Does geography matter? Spatial patterns in the formation of economic preferences

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- Economic preferences are a key concept in economic theory

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- They are predictive of behaviors and outcomes
  - Educational achievement (e.g., Castillo et al. 2011, Golsteyn, Grönqvist, and Lindahl 2014; Castillo, Jordan, and Petrie 2018)
  - Labour market outcomes (e.g., Bandiera et al. 2005, 2010; Heckman, Stixrud, and Urzua 2006; Burks et al., 2009; Deming 2017)
  - Financial success (e.g., Meier and Sprenger 2010, 2012; Dohmen et al. 2011)
  - Health status (e.g., Chabris et al. 2008; Sutter et al. 2013)

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- They are predictive of behaviors and outcomes
- Preferences are largely shaped in childhood and adolescence (e.g., Heckman, 2007; Sutter et al., 2019)

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- They are predictive of behaviors and outcomes

- Preferences are largely shaped in childhood and adolescence

- Some predictors have been identified

  - Socioeconomic status, parental transmission (individual level) (e.g., Dohmen et al., 2011; Chowdhurry et al., 2022)

 - Geographical or cultural variables (macro level) (e.g., Falk et al., 2018; Sutter et al., 2018)
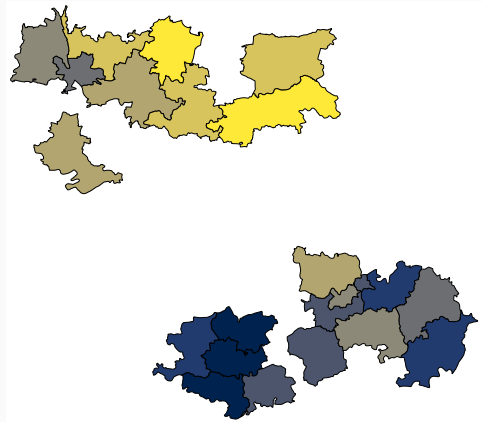
- Economic preferences are a key concept in economic theory
- They are predictive of behaviors and outcomes

- Preferences are largely shaped in childhood and adolescence
- Some predictors have been identified

- Still, large unexplained variation in preferences

(a) Patience, Netrokona
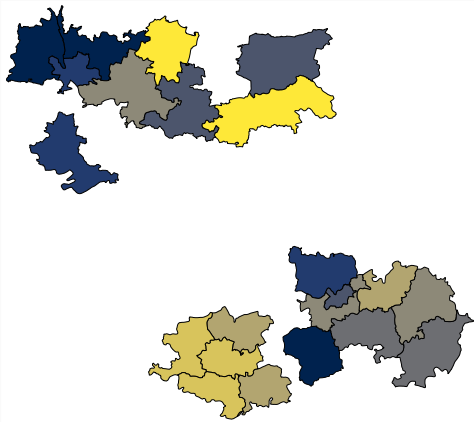
(b) Prosociality, Netrokona

- Document and quantify the role of the *local environment* or *non-family input* in children's and adolescents' preferences in a sample with 6000 children from Bangladesh
    - Physical environment, e.g., shocks
    - Social environment, e.g., peer effects, culture, ...

    $\Rightarrow$ Capture the general *public* investment into children's skills (in the framework by Cunha and Heckman, 2007)

- Capture the local environment in different ways
    - Fixed effects
    - Spatial Autoregressive models
    - (Kriging)

    $\Rightarrow$ How stable are preferences *geographically*?

