Social Interactions Do Matter

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Social Interactions Do Matter:
Two Examples

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1. OUTLINE and OVERVIEW

Outline

- **PART 1.** "ICT and Cities Revisited", with Emmanouil Tranos

  Revisit Ioannides, Overman, Rossi-Hansberg and Schmidheiny, *Economic Policy* (2008)

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  - Test importance via impact on city size distributions of adoption of Information and Communication Technologies (ICT)

    Discuss new empirical results on impact of ICT adoption worldwide

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  - Past incidence of rent-seeking and corruption define norms

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    Discuss new empirical results on impact of ICT adoption worldwide
- **PART 2.** "Corruption and Rent-seeking in Economic Growth", with Costas Azariadis
  - Past incidence of rent-seeking and corruption define norms
  - Evolution of corruption and rent-seeking via a model of economic growth in the presence of
    social interactions from norms *and* from individual social effects
  - Use model to structure empirical investigation
- Two examples: $\Longrightarrow$ "Social Interactions Do Matter!"

1.1 Impact of ICT on urban decentralization

- Rossi-Hansberg and Wright (2007), adapted by Ioannides, Overman, Rossi-Hansberg and Schmidheiny (2008), city j TFP:

$$\tilde{A}_{tj} = A_{tj} \overbrace{\tilde{H}_{tj}^{\gamma_j(\iota_{c,t})} \tilde{N}_{tj}^{\varepsilon_j(\iota_{c,t})}}^{\text{Social Effects}},\ A_{tj} \sim i.i.d.N(0,\upsilon),$$

$\tilde{N}_{tj}^{\gamma_j(\iota_{c,t})}, \tilde{H}_{tj}^{\gamma_j(\iota_{c,t})}$: city j employment, human capital; β_j : elasticity of physical capital in city j; $\iota_{c,t}$: ICT in country c.

- $\text{Var}[\ln s_j] = 4\upsilon \left[\left(\frac{1}{1-2(\gamma_j+\epsilon_j)} \right)^2 + \left(\frac{\beta_j}{1-2(\gamma_j+\epsilon_j)+\beta_j} \right)^2 \right]$

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ICT via γ_j, ϵ_j: smaller dispersion, greater urban decentralization.

- Pareto distribution stark heterogeneity of city size distributions.

  1. First stage: estimate Pareto exponent $\zeta_{c,t}$:
     $\ln \text{rank}_i = \ln S_{0,c,t} + \zeta^{c,t} \ln S_{i,c,t} + e_{i,c,t}$.
  2. Second stage: Explain $\zeta_{c,t}$: $\hat{\zeta}_{c,t} = \theta_c + \delta t + \mathbf{X}_{c,t}\eta + \phi_{c,t}$

- ICT included in $\mathbf{X}_{c,t}$: landlines, mobiles, internet, all p.c.

- Robustness, instead of $\zeta_{c,t}$: Gini, Herfindahl, Coefficient of variation

1.2 Estimating Impact of ICT

- Correlations: (internet, mobile) $= 0.8464$; (fixed, internet) $= 0.154$: (fixed, mobile) $= 0$.
- Explanatory variables, second stage:

  log ICT var, year dummy, log pop, log GDP p.c., SD of log GDP p.c.,trade openness, share non-agricultural, share gov expenditure, log land area, number of cities, country fixed effects
- Urban structure and ICT jointly determined:
  - If already dispersed spatial structure: demand for ICT.
  - ICT adoption: affects urban structure

1.3 Results

- Instruments: public telecom monopoly, time since its deregulation, private telecom monopoly, time since its deregulation

- Results: GDP p.c. and trade openness, consistent negative effect (wealthier countries more dispersed urban systems). Trade openness weakens agglomeration forces (Fujita, Krugman, and Venables 1999). Significant, negative time trend: agglomeration forces weaken over time.

- Columns 1–4: WLS regressions. Columns 5–8 2SLS regressions

  Columns 1, 3, 5, 7: ICT var, time trend, constant.

  Columns 3, 4, 7, 8: Fixed effects

- Summary: the coefficients of the ICT variables, estimated with FE and WLS, 2SLS, are generally highly significant and negative, implying that that increasing ICT adoption by country decreases the dispersion in city sizes, increasing decentralization.

