting samples vary between less than 200 observations to more than 1,500 observations by reform
- use inverse probability weights to assign each reform equal weight (pre- and post-reform)
  - avoids that results are driven by oversampled populations and reforms
  - eases interpretation of simple differences and estimated effect

Simple Differences: Distribution



Age Gradient in Patience



Cohort

Empirical Strategy: Basic Specification

- $PAT_i arc$ = Patience of individual i of age a in reform r in country c
- $Treated_{arc}$ = indicator variable that is 1 if individual of age a is born after the pivotal cohort of reform r in country c and 0 otherwise
- γ_{rc} = reform-country specific fixed effect
- f_{arc} = reform-country specific age gradient

$$PAT_{iarc} = \beta Treated_{arc} + \gamma_{rc} f_{rc} + \alpha_{rc} f_{arc} + \epsilon_{iarc} \tag{1}$$

Empirical Strategy: Add-Ons

- we also estimate an extended version of the empirical specification that includes distinct pre-reform and post-reform age effects

$$PAT_{iarc} = \beta Treated_{arc} + \gamma_{rc} f_{rc} + \alpha_{rc} f_{arc} + \mu_{rc} Treated_{arc} \times f_{arc} + \epsilon_{iarc} \tag{1'}$$

Empirical Strategy: Add-Ons

- some reforms do not immediately apply everywhere and are phased in across time
- not every individual in a pivotal cohort is treated, as most of the time the definition is mid-year (e.g. 1st of August, September, October)
- $Partially\,Non-Treated$ is an indicator variable that is one if an individual is born in the pivotal cohort or in the time of phasing in and 0 otherwise

$$\begin{aligned} PAT_{iarc} = & \beta\, Treated_{arc} + \gamma_{rc} f_{rc} + \alpha_{rc} f_{arc} \left(+\mu_{rc}\, Treated_{arc} \times f_{arc}\right) + \epsilon_{iarc} \\ & + \eta\, Treated_{rac} \times Partially\ \ NonTreated_{arc}. \end{aligned} \tag{2}$$

Effect of Compulsory Schooling Reforms on Patience

	Patience		
	(1)	(2)	(3)
Panel A.			
Treated	0.058*	0.054*	0.058*
	(0.032)	(0.033)	(0.032)
Adj. R^2	0.142	0.142	0.142
Panel B.			
Treated	0.103***	0.095**	0.099**
	(0.036)	(0.039)	(0.039)
Partially Non-Treated	−0.088***	−0.078**	−0.085**
	(0.029)	(0.033)	(0.035)
Adj. R^2	0.142	0.142	0.142
Age trend	homogeneous linear	homogeneous quadratic	heterogeneous linear
Age Bins × Developed			
Number of Countries	48	48	48
Number of Reforms	50	50	50
N	19,680	19,680	19,680

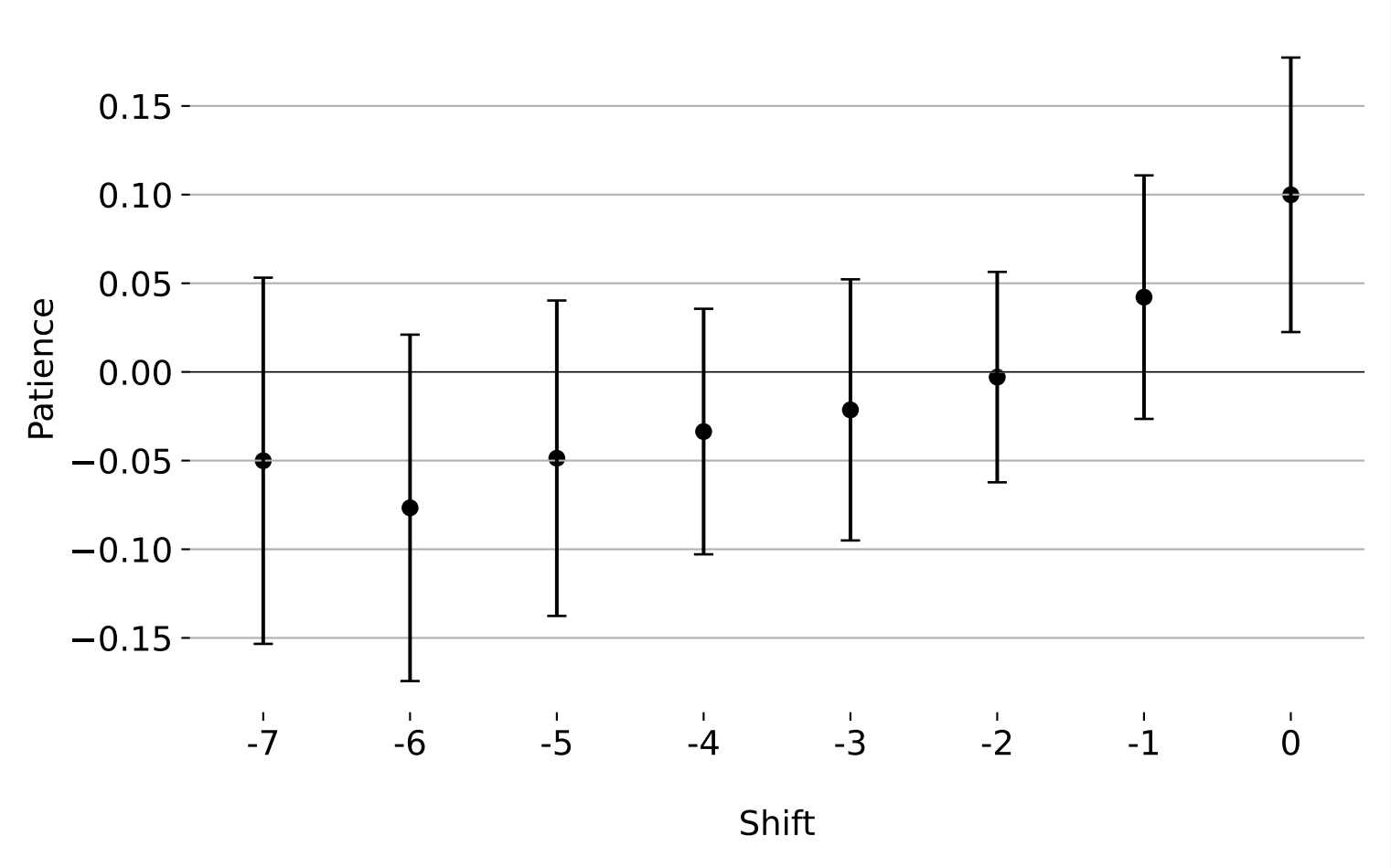
Notes: * p<0.1; ** p<0.05; *** p<0.01.