- Discuss potential mechanisms

Data

Part of long-standing data collection in rural Bangladesh

- Experimental (incentivized) and survey measures of time, risk and social preferences of children and their parents
- 4 districts of rural Bangladesh: Netrokona, Sunamganj, Chandpur, Gopalganj
- 11 subdistricts, 168 villages, 4000 households, 6010 children
- Children of ages 6-16
- Automatically collected geolocation
- Median of 38 children per village (min 10)
- 2019-wave
- Village-level information from 2014 to 2018
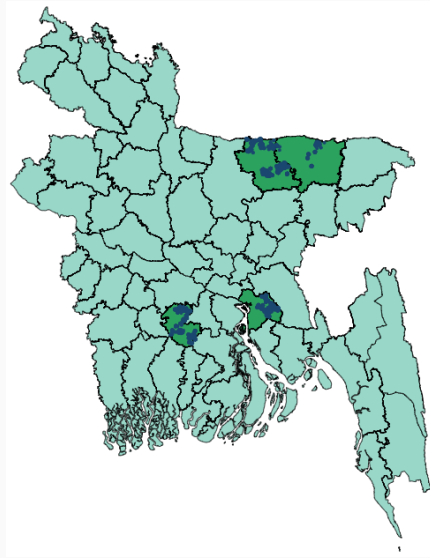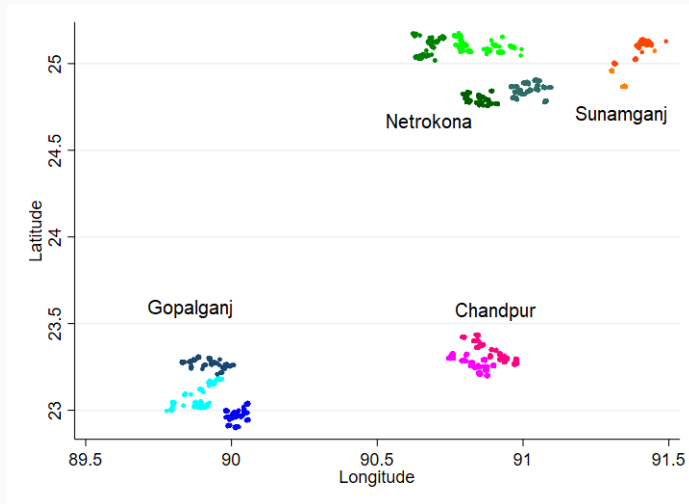
Incentivized experimental measures:

- Time preferences: (Details)
  Six choices consisting of trade-offs between smaller, sooner and larger, later rewards -
  number of patient choices [0 to 6 - mean 1.9]

- Risk preferences (à la Binswanger, 1980): (Details)
  Choice of one out of six increasingly risky gambles that yielded either a high or a low
  payoff with equal probability - gamble number chosen [1 to 6 - mean 4.3]

- Social preferences (à la Fehr et al., 2008): (Details)
  Four allocation choices dividing stars between the participant and another (unknown)
  child – number of stars a child allocated to the other child / all allocated stars [0.29 to
  0.58 - mean 0.47]

Survey measures:

- Time preferences:

  "I am good at giving up something nice today in order to get something even nicer in the future" [1 to 5 - mean 3.4]

- Risk preferences:

  "I often take risks" [1 to 5 - mean 2.5]

- Social preferences:

  My child...
    - is considerate of other people's feelings
    - shares readily with other children (treats, toys, pencils, etc.)
    - is helpful if someone is hurt, upset or feeling ill
    - is kind to younger children
    - often volunteers to help others (parents, teachers, other children)

  [0 to 10 - mean 7.5]

Model

$$Y_i = \beta_0 + \beta_1 Y_i^{mother} + \beta_2 Y_i^{father} + \gamma X_i + f(geolocation) + \epsilon_i$$

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with $f(.)$

- Fixed effects: district, subdistrict, village
- SAR term: different weights
- Kriging

Spatial Autoregressive model: $f(geolocation) = \rho Wy$, i.e.,

$$y = \beta X + \rho Wy + \epsilon$$

with W a weighting matrix accounting for spatial proximity

SAR models

Spatial Autoregressive model: $f(geolocation) = \rho Wy$, i.e.,

$$y = \beta X + \rho Wy + \epsilon$$

with W a weighting matrix accounting for spatial proximity

- $W1 = W_{ij} = 1$ if i and j in same village
- $W2$ extends $W1$

if i and j in same village	1
dist i - $j < 1$	1/2
dist i - j in $(1-18)$	1/4
dist i - j in $(18-48)$	1/8
dist i - $j > 48$	0