Table 1: Descriptive statistics

Variables	Observations	Mean	Std. Dev.	Min	Max
zipf	114	-1.300236	0.1874295	-1.84867	-0.9066
fixed_ln	100	3.504732	0.6132262	1.707985	4.291839
net_ln	81	2.369952	2.468757	-2.99573	4.552042
mobile_ln	82	3.128825	2.24817	-2.95188	5.112515
pop_ln	100	16.80452	1.148188	15.26042	19.54998
gdp_pc_ln	104	10.11745	0.8149692	7.879383	11.38248
trade	95	75.17003	34.00863	19.76061	185.7471
non_agri	77	95.84652	3.825648	80.59406	99.39737
gov_exp	81	33.01055	9.753086	12.47803	54.16781
land_ln	108	12.70219	1.776995	10.31824	16.61218
n_cities	114	114.386	128.0138	18	825
monopub	114	0.3245614	0.4702779	0	1
monopriv	114	0.0701754	0.2565702	0	1
time_after_public_monopoly	114	9.842105	10.32102	0	37
time_after_private_monopoly	114	20.42105	11.82984	0	38

Table 2: Fixed telephony regressions

VARIABLES	(1) zipf05	(2) zipf05	(3) zipf05	(4) zipf05	(5) zipf05	(6) zipf05	(7) zipf05	(8) zipf05
fixed_ln	-0.0978***	-0.0734*	-0.0037	-0.0638***	-0.0774***	-0.0015	-0.0023	-0.1012***
	(0.0190)	(0.0395)	(0.0117)	(0.0190)	(0.0286)	(0.0814)	(0.0122)	(0.0258)
Year	-0.0016	0.0011	-0.0030***	-0.0026**	-0.0019*	0.0024	-0.0030***	-0.0033***
	(0.0010)	(0.0020)	(0.0003)	(0.0010)	(0.0010)	(0.0023)	(0.0003)	(0.0008)
pop_ln		-0.0457*		0.1055		-0.0461*		0.1696**
		(0.0265)		(0.0954)		(0.0251)		(0.0822)
gdp_pc_ln		-0.0514		0.0752*		-0.0894		0.0933***
		(0.0436)		(0.0419)		(0.0562)		(0.0339)
gdp_pc_growth_sd		-0.0239		0.6412		-0.0222		101.7910
		(0.0168)		(0.3840)		(0.0160)		(78.1181)
Trade		0.0002		-0.0007		0.0002		-0.0007*
		(0.0008)		(0.0005)		(0.0008)		(0.0004)
non_agri		-0.0100		0.0058		-0.0105		0.0083**
		(0.0101)		(0.0043)		(0.0096)		(0.0036)
gov_exp		-0.0057***		0.0031***		-0.0053***		0.0028***
		(0.0018)		(0.0010)		(0.0018)		(0.0008)
land_ln		0.0389**		-4.0203*		0.0379***		-2.6930
		(0.0154)		(2.3828)		(0.0146)		(1.9883)
n_cities		-0.0002*		-0.0007***		-0.0002*		-0.0008***
		(0.0001)		(0.0001)		(0.0001)		(0.0001)
Country FE			Yes	Yes			Yes	Yes
Constant	2.2444	-1.2116	4.9280***	45.9584*	2.7482	-3.5874	4.9498***	-111.1068
	(1.9512)	(3.5989)	(0.6357)	(26.3979)	(2.0048)	(4.1565)	(0.5587)	(87.2169)
Observations	100	72	100	72	100	72	100	72
R-squared	0.2736	0.6148	0.9452	0.9915	0.2651	0.5938	0.9452	0.9907
Sargan					5.257	9.624	1.673	2.942
Chi-sq(1) P-val					0.154	0.0221	0.643	0.230
Weak identification					18.08	3.864	36.15	5.833

Standard errors in parentheses, Columns 1-4 are WLS regressions and 5-8 2SLS

IV for 5-8: monopub, monopriv, time_after_public_monopoly, time_after_private_monopoly

*** p<0.01, ** p<0.05, * p<0.1

Internet regressions

VARIABLES	(1) zipf05	(2) zipf05	(3) zipf05	(4) zipf05	(5) zipf05	(6) zipf05	(7) zipf05	(8) zipf05
net_ln	-0.0201*	-0.0145	-0.0022	-0.0104***	-0.0250*	-0.0195	0.0017	-0.0144***
	(0.0106)	(0.0122)	(0.0035)	(0.0037)	(0.0146)	(0.0139)	(0.0045)	(0.0035)
Observations	81	66	81	66	81	66	81	66
R-squared	0.0689	0.6282	0.9501	0.9916	0.0663	0.6271	0.9489	0.9913
Sargan					5.810	7.096	2.335	1.012
Chi-sq(1) P-val					0.121	0.0288	0.311	0.315
Weak identification					19.29	31.46	12.56	21.82

Standard errors in parentheses, Columns 1-4 are WLS regressions and 5-8 2SLS
IV for 5-8: monopub, monopriv, time_after_public_monopoly, time_after_private_monopoly
*** p<0.01, ** p<0.05, * p<0.1