Effect of Compulsory Schooling Reforms on Patience

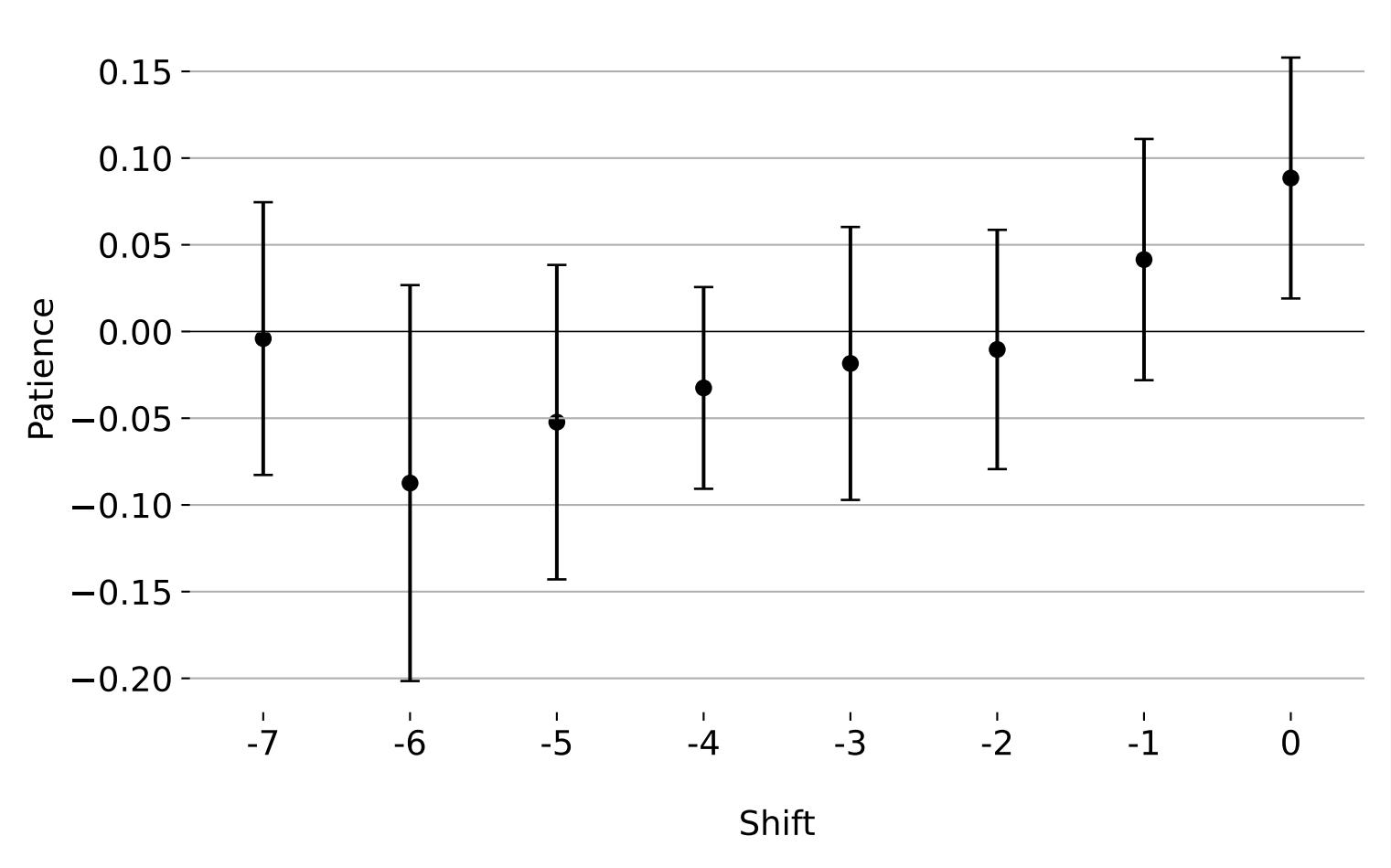
	Patience		
	(1)	(2)	(3)
Panel A.			
Treated	0.054*	0.05	0.045
	(0.032)	(0.031)	(0.03)
Adj. R^2	0.142	0.142	0.142
Panel B.			
Treated	0.096***	0.087**	0.086**
	(0.033)	(0.034)	(0.035)
Partially Non-Treated	−0.079***	−0.069**	−0.081**
	(0.029)	(0.03)	(0.033)
Adj. R^2	0.142	0.142	0.142
Age trend	homogeneous linear	homogeneous quadratic	heterogeneous linear
Number of Countries	48	48	48
Number of Reforms	50	50	50
Age Bins × Developed	✓	✓	✓
N	19,680	19,680	19,680