1(18)[48] median of the max dist. between two children in the same village (subdistrict) [district] in Km

Role of the local environment

Patience Index
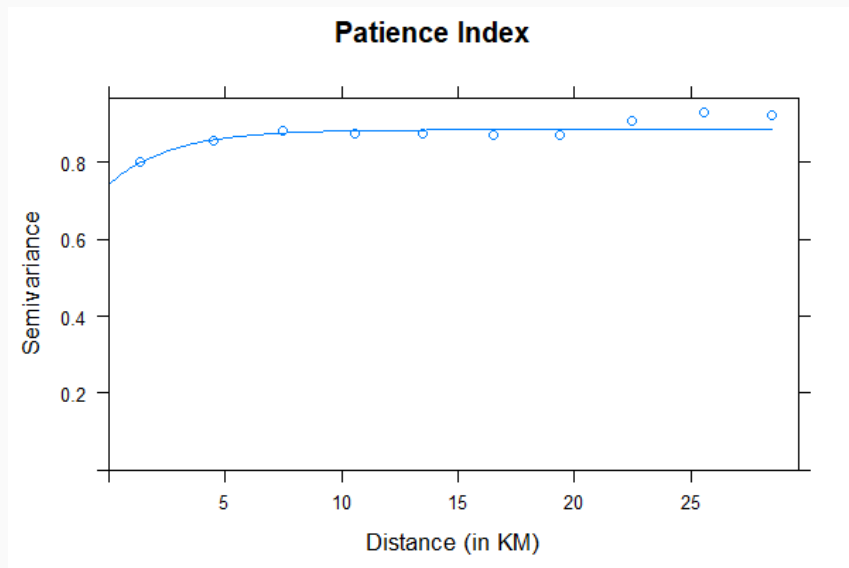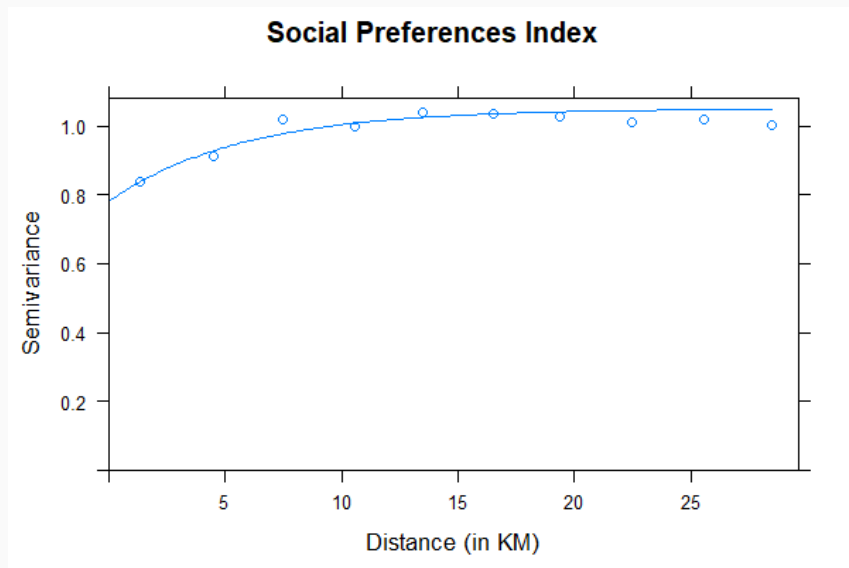
	Ind C	HH C	Parents C	D FE	SD FE	V FE	W1	W2
IQ score	0.010^{***}	0.004^{**}	0.002	-0.002	-0.002	-0.001	-0.000	-0.002
Female	0.005	-0.006	-0.015	-0.005	0.003	-0.004	-0.009	-0.002
Ages 9-12	-0.226^{***}	-0.202^{***}	-0.197^{***}	-0.203^{***}	-0.200^{***}	-0.182^{***}	-0.191^{***}	-0.204^{***}
Ages 13-16	-0.189^{***}	-0.177^{***}	-0.178^{***}	-0.201^{***}	-0.199^{***}	-0.190^{***}	-0.186^{***}	-0.203^{***}
HH size		0.004	0.001	0.006	0.007	0.006	0.006	0.006
Rich		0.096^{***}	0.076^{**}	0.044	0.056^{*}	0.067^{**}	0.068^{**}	0.043
Electricity in HH		0.408^{***}	0.290^{***}	0.154^{***}	0.083^{*}	0.050	0.147^{***}	0.144^{***}
Age mother		-0.006^{**}	-0.006^{**}	-0.007^{**}	-0.006^{**}	-0.005	-0.005^{**}	-0.007^{**}
Liter. mother		0.063^{*}	0.025	-0.055^{*}	-0.041	-0.034	-0.013	-0.053^{*}
IQ score mother		0.003	0.003	0.001	0.001	0.003	0.002	0.001
Patience idx mother			0.171^{***}	0.092^{***}	0.080^{***}	0.035^{**}	0.093^{***}	0.086^{***}
Patience idx father			0.180^{***}	0.106^{***}	0.092^{***}	0.065^{***}	0.113^{***}	0.100^{***}
Chandpur				0.716^{***}				
Sunamganj				0.220^{***}				
Gopalganj				0.540^{***}				
W.Patience idx							0.836^{***}	0.878^{***}
Subdistrict FE	No	No	No	No		No	No	No
Village FE	No	No	No	No	No		No	No
R2/pseudo_R2	0.01	0.07	0.13	0.19	0.20	0.26	0.18	0.19
BIC	16996	16764	16396	16033	16004	16931	15961	15994
ratio_BIC	1.00	0.99	0.96	0.94	0.94	1.00	0.94	0.94