Mobile telephony regressions

VARIABLES	(1) zipf05	(2) zipf05	(3) zipf05	(4) zipf05	(5) zipf05	(6) zipf05	(7) zipf05	(8) zipf05
mobile_ln	-0.0259**	-0.0173	-0.0023	-0.0145***	-0.0147	-0.0284*	0.0014	-0.0156***
	(0.0114)	(0.0150)	(0.0036)	(0.0039)	(0.0157)	(0.0168)	(0.0037)	(0.0034)
Observations	82	67	82	67	82	67	82	67
R-squared	0.0866	0.6232	0.9492	0.9925	0.0754	0.6196	0.9482	0.9925
Sargan					8.067	6.951	3.970	0.560
Chi-sq(1) P-val					0.0446	0.0735	0.265	0.756
Weak identification					20.21	27.93	25.30	22.61

Standard errors in parentheses, Columns 1-4 are WLS regressions and 5-8 2SLS
IV for 5-8: monopub, monopriv, time_after_public_monopoly, time_after_private_monopoly
*** p<0.01, ** p<0.05, * p<0.1

Table 5.1: Fixed telephony regressions for using alternative measures of urban concentration

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Zipf	-0.0978***	-0.0734*	-0.0037	-0.0638***	-0.0774***	-0.0015	-0.0023	-0.1012***
	(0.0190)	(0.0395)	(0.0117)	(0.0190)	(0.0286)	(0.0814)	(0.0122)	(0.0258)
Gini	-0.0079	-0.0083	-0.0168**	-0.0363***	0.0315	0.0643	-0.0234***	-0.0521***
	(0.0132)	(0.0295)	(0.0072)	(0.0098)	(0.0309)	(0.1076)	(0.0084)	(0.0122)
HHI	0.0089	0.0058	-0.0027	-0.0154	-0.0211	0.0187	-0.0060	-0.0383**
	(0.0109)	(0.0220)	(0.0050)	(0.0131)	(0.0256)	(0.0765)	(0.0059)	(0.0163)
CV	0.0564	-0.0081	-0.1433***	-0.1519**	0.4200	0.1784	-0.1432***	-0.1860***
	(0.1208)	(0.2643)	(0.0389)	(0.0569)	(0.2843)	(0.9221)	(0.0455)	(0.0687)

Table 5.2: Internet regressions using alternative measures of urban concentration

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Zipf	-0.0201*	-0.0145	-0.0022	-0.0104***	-0.0250*	-0.0195	0.0017	-0.0144***
	(0.0106)	(0.0122)	(0.0035)	(0.0037)	(0.0146)	(0.0139)	(0.0045)	(0.0035)
Gini	-0.0017	-0.0055	-0.0046**	-0.0046**	0.0002	-0.0057	-0.0075***	-0.0061***
	(0.0069)	(0.0110)	(0.0018)	(0.0019)	(0.0110)	(0.0156)	(0.0020)	(0.0019)
HHI	0.0017	-0.0069	-0.0032**	-0.0050**	-0.0097	-0.0072	-0.0027*	-0.0044**
	(0.0056)	(0.0079)	(0.0013)	(0.0020)	(0.0092)	(0.0112)	(0.0014)	(0.0020)
CV	-0.0205	-0.0588	-0.0266**	-0.0186*	0.0179	-0.1315	-0.0440***	-0.0309***
	(0.0651)	(0.1013)	(0.0105)	(0.0105)	(0.1041)	(0.1445)	(0.0117)	(0.0107)

Table 5.3: Mobile telephomy regressions using alternative measures of urban concentration

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Zipf	-0.0259**	-0.0173	-0.0023	-0.0145***	-0.0147	-0.0284*	0.0014	-0.0156***
	(0.0114)	(0.0150)	(0.0036)	(0.0039)	(0.0157)	(0.0168)	(0.0037)	(0.0034)
Gini	-0.0039	-0.0094	-0.0036**	-0.0058**	-0.0006	-0.0158	-0.0057***	-0.0080***
	(0.0065)	(0.0116)	(0.0016)	(0.0023)	(0.0127)	(0.0167)	(0.0017)	(0.0023)
HHI	0.0037	-0.0084	-0.0011	-0.0034	-0.0087	-0.0128	-0.0022*	-0.0050**
	(0.0053)	(0.0083)	(0.0012)	(0.0025)	(0.0106)	(0.0119)	(0.0013)	(0.0024)
CV	-0.0045	-0.1035	-0.0273***	-0.0264**	0.0037	-0.2268	-0.0339***	-0.0350***
	(0.0620)	(0.1062)	(0.0093)	(0.0125)	(0.1207)	(0.1538)	(0.0095)	(0.0122)
For all regressions								
Country FE			Yes	Yes			Yes	Yes
Control variables	No	Yes	No	Yes	No	Yes	No	Yes