Notes: * p<0.1; ** p<0.05; *** p<0.01.

Placebo Effect: Without Age Fe



Placebo Effect: With Age Fe



Other Robustness

- Age effects:
  - RDD-like specification with quadratic age gradients RDD: quadratic
  - Cutting window down to 7 years 7-year window
- Leave-one-out estimation: coefficients are stable when dropping one reform. Leave-one-out
- Different specifications of partial treatment Partial
- Controlling for other preference measures

IV estimate of Yrs. of Education

	Patience		*Yrs. education*	
	(1)	(2)	(3)	(4)
Panel A. OLS				
Yrs. education	0.022***	0.022***		
	(0.003)	(0.003)		
Panel B. IV				
Yrs. education	0.135*	0.111*		
	(0.070)	(0.062)		
Treated			0.711***	0.728***
			(0.196)	(0.183)
F			13.22	15.83
AR 95% CI	(0.017 0.378)	(0.007, 0.302)		
AR *p*-value	0.028	0.037		
Age Trend	heterogeneous linear	heterogeneous linear	heterogeneous linear	heterogeneous linear
Age Bins × Developed		✓		✓
N	19,415	19,415	19,415	19,415

Notes: * p<0.1; ** p<0.05; *** p<0.01.

Heterogeneity

	Dependent variable:			
	Patience			
	(1)	(2)	(3)	(4)
Treated	0.014	0.053	0.083	−0.140
	(0.043)	(0.049)	(0.102)	(0.097)
Treated × Secondary Edu. Reform	0.156***			0.152**
	(0.059)			(0.063)
Treated × Developed		0.089		0.078
		(0.063)		(0.066)
Treated × Share censored (pre reform)			0.027	0.197
			(0.150)	(0.131)
Age Trend	heterogeneous	heterogeneous	heterogeneous	heterogeneous
	linear	linear	linear	linear
Age Bins × Developed				
Observations	19,680	19,680	19,680	19,680
Adjusted R^2	0.143	0.142	0.142	0.143

Notes: *p<0.1; **p<0.05; ***p<0.01.

Heterogeneity

	Dependent variable:			
	Patience			
	(1)	(2)	(3)	(4)
Treated	0.018	0.043	0.072	−0.122
	(0.040)	(0.047)	(0.087)	(0.101)
Treated × Secondary Edu. Reform	0.125**			0.119*
	(0.057)			(0.064)
Treated × Developed		0.084		0.079
		(0.059)		(0.063)
Treated × Share censored (pre reform)			0.024	0.175
			(0.131)	(0.137)
Age Trend	heterogeneous	heterogeneous	heterogeneous	heterogeneous
	linear	linear	linear	linear
Age Bins × Developed	✓	✓	✓	✓
Observations	19,680	19,680	19,680	19,680
Adjusted R^2	0.143	0.142	0.142	0.143

Notes: * p<0.1; ** p<0.05; *** p<0.01.

Summary

Summary

- Preferences exhibit large heterogeneity across and within countries
- This variation is at least partly systematic and linked to both individual-level characteristics and aggregate cultural or biogeographic endowments
- The survey measures of preferences appear to capture heterogeneity that is relevant for explaining outcomes.
- The data are well suited for many potential research agendas, on the determinants and implications of preference variation.

Summary

- Evidence of correlations between per capita income and patience:
  - Across levels of aggregation, differences in income as well as the accumulation of human capital, physical capital, and the stock of knowledge are systematically linked to variation in patience
  - Data reveal strong aggregation effects with respect to patience.
  - Results from a quantitative analysis of our model are consistent with the idea that the difference in magnitude of coefficients across levels of aggregation is partly driven by general equilibrium effects and human capital externalities

Summary

- Years of education has non-negligible effect on patience
  - Effect is mainly driven by secondary education
  - No significant differences in effect size by level of development
  - No significant differences in effect size by pre-reform distribution of patience

Thank you!

The GPS as a Complement to Existing Global Surveys

- Questions in existing global surveys, although designed for other purposes, could potentially serve as proxies for the set of preferences measured in the GPS.
- A challenge is distinguishing weak from strong proxies, when relying on intuition.
- World Values Survey and data of Hofstede (2001) are examples of widely used global surveys designed to measure traits that might be related to preferences.
- We identify questions that are most closely related to preference measures in the GPS.