N=6006. Regressions include a constant, indicator variables for imputed observations, parenting style and father controls.

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	Ind C	HH C	Parents C	D FE	SD FE	V FE	W1	W2
IQ score	−0.007***	−0.006***	−0.006***	−0.002	−0.002	−0.003	−0.004*	−0.002
Female	−0.106***	−0.100***	−0.099***	−0.104***	−0.099***	−0.099***	−0.100***	−0.104***
Ages 9-12	0.092***	0.096***	0.096***	0.109***	0.116***	0.114***	0.109***	0.110***
Ages 13-16	0.127***	0.132***	0.132***	0.156***	0.177***	0.171***	0.155***	0.161***
HH size		−0.011	−0.010	−0.006	−0.004	−0.001	−0.006	−0.009
Rich		0.003	0.015	0.041	0.044	0.058*	0.035	0.046
Electricity in HH		0.017	0.020	0.132***	0.048	0.082	0.012	0.115***
Age mother		−0.002	−0.002	−0.001	−0.000	0.000	−0.001	−0.001
Liter. mother		−0.131***	−0.128***	−0.082**	−0.065*	−0.033	−0.084**	−0.052
IQ score mother		0.000	0.000	0.001	0.002	−0.001	0.000	0.000
Risk idx mother			0.009	0.031**	0.023*	0.016	0.013	0.033**
Risk idx father			0.000	0.019	0.014	0.006	0.004	0.018
Chandpur				−0.503***				
Sunamganj				−0.395***				
Gopalganj				−0.272***				
W.Risk index							0.794***	1.493***
Subdistrict FE	No	No	No	No		No	No	No
Village FE	No	No	No	No	No		No	No
R2/pseudo_R2	0.01	0.02	0.02	0.05	0.08	0.14	0.03	0.04
BIC	17018	17078	17109	16944	16857	17795	16827	16870
ratio_BIC	1.00	1.00	1.01	1.00	0.99	1.05	0.99	0.99

N=6001. Regressions include a constant, indicator variables for imputed observations, parenting style and father controls.