Standard errors in parentheses, Columns 1-4 are WLS regressions for the Zipf coefficient and OLS for the Gini coefficient, Hefrindahl index and coefficient of variation. 2SLS is used for columns 5-8 with the following IVs: monopub, monopriv, time_after_public_monopoly, time_after_private_monopoly. The Zipf coefficient estimates are duplicates from Table 5

*** p<0.01, ** p<0.05, * p<0.1

2.1. AGENDA and OVERVIEW

Agenda

- Isolate impact of conventional "non-economic" factors on growth
  - culture, politics, history and institutions (chiefly, enforcement of property rights)
  - economic performance and institutions jointly determined outcomes
  - major forces: culture, politics and history (exogenous)
  - history as a source of social norms
- Stage 1: Theory of corruption and rent-seeking, given history, culture and institutions, operating via social interactions
  - explain incidence of corruption and rent-seeking as outcomes
  - trace long-run impact on net output and growth
- Stage 2: Explain institutions
- Stage 3: Empirics

2.2. SOCIAL INTERACTIONS IN CORRUPTION AND RENT-SEEKING BEHAVIOR: model highlights

- Agents: $i = 1$ more productive than $i = 2$. Two-generations OLG. $j = 1, \cdots, \mathcal{J}$ countries. Only young work.
- Type-1: producers or enforcers (may be corrupt); type-2: producers or rent-seekers
  - Common utility function for $i = 1, 2$, and $\beta \in [0, 1]$:
    $$u_{i,t} = (1 - \delta_{i,t})[c_t(t,i)]^{1-\beta}[c_{t+1}(t,i)]^{\beta} = \text{private payoff}$$
    $(c_t(t,i), c_{t+1}(t,i))$ = agent-i life cycle consumption
  - δ_{it} = social interactions term between young and old
    - Non-conformism "tax" by old who disagree with type-i's occupational choice
    - Conformism "subsidy" from old who agree, plus random effects
  - Indirect lifetime utility:
    $$v_{i,t} = (1 - \delta_{i,t}) y_{i,t} R_{t+1}^{\beta}$$
    $y_{i,t}$ i's (after-tax) income, $R_{t+1} = 1$ plus world rate of interest
  - Common time endowment profile for $i = 1, 2$: $\omega_{i,t} = (1, 0)$
  - Common production technology for all i and j: $Y = K^{\alpha} N^{1-\alpha}$

2.3. CULTURE, INTERACTIONS, INSTITUTIONS: model cont/d

x_t : share of corrupt enforcers, type-1. ρ_t : share of type-2 rent-seekers
Lagged values define norms: x_{t-1}, ρ_{t-1}

- $\sigma \in [0, 1]$: culture parameter. Registers sensitivity to norms

  Greif (1994): "Cultural beliefs are the ideas and thoughts common to several people that govern interaction — between these people and among them, ... which capture people's expectations with respect to actions that others ..."

  $\sigma = 0$: individualism. $\sigma = 1$: collectivism. Measure: Hofstede

- Social interaction effects: linked to antisocial behavior
  - Lagged endogenous social effect, Conformism/non-conformism. Simplify: only "cross-effects":
    - Producers incur "tax:" type-2: $\sigma\rho_{t-1}$ type-1: σx_{t-1}
    - Rent-seekers incur a "tax:" $\sigma(1 - \rho_{t-1})$. Corrupt enforcers: $\sigma(1 - x_{t-1})$.
  - Individual social effect shock scales antisocial income

- Institutions North (1990): "the humanly devised **constraints** that structure human interactions ... rules, laws, constitutions,... and their enforcement characteristics."

2.4. WORLD WITHOUT CORRUPTION

Utopia benchmark: no corruptible humans or externalities
Only one type of producers:

- No wastage on enforcement
- Each nation has one unit of productive labor and saves fraction β of total wage bill
- Equilibrium: world saving = world capital

$$K_{t+1} = \beta w_t \mathcal{J}, \quad \mathcal{J} = \text{world mass of workers}$$
$$k_{t+1} = \beta(1-\alpha)k_t^{\alpha}, \quad k_t \equiv K_t/\mathcal{J}$$