The GPS as a Complement to Existing Global Surveys

- Nothing on positive or negative reciprocity
- Time preference:
  - WVS asks: "Here is a list of qualities that children can be encouraged to learn at home. Which, if any, do you consider to be especially important?"
  - Hofstede: long term orientation
- Risk preference:
  - WVS asks: "Adventure and taking risks are important to this person, to have an exciting life."
  - Hofstede: uncertainty avoidance
- Altruism: WVS: similarity to a hypothetical person for whom "[i]t is important [...] to do something for the good of society."
- Trust: WVS: "most people can be trusted" or rather "you can't be too careful."

Relationships between preference proxies in the WVS and Hofstede (2001) and GPS measures

Table 17: Relationships between preference proxies in the WVS and Hofstede (2001) and GPS measures

	Spearman's rho	p-value	Obs.
WVS Long Term Orientation	0.09	0.52	60
Hofstede Long Term Orientation	0.44	<0.01	56
(correlations with GPS patience)			
WVS Value of stimulation	0.32	0.03	47
Hofstede Uncertainty avoidance	-0.38	< 0.01	62
(correlation with GPS risk taking)			
WVS Altruism	0.20	0.24	35
(correlation with GPS altruism)			
WVS Trust	0.49	<0.01	60
(correlation with GPS trust)			

Survey Items

Assessing endogeneity concerns

Table 18: Patience and per capita income: Robustness

	Dependent variable: Log [GDP p/c PPP]							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Patience of top income quintile	1.60***							
	(0.19)							
Patience		2.00***	0.77***	1.52***	1.04***	1.17***	1.37***	
		(0.33)	(0.27)	(0.41)	(0.24)	(0.24)	(0.27)	
GDP deflator		-0.068*						
		(0.03)						
Deposit interest rate		0.037						
		(0.04)						
Property rights			0.029***					
			(0.01)					
Democracy			-0.012					
			(0.05)					
Subj. institutional quality				0.014				
				(0.01)				
Avg. life expectancy					0.12***			
					(0.02)			
Avg. years of education						0.24***		
						(0.05)		
Math and science test scores							0.63**	
							(0.31)	
Patience (binarized staircase)								4.78***
								(0.68)
Continent FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	76	59	72	59	76	72	49	76
R^2	0.69	0.64	0.79	0.69	0.81	0.77	0.72	0.66

OLS estimates, robust standard errors in parentheses. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$)

Robustness

7-years around reform

	Patience					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A.						
Treated	0.096**	0.093**	0.096**	0.085**	0.101***	0.092**
	(0.037)	(0.038)	(0.038)	(0.038)	(0.037)	(0.038)
Adj. R^2	0.141	0.141	0.143	0.143	0.142	0.143
Panel B.						
Treated	0.154***	0.15***	0.151***	0.136***	0.152***	0.138***
	(0.044)	(0.044)	(0.05)	(0.048)	(0.049)	(0.048)
Partially Non-Treated	−0.093***	−0.091***	−0.091**	−0.082**	−0.091**	−0.08**
	(0.032)	(0.033)	(0.037)	(0.036)	(0.04)	(0.038)
Adj. R^2	0.141	0.141	0.143	0.143	0.143	0.143
Specification	linear	linear	quadratic	quadratic	RDD: linear	RDD: linear
Age Bins × Developed		✓		✓		✓
N	14,689	14,689	14,689	14,689	14,689	14,689

Notes: * p<0.1; ** p<0.05; *** p<0.01.