	Ind C	HH C	Parents C	D FE	SD FE	V FE	W1	W2
IQ score	0.007***	0.006***	0.005***	0.003	0.000	-0.001	0.002	0.001
Female	0.085***	0.069***	0.067***	0.072***	0.060**	0.068***	0.068***	0.068***
Ages 9-12	0.242***	0.221***	0.216***	0.208***	0.174***	0.177***	0.195***	0.189***
Ages 13-16	0.475***	0.457***	0.449***	0.439***	0.388***	0.390***	0.415***	0.410***
HH size		0.004	0.004	0.003	0.001	0.005	0.006	0.007
Rich		0.082***	0.091***	0.096***	0.066**	0.057*	0.066**	0.086***
Electricity in HH		-0.248***	-0.230***	-0.207***	-0.077*	-0.021	-0.116***	-0.068
Age mother		0.002	0.002	0.002	0.004	0.002	0.003	0.002
Liter. mother		-0.065*	-0.075**	-0.036	0.003	-0.002	-0.040	-0.022
IQ score mother		0.002	0.002	-0.002	-0.001	-0.001	0.001	-0.002
Prosocial idx mother			0.073***	0.065***	0.036***	0.030**	0.048***	0.034***
Prosocial idx father			0.099***	0.097***	0.063***	0.058***	0.074***	0.060***
Chandpur				-0.247***				
Sunamganj				0.060				
Gopalganj				0.085**				
W.Prosocial index							0.864***	2.696***
Subdistrict FE	No	No	No	No	Yes	No	No	No
Village FE	No	No	No	No	No	Yes	No	No
R2/pseudo_R2	0.03	0.07	0.09	0.10	0.18	0.23	0.11	0.12
BIC	16932	16768	16714	16667	16141	17157	16217	16295
ratio_BIC	1.00	0.99	0.99	0.98	0.95	1.01	0.96	0.96

N=6008. Regressions include a constant, indicator variables for imputed observations, parenting style and father controls.

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Potential mechanisms

Affect preferences beyond village level

- Shocks
  - Floods, droughts, cyclones, murrains
- Agroecological variables
  - Number of harvesting seasons (aus - rainfed season)
- Exchange with different culture/norms
  - Distance to India

Descriptive

	Patience	Risk	Prosociality
Flood	-0.11***	0.07***	0.10***
Drought	0.07***	0.04***	0.01
Cyclone	-0.25***	0.09***	0.01
Aus season	-0.21***	0.12***	-0.14***
Harvesting seasons	-0.13***	0.14***	-0.17***
Murrain	0.14***	0.03*	0.02
Proximity to India	-0.24***	0.03**	0.10***

	Water: irrigation	Water: shock
	Loadings[†]	
Flood	0.22	-0.73
Drought	-0.25	0.47
Cyclone	0.43	-0.20
Aus season	0.62	0.23
Harvesting seasons	0.57	0.39
	Correlations	
Patience	-0.24***	0.07***
Risk tolerance	0.14***	0.03**
Prosociality	-0.11***	-0.16***

[†] First two components, 64% of variation

	LRT w/o spatial	LRT w SAR	Improvement Likelihood*
Water: irrigation	0.000	0.000	5.9
Water: shock	0.000	0.027	1.2
Murrain	0.000	0.969	0.0
Proximity to India	0.000	0.014	1.5

*in percentage points of the improvement achieved by including the SAR term

- Each potential mechanism contributes significantly to the likelihood
- Some mechanisms are not relevant once we account for spatial correlations
- They improve the likelihood but by little

Risk

	LRT w/o spatial	LRT w SAR	Improvement Likelihood
Water: irrigation	0.000	0.971	0.0
Water: shock	0.047	0.021	2.2
Murrain	0.006	0.000	6.6
Proximity to India	0.659	0.024	2.1

Prosociality

	LRT w/o spatial	LRT w SAR	Improvement Likelihood
Water: irrigation	0.000	1.000	-1.1
Water: shock	0.000	0.000	5.3
Murrain	0.098	0.039	1.1
Proximity to India	0.000	1.000	-20.9

Conclusions

- Individual- and household-level variables are important also in our data
- Existence of intergenerational transmission of preferences confirmed with our data
- *Local environment* is relevant beyond the family
- Predictive power of these *non-family inputs* as relevant as family inputs
- A model taking into account the importance of villages but also the spatial proximity of observations performs best
- Decay in the "geographical stability" is exponential in the distance
- Patterns cannot be explained by influence factors such as schools, village neighborhood, or natural shocks and their frequency

Thank you very much!