- Social interactions do not affect savings

2.4. WORLD WITHOUT CORRUPTION, cont'd

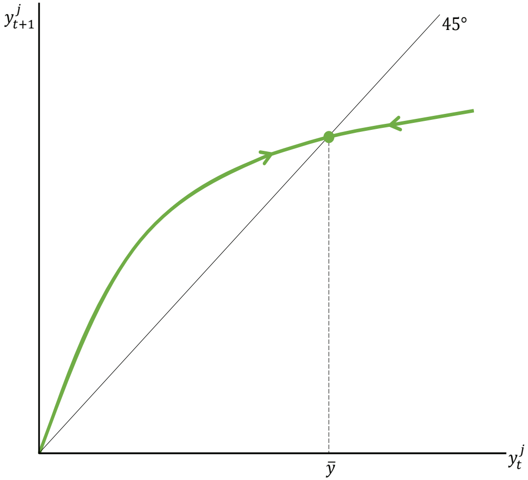


Figure 1: Growth without corruption

(b) Conclusions: without corruption/rent-seeking

- Capital mobility: ⇒ GDP per capita differences disappear at $t = 0$

2.5. MODEL: Producers' Expected income

- normalize pre-tax (world-wide) wage rate: $w = 1$.
- income tax rate: $\phi, \in [0, 1]$
- Rent-seekers match with producers, DMP-style: $z = \frac{\text{rent-seekers}}{\text{victims}}$
- probability producer meets rent-seeker: $p(z)$.
- Expected incomes, adjusted for social interactions:

$$y^p_{1,t} = \underbrace{\overbrace{(1-\phi)[1-p(z_t)]}}_{text after tax and ``looting''} \quad \overbrace{(1-\sigma\rho_{t-1})}^{\text{after social interaction ``tax''}}$$

$$y^p_{2,t} = \gamma y^p_1$$

where

social norm: lagged rent-seeking ρ_{t-1}

2.5. MODEL, cont/d: Type-2 Producers and Rent-seekers

- Type-2: producer: $y^P_{2,t} = \gamma y^P_{1,t}$
- Type-2: Rent-seekers: ϵ: individual social effect shock, realized, I.I.D. $\sim$ Pareto C.D.F. $G(\epsilon) = 1 - (\frac{\bar{\epsilon}}{\epsilon})^{\zeta}, \quad \overline{\epsilon} > 0, \zeta \geq 2$

$$y^{RS}(\epsilon) = (1-\phi)\frac{p(z)}{z}[1-q(\theta)]\overbrace{(1-\sigma(1-\rho_{t-1}))}^{\text{after interactions "tax"}}\quad\overbrace{\epsilon}^{\text{ind. soc. effect}}$$

$$= \text{producer income} \times \text{Pr(rent seeker meets producer)}(z)$$

$$\times \text{Pr(rent seeker evades enforcers)}(\theta)$$

$$\times \text{(1-tax or subsidy from norms)}$$

$$\times \underbrace{\text{(1-tax or subsidy from random social interactions)}}_{\text{individual social effect}}$$

2.5. MODEL, cont/d: Type-1 Expected income: enforcers

Enforcers

- Honest:
$$y_t^{HE} = (1-\phi)(1-p(z_t))(1-\sigma x_{t-1})$$
- Corrupt exposed with fixed prob. π, forfeits wages, but consumes "looted" income from rent-seekers, adjusted for social interactions "tax", and individual social effect shock $\epsilon > 0$:

$$y_t^{RE}(\epsilon) = \overbrace{(1-\phi)[(1-\pi)(1-p(z_t))}^{\text{own wage income}} \quad \overbrace{(1-\sigma x_{t-1})}^{\text{net of social interactions "tax"}}$$
$$+ \underbrace{\frac{p(z_t)}{z_t}\frac{q(\theta_t)}{\theta_t}(1-\sigma(1-x_{t-1}))}_{\text{loot after social interactions "tax"}} \quad \overbrace{\epsilon}^{\text{individual social effect}}$$

2.6. Occupational Choice

- Given institutions and factor prices, all households choose honest behavior if ϵ-shock is "small enough", i.e. if

$$y^{HE} \geq y^{RE}(\epsilon) \quad \text{for enforcers} \tag{1a}$$

$$\gamma y_1^P \geq y^{RS}(\epsilon) \quad \text{for type-2 people} \tag{1b}$$

- Define the auxiliary function, convex decreasing:

$$m(y) := \frac{1-\sigma y}{1-\sigma+\sigma y} \quad \text{for} \quad y \in [0,1] \tag{2}$$

Conditions for honest behavior, simplified:

$$\epsilon \leq \frac{\pi\theta}{q(\theta)} A m(x_{t-1}) \quad \text{for enforcers} \tag{3a}$$

$$\epsilon \leq \frac{\gamma A}{1-q(\theta)} m(\rho_{t-1}) \quad \text{for type-2 agents} \tag{3b}$$