Back

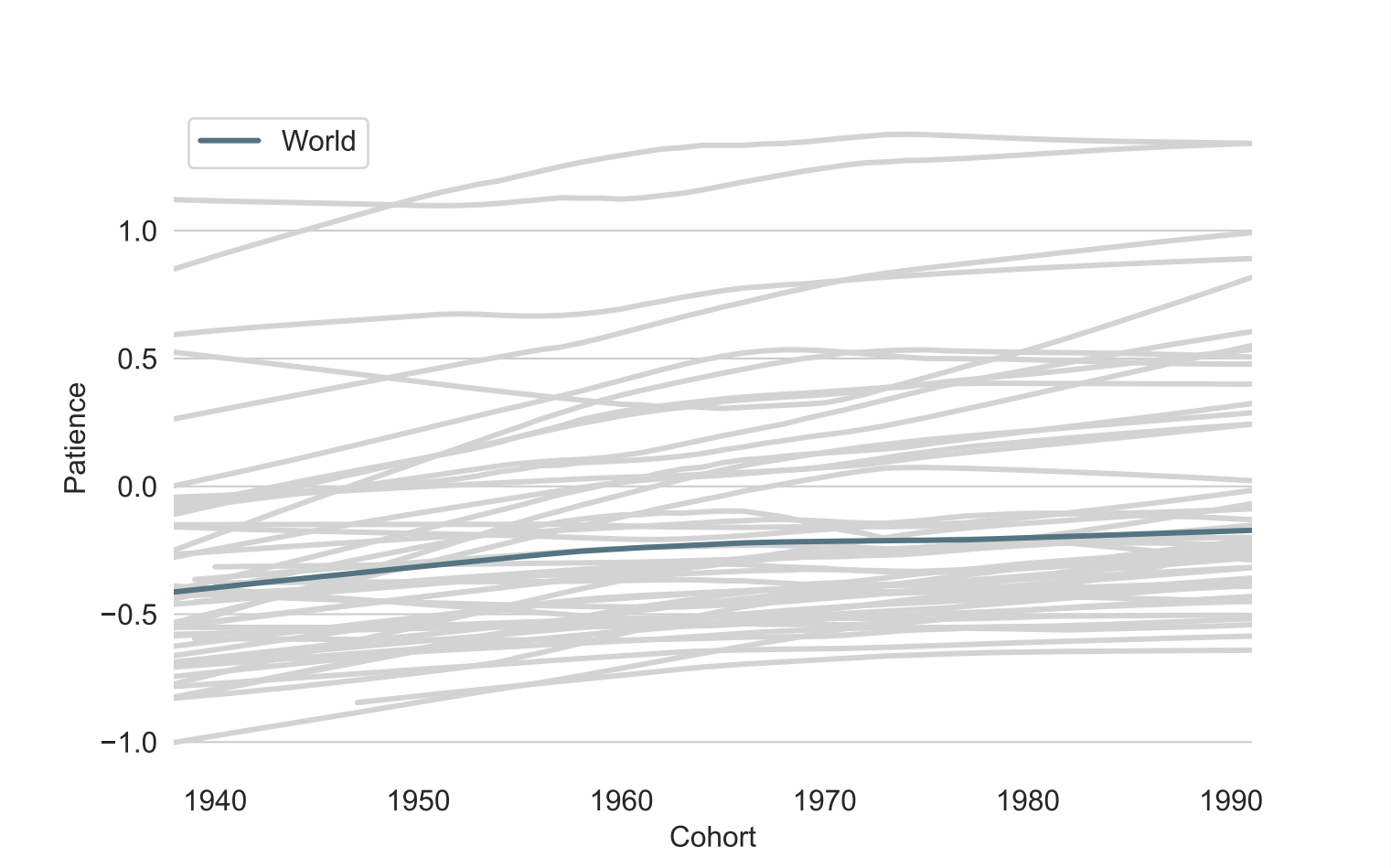
Quadratic RDD-like specification

	Patience	
	(1)	(2)
Panel A.		
Treated	0.112**	0.103**
	(0.054)	(0.05)
Adj. R^2	0.144	0.144
Panel B.		
Treated	0.168**	0.153**
	(0.075)	(0.071)
Partially Non-Treated	−0.079	−0.069
	(0.052)	(0.052)
Adj. R^2	0.144	0.144
Specification	RDD: quadratic	RDD: quadratic
Age Bins × Developed		✓
N	19,680	19,680

Notes: * p<0.1; ** p<0.05; *** p<0.01.