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Appendix slides

Table 1: Time preferences experiment for children

Choice Set 1	2 stars tomorrow	vs.	3 stars in 3 weeks
	2 stars tomorrow	vs.	4 stars in 3 weeks
Choice Set 2	2 stars tomorrow	vs.	3 stars in 3 months
	2 stars tomorrow	vs.	4 stars in 3 months
Choice Set 3	2 stars in 1 month	vs.	3 stars in 4 months
	2 stars in 1 month	vs.	4 stars in 4 months

Table 2: Risk preferences experiment for children (example for age 10 to 11)

Age 10 to 11	Low amount (50% chance)	High amount (50% chance)	
Gamble 1	25	25	⎫
Gamble 2	22	48	⎬ risk-averse
Gamble 3	20	60	⎪
Gamble 4	15	75	⎭
Gamble 5	5	95	⎬ risk-neutral
Gamble 6	0	100	⎬ risk-seeking

Table 3: Social preferences experiments for children

(a) Games

Costly prosocial game	1 star for me 1 star for the other child (1,1)	vs.	2 stars for me 0 stars for the other child (2,0)
Costless prosocial game	1 star for me 1 star for the other child (1,1)	vs.	1 star for me 0 stars for the other child (1,0)
Costless envy game	1 star for me 1 star for the other child (1,1)	vs.	1 star for me 2 stars for the other child (1,2)
Costly envy game	1 star for me 1 star for the other child (1,1)	vs.	2 stars for me 3 stars for the other child (2,3)

Descriptive statistics

	mean	sd	min	max
Individual level controls				
Female	0.5	0.5	0	1
Age	11.1	2.5	6	16
IQ score	24.4	7.4	4	56
Household level controls				
HH size	5.7	1.6	2	21
Rich	0.2	0.4	0	1
Electricity in HH	0.9	0.3	0	1
Age mother	36.6	6.2	19	83
Age father	44.3	8.0	18	84
Liter. mother	0.7	0.5	0	1
Liter. father	0.6	0.5	0	1
IQ score mother	17.8	4.6	4	50
IQ score father	19.2	4.9	7	52
Observations	5936			

Parenting style

	mean	sdev	min	max
Emotional warmth	3.4	0.7	1	5
Inconsistent parenting	2.6	0.8	1	5
Monitoring	3.0	0.6	1	5
Negative communication	2.6	0.7	1	5
Psychological control	1.9	0.7	1	4
Strict control	2.7	0.8	1	5

Potential mechanisms

	mean	sd	min	max	N
Flood	0.27	0.47	0	2	147
Drought	0.25	0.47	0	2	147
Cyclone	0.71	0.65	0	2	147
Aus season	0.51	0.50	0	1	147
Harvest seasons	1.76	0.78	1	3	147
Murrain	0.51	0.62	0	2	147
Proximity to India	0.18	0.20	0	1	6010

Robustness: mothers

	Patience		Risk		Prosociality	
	(1)	(2)	(3)	(4)	(5)	(6)
IQ score mother	-0.003	-0.003	0.012***	0.006**	0.009***	0.001
Age mother	-0.006***	-0.007***	-0.006***	-0.004**	-0.002	-0.003
Rich	-0.023	-0.047	-0.030	-0.026	0.044	0.054
Electricity in HH	0.045	0.170***	-0.003	-0.148***	0.087	0.005
Constant	0.272	0.224**	0.456*	0.222**	-0.432*	0.083
W_ah						
Patience index mother		1.122***				
Risk index mother				1.615***		
Prosocial index mother						2.226***
Village FE	Yes	No	Yes	No	Yes	No
Observations	5712	5712	5712	5712	5712	5712
AIC	14414	14906	15704	15914	15924	15981
ratio_AIC	0.89	0.92	0.97	0.98	0.98	0.99
R2	0.31		0.14		0.10	
adj_R2	0.29		0.11		0.08	
pseudo_R2		0.18		0.00		0.00

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$