2.6. Occupational Choice: conclusions

At any point in time t :

- honest behavior is more likely if social norms are "good" (low values of (x_{t-1},ρ_{t-1}))

- honest behavior is more likely if institutions are strong (high value of θ)

- role of σ, culture (traditionalism, or individualism) is indeterminate

2.7. EVOLUTION OF OCCUPATIONAL EQUILIBRIUM FOR GIVEN INSTITUTIONS

Aims

- Fix institutions forever at exogenous value $\theta \in [0, b]$
- Given Culture parameter $\sigma \in [0, 1]$
- Predetermined "social norms:" $(\rho_{t-1}, x_{t-1}) \in [0, 1]$,
- How dynamic equilibria(ρ_t, x_t) evolve over time?
- What values do they converge to in the long-run?

Member of young generation draw ϵ, when considering antisocial behavior, with CDF $G(\cdot)$:

$$\epsilon \leq \frac{\pi\theta}{q(\theta)} Am(x_{t-1}) \text{ for enforcers} \Rightarrow \; 1 - x_t = G\left[\frac{\pi\theta}{q(\theta)} Am(x_{t-1})\right]$$

$$\epsilon \leq \frac{\gamma A}{1 - q(\theta)} m(\rho_{t-1}) \;\; \text{type-2 agents} \Rightarrow \; 1 - \rho_t = G\left[\frac{\gamma A}{1 - q(\theta)} m(\rho_{t-1})\right]$$

2.7. OCCUPATIONAL EQUILIBRIUM, GIVEN INSTITUTIONS, cont'd

Individual social effects $\sim$ Pareto: $G(\epsilon) = 1 - (\frac{\bar{\epsilon}}{\epsilon})^{\zeta}$, $\overline{\epsilon} > 0, \zeta \geq 2$
And assuming $x_{t-1} = \rho_{t-1}$, (identical public & private norms):

$$1 - \rho_t = G\Big[\frac{\gamma A}{1 - q(\theta)} m(\rho_{t-1})\Big]$$

$$1 - x_t = G\Big[\frac{\pi \theta A}{q(\theta)} m(\rho_{t-1})\Big]$$

Rewriting,

$$\rho_t = J(\rho_{t-1}; \theta, \sigma), \ \frac{\rho_t}{x_t} = \Big[\frac{\pi\theta}{q(\theta)}(1 - q(\theta))(\frac{\overline{\epsilon}}{\gamma})\Big]^{\zeta}$$

where

$$J(\rho_{t-1}; \theta, \sigma) = \Big[\frac{B(\theta)}{m(\rho_{t-1})}\Big]^{\zeta} \tag{5a}$$

$$B(\theta) = [1 - q(\theta)](\frac{\overline{\epsilon}}{\gamma A}) \leq 1 \tag{5a}$$

$$m(\rho_{t-1}) = \frac{1 - \sigma\rho_{t-1}}{1 - \sigma + \sigma\rho_{t-1}} \tag{2}$$

2.7. OCCUPATIONAL EQUILIBRIUM FOR GIVEN INSTITUTIONS, cont'd

Notes

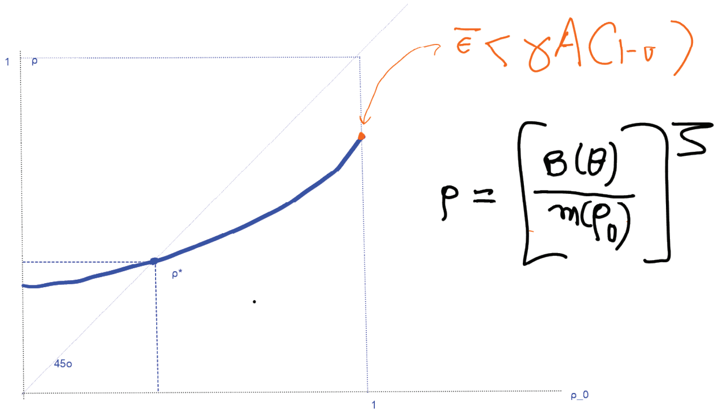
i. The rent-seeking-to-corruption ratio $\frac{\rho}{x}$ depends on technology (probability of identifying dishonest persons), not on culture (σ, ρ_{t-1})

ii. For individualist societies $(\sigma = 0, \epsilon = 1)$, anti-social behavior depends entirely on the quality of institutions.

iii. Function J is increasing convex function of ρ_0 for each (θ, σ)

iv. Dynamics of rent-seeking: for given institutions, θ, and social norm, ρ_{t-1}, long-run equilibrium is $\rho^*(\theta)$, i.e long-run rent-seeking and corruption are decreasing functions of institutions, of human capital, γ, and of A?