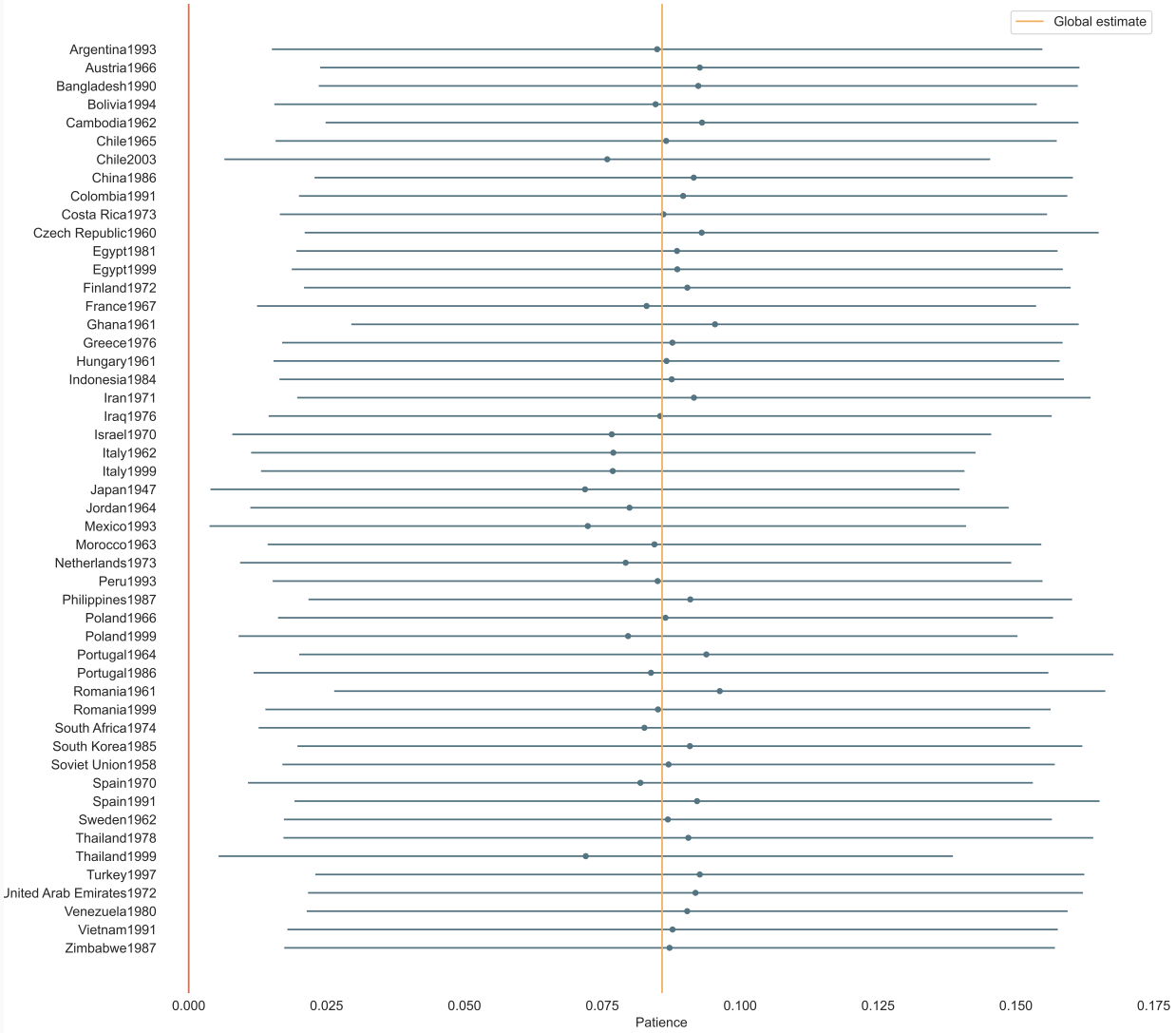
Back

Cohort Gradient in Patience



Back

Leave-one-out



Partial Specifications

	Dependent variable:					
	Patience					
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	0.102***	0.098***	0.096**	0.087**	0.095**	0.089**
	(0.040)	(0.035)	(0.040)	(0.035)	(0.040)	(0.036)
Age Trend	heterogeneous linear	heterogeneous linear	heterogeneous linear	heterogeneous linear	heterogeneous linear	heterogeneous linear
Age Bins × Developed		✓		✓		✓
Partial specification	Country Specific	Country Specific	Time Specific	Time Specific	C-T Specific	C-T Specific
Observations	19,680	19,680	19,680	19,680	19,680	19,680
Adjusted R^2	0.142	0.143	0.142	0.143	0.143	0.143

Notes: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$.

Back

Wording of Survey Items

In the following, "willingness to act" indicates the following introduction: *We now ask for your willingness to act in a certain way in four different areas. Please again indicate your answer on a scale from 0 to 10, where 0 means you are "completely unwilling to do so" and a 10 means you are "very willing to do so". You can also use any numbers between 0 and 10 to indicate where you fall on the scale, like 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.*

Similarly, "self-assessments" indicate that the respective statement was preceded by the following introduction: *How well do the following statements describe you as a person? Please indicate your answer on a scale from 0 to 10. A 0 means "does not describe me at all" and a 10 means "describes me perfectly". You can also use any numbers between 0 and 10 to indicate where you fall on the scale, like 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.*

Patience

1. (Sequence of five interdependent quantitative questions:) *Suppose you were given the choice between receiving a payment today or a payment in 12 months. We will now present to you five situations. The payment today is the same in each of these situations. The payment in 12 months is different in every situation. For each of these situations we would like to know which you would choose. Please assume there is no inflation, i.e, future prices are the same as today's prices. Please consider the following: Would you rather receive 100 Euro today or x Euro in 12 months?*
2. (Willingness to act:) *How willing are you to give up something that is beneficial for you today in order to benefit more from that in the future?*

Back Preference Module
Back to Patience and Accumulation

Risk Taking

1. *(Similar to self-assessment:) Please tell me, in general, how willing or unwilling you are to take risks. Please use a scale from 0 to 10, where 0 means "completely unwilling to take risks" and a 10 means you are "very willing to take risks". You can also use any numbers between 0 and 10 to indicate where you fall on the scale, like 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.*
2. (Sequence of five interdependent quantitative questions:) *Please imagine the following situation. You can choose between a sure payment of a particular amount of money, or a draw, where you would have an equal chance of getting amount x or getting nothing. We will present to you five different situations. What would you prefer: a draw with a 50 percent chance of receiving amount x, and the same 50 percent chance of receiving nothing, or the amount of y as a sure payment?* Back Preference Module

Back Preference Module

Positive Reciprocity

1. (Self-assessment:) *When someone does me a favor I am willing to return it.*
2. *(Hypothetical situation:) Please think about what you would do in the following situation. You are in an area you are not familiar with, and you realize you lost your way. You ask a stranger for directions. The stranger offers to take you to your destination. Helping you costs the stranger about 20 Euro in total. However, the stranger says he or she does not want any money from you. You have six presents with you. The cheapest present costs 5 Euro, the most expensive one costs 30 Euro. Do you give one of the presents to the stranger as a "thank-you"-gift? If so, which present do you give to the stranger? No present / The present worth 5 / 10 / 15 / 20 / 25 / 30 Euro.*

Back Preference Module

Negative Reciprocity

1. (Self-assessment:) *If I am treated very unjustly, I will take revenge at the first occasion, even if there is a cost to do so.*
2. (Willingness to act:) *How willing are you to punish someone who treats you unfairly, even if there may be costs for you?*
3. (Willingness to act:) *How willing are you to punish someone who treats others unfairly, even if there may be costs for you?*

Back Preference Module

Altruism

1. *(Hypothetical situation:) Imagine the following situation: Today you unexpectedly received 1,000 Euro. How much of this amount would you donate to a good cause? (Values between 0 and 1000 are allowed.)*
2. (Willingness to act:) *How willing are you to give to good causes without expecting anything in return?*

Back Preference Module

Trust

(Self-assessment:) *I assume that people have only the best intentions.*

Back Preference Module

Model Setup

Let generations be indexed by the period during which they are young. The preferences of individual i are represented by

$$U(i) = \ln c_t + \beta(i) \ln c_{t+1} + [\beta(i)]^2 \ln c_{t+2} \ , \tag{3}$$

where $\beta(i) \in (0, 1)$ is the discount factor of individual i, which corresponds to this individual's level of patience. For analytical convenience, $\beta(i)$ is modeled as a draw from a uniform distribution $\beta \sim U[\chi - \varepsilon;\ \chi + \varepsilon]$, where $\chi > 0$ reflects the average level of patience in the population and where the density is $\frac{1}{2\varepsilon}$ (with $\varepsilon > 0$, $\chi > 0$ and $0 < \chi - \varepsilon < \chi + \varepsilon < 1$). In the analysis below, variation in $\beta(i)$ conditional on χ captures individual-level heterogeneity within an economy, whereas variation in χ reflects comparisons across model economies.

Model: Human Capital Acquisition

Becoming a skilled worker requires devoting a fraction $(1 - \psi)$ of the first period of life to skill acquisition. We assume that the stock of human capital increases with the time spent on education according to a standard Mincerian specification, with the stock of individual human capital corresponding to $h = e^{\rho(1-\psi)}$, where $\rho > 0$ is the parameter for the return. For analytical simplicity, we restrict attention to a binary education choice.

Budget Constraints

Denote the wage of unskilled workers by w^L, the earnings of a skilled worker as $w^H h$, the savings rates of unskilled and skilled workers as s^L and s^H, and the return on capital as R. We assume that individuals cannot save or borrow when young. The respective budget constraints are then

$$\text{unskilled:} \quad c_t^y = w_t^L \ , \qquad c_{t+1}^m = w_{t+1}^L \cdot (1 - s_{t+1}^L) \ , \qquad c_{t+2}^o = w_{t+1}^L \cdot s_{t+1}^L \cdot R_{t+2} \ , \tag{4}$$

$$\text{skilled:} \quad c_t^y = w_t^L \psi \ , \quad c_{t+1}^m = w_{t+1}^H h \cdot (1 - s_{t+1}^H) \ , \quad c_{t+2}^o = w_{t+1}^H h \cdot s_{t+1}^H \cdot R_{t+2} \tag{5}$$

Individuals take wages and capital returns as given.

Optimal Individual Decisions

The optimal savings decision in the second period of life for an unskilled worker i of generation t is determined by maximizing (3) subject to (4). Analogously, the optimal savings decision for individual i conditional on becoming a skilled worker is determined by maximizing (3) subject to (5). Solving the individual decision problems delivers the optimal savings rate as

$$s_{t+1}^{L} = s_{t+1}^{H} = \frac{\beta(i)}{1+\beta(i)} \,, \tag{6}$$

which is strictly increasing in individual i's patience $\beta(i)$. Due to log utility, the savings rate does not depend on the return to capital nor on the education status of the individual.

Optimal Individual Decisions

The choice to become a skilled worker involves a comparison of (indirect) lifetime utilities. The condition for becoming skilled is determined by whether the return for becoming skilled, which is given by the wage ratio $\eta_{t+1} = \frac{w^H_{t+1}}{w^L_{t+1}}$, matches the compensation that an individual requires for being willing to spend a fraction $(1 - \psi)$ of the first period of life on acquiring human capital. After cancelling common terms (wages), substituting from the optimal savings decision and simplifying, the condition for a preference for becoming skilled is given by

$$\eta_{t+1} > \eta(i) = \frac{\psi^{\frac{-1}{\beta(i)(1+\beta(i))}}}{h} \ , \tag{7}$$

with $\eta(i)$ denoting the minimum compensation that is required for making the individual with patience $\beta(i)$ indifferent between becoming skilled or remaining unskilled. This minimum compensation is decreasing in patience $\beta(i)$ since a higher $\beta(i)$ implies a greater utility weight on the earnings premium that is associated with becoming skilled, thus implying a lower requirement for market compensation.

Aggregate Equilibrium

The production of final output Y during period t combines the available stocks of physical capital, skilled labor and unskilled labor. In light of the empirical evidence regarding capital-skill complementarities, we assume that the production function takes the form

$$Y_t = A_t \left[\left(K_t^{\theta} + H_t^{\theta} \right)^{\frac{\sigma}{\theta}} + L_t^{\sigma} \right]^{\frac{1}{\sigma}} , \tag{8}$$

with the aggregate capital stock in period t denoted by K_t, the stock of unskilled labor denoted by L_t, the effective stock of skilled labor denoted by H_t, and A_t denoting total factor productivity (TFP).