2.7. OCCUPATIONAL EQUILIBRIUM FOR GIVEN INSTITUTIONS, cont'd



- Rent-seeking, given norms

2.7. OCCUPATIONAL EQUILIBRIUM FOR GIVEN INSTITUTIONS

V. Examples show GDP may be decreasing in θ for small θ.

That happens when an improvement in policing requires more labor from production than it releases from rent-seeking. [cf. Fig. 4]

Vi. This is consistent with the observation that corruption and GDP are sometimes positively correlated.

Sometimes, this is interpreted as "corruption lubricating the wheels of trade... !"

2.7. OCCUPATIONAL EQUILIBRIUM FOR GIVEN INSTITUTIONS, cont'd

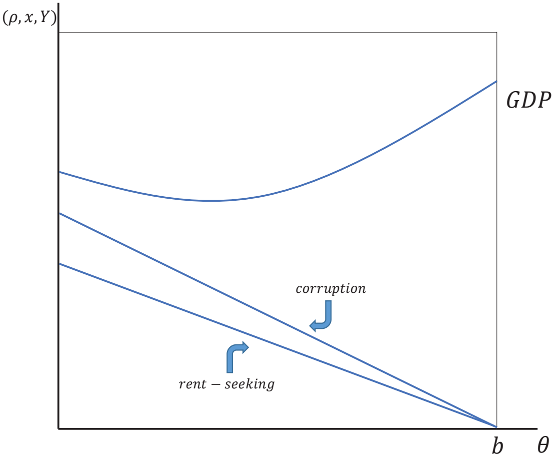


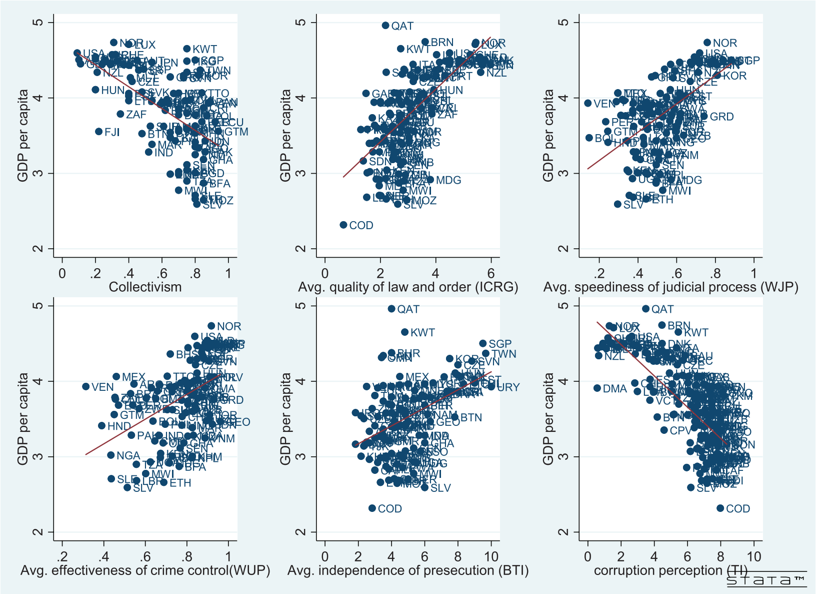
Figure 3: Institutions vs. (x,ρ,Y)

2.7. OCCUPATIONAL EQUILIBRIUM FOR GIVEN INSTITUTIONS: summary

- Rent-seeking and corruption, when public norms $\equiv$ private norms:
  - decreasing functions of institutional quality, θ, and of human capital, γ.
  - increasing functions of respective own norms, (ρ_{t-1}, x_{t-1}).
  - increasing (decreasing) function of σ, if norms are poor (good): $\rho_{t-1} >\ (< 0)\frac{1}{2}$.
  - contemporaneous correlation of corruption and rent-seeking depends on: $\theta, \pi, q(.), \gamma, \bar{\epsilon}$.

    No strong restrictions a priori.
  - **Steady state** corruption and rent-seeking: decreasing functions of institutional quality and **independent of norms**.
  - GDP p.c.: decreasing function of contemporaneous of corruption and rent-seeking, and of past (ρ_{t-1}, x_{t-1}).
  - GDP p.c. may initially decrease in institutional quality before it starts increasing.
- General case, when public norms $\neq$ private norms: Just more complicated nonlinear dynamics!