Production

From the determination of competitive wages, it follows that during the second period of their lives, skilled workers supply their human capital and enjoy an earnings premium

$$\eta_{t+1} h = \frac{w_{t+1}^{H} h}{w_{t+1}^{L}} = e^{\rho(1-\psi)} \cdot \left[K_{t+1}^{\theta} + H_{t+1}^{\theta}\right]^{\frac{\sigma-\theta}{\theta}} \frac{L_{t+1}^{1-\sigma}}{H_{t+1}^{1-\theta}} \,. \tag{9}$$

Factor Market Clearing

In a given generation, only individuals with $\beta(i) > \tilde{\beta}_t$ optimally decide to become skilled. Since unskilled labor is supplied by workers of two adjacent generations (during the first period of life and those that remain unskilled during the second period of life), the stock of unskilled labor is given by

$$L_t = \frac{1}{2\varepsilon}\left[\int_{\chi-\varepsilon}^{\tilde{\beta}_{t-1}} 1\, d\beta + \int_{\chi-\varepsilon}^{\tilde{\beta}_t} 1\, d\beta + \int_{\tilde{\beta}_t}^{\chi+\varepsilon} \psi\, d\beta\right], \tag{10}$$

where $\tilde{\beta}_{t-1}$ and $\tilde{\beta}_t$ correspond to the patience thresholds that determine the stock of skilled workers of generations $t-1$ and t, respectively.

Factor Market Clearing

The stock of skilled workers in a given period is given by

$$H_t = \frac{1}{2\varepsilon} \int_{\tilde{\beta}_{t-1}}^{\chi+\varepsilon} e^{\rho(1-\psi)} \, d\beta \, . \tag{11}$$

Factor Market Clearing

Since individual savings differ across education groups as consequence of different labor incomes, the information about the population composition allows for the determination of aggregate capital accumulation, with capital supply given by

$$K_{t+1} = \frac{1}{2\varepsilon}\left[\int_{\chi-\varepsilon}^{\tilde{\beta}_{t-1}} \frac{\beta(i)}{1+\beta(i)}(w_t^L \cdot 1)\, d\beta(i) + \int_{\tilde{\beta}_{t-1}}^{\chi+\varepsilon} \frac{\beta(i)}{1+\beta(i)}(w_t^H \cdot h)\, d\beta(i)\right]. \tag{12}$$

Extension: Human Capital Externalities

In its most basic form, the model does not feature an effect of patience on factor productivity. In a model extension, we consider a simplified human capital externality of the stock of skilled workers on effective total factor productivity,

$$A_t = \bar{A} \cdot H_t^{\gamma} \ , \tag{13}$$

where $\bar{A}$ captures heterogeneity in productivity that is orthogonal to accumulated factors (in the sense of a Solow residual) and $\gamma \geq 0$.

Equilibrium

The remaining analysis focuses on the steady-state equilibrium. The equilibrium is characterized by a skill share λ and the aggregate allocations of skilled and unskilled labor and capital, as well as the corresponding competitive prices such that all individual decisions are consistent with the prices and the aggregate allocation. The key condition for equilibrium is the consistency of the indifference condition for education (7) with the earnings premium that emerges from the relative supply of skilled labor, and the corresponding capital supply and demand.

Equilibrium

In steady state, wages and the share of skilled individuals are constant, such that $\eta_{t+1} = \eta$ and $\lambda_t = \lambda$. This follows from the one-to-one mapping between λ and $\tilde{\beta}$ and solving the condition for becoming unskilled vs. skilled (7) at the point of indifference, which determines the threshold level for patience as

$$\tilde{\beta} = \frac{1}{2}\left[-1 + \sqrt{1 - 4 \cdot \frac{\ln \psi}{\ln(\eta h)}}\right] .$$

Equilibrium

Under the assumption that $\beta(i)$ is distributed uniformly, this mapping is $\lambda = \frac{\chi+\varepsilon-\tilde{\beta}}{2\varepsilon} \Leftrightarrow \tilde{\beta} = \chi + \varepsilon - 2\varepsilon\lambda$.[1]

In terms of comparative statics, a key result for the subsequent analysis is that the equilibrium share of skilled individuals is unambiguously higher in a more patient population. In particular, comparing across equilibria, the following conditions hold regarding the effect of an increase in χ: $0 < \frac{d\,\tilde{\beta}}{d\,\chi} < 1$, and $\frac{d\,\lambda}{d\,\chi} = \frac{1}{2\varepsilon}\left(1 - \frac{d\,\tilde{\beta}}{d\,\chi}\right) > 0$. These conditions also imply that the threshold in terms of individual patience for becoming skilled is higher in a country with a higher average level of patience.

Back to Aggregation Effects

[1] The average level of patience of unskilled workers is then given by $\underline{\beta} = \chi - \varepsilon\lambda$. Equivalently, the average patience of skilled workers is $\bar{\beta} = \chi + \varepsilon(1-\lambda)$.