2.8. ILLUSTRATIVE REGRESSION: GDP p.c. AGAINST INSTITUTIONS



2.9 OUTLINE OF EMPIRICAL RESULTS: GDP p.c. regressions

- $y_{j,t}$, GDP p.c., as a function of: lagged corruption, institutions, human capital, culture:

$$y_{j,t} = b + b_{cpi} \cdot \text{CPI}_{j,t-1} + b_I \cdot \text{Institution}_{i,j,t-1} + \beta_{cu} \cdot \text{culture}_{j,t-1}$$
$$+ b_h \cdot \text{human capital}_{j,t-1} + D_t + \varepsilon_{j,t},$$

  alternative specifications for $\varepsilon_{j,t}$: IID, Random Effects, Fixed Effects.

- Results: predictions largely confirmed:
  - lagged corruption: negative effect, and with RE (when significant)
  - lagged individual institutions: positive effect (generally)
  - lagged vector of all institutions: generally positive, though not all
  - lagged human capital: strong positive, almost all regressions with FE, weaker with RE
  - Culture Hofstede collectivism, time invariant: strong negative, and with RE

    Alternative proxies to try: traditional vs. secular-rational values, survival vs. self-expression values: so far, disappointing

2.10. OUTLINE OF EMPIRICAL RESULTS: Corruption regressions

- Corruption as a function of lagged corruption, institutions, human capital, culture: theory suggests nonlinear effects

$$\text{CPI}j,t = b + b_{cpi} \cdot \tanh(CPI_{j,t-1}) + b_I \cdot \text{Institutions}_{j,t-1} + \beta_{cu} \cdot \text{culture}_{j,t-1}$$
$$+ b_h \cdot \text{human capital}_{j,t-1} + D_t + \varepsilon_{j,t},$$

  Function $\tanh(\cdot)$, a transformation of the logistic function: $\tanh(bx) = \frac{e^{cx} - e^{-cx}}{e^{cx} + e^{-cx}}$.

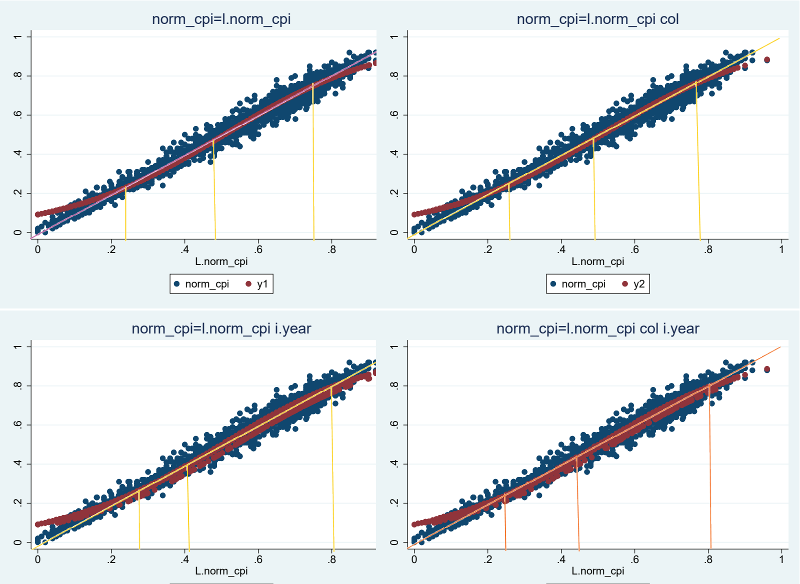
  Sigmoid, allowing several ways to study impact of institutions:

  - direct effects on corruption: lagged corruption, collectivism increase corruption; lagged GDP p.c., human capital, no effect; lagged protection against expropriation and protection of property rights decrease corruption.
  - indirect effect by influencing parameter estimate: controlling for lagged institutions reduces the estimate of key parameter b; reduces likelihood of multiple equilibria.

- Predicted corruption implies three equilibria:

  two stable: low $\approx .20$; high $\approx .80$. Middle: unstable.

2.10. OUTLINE OF EMPIRICAL RESULTS: Corruption regressions graphics



2.11. OUTLINE OF EMPIRICAL RESULTS: Determination of Individual Institutions

- institution$_i$, as a function of lagged: corruption, GDP p.c., human capital, and alternative error structure specifications

$$\text{Institution}_{i,j,t-1} = b + b_{cpi,i} \cdot \text{CPI}_{j,t-1} + b_y \cdot y_{j,t-1} + \beta_{cu,i} \cdot \text{culture}_{j,t-1}$$

$$+ b_{h,i} \cdot \text{human capital}_{j,t-1} + D_t + \varepsilon_{j,t},$$

- Theory implies higher lagged corruption (“norms”) lead to weaker current institutions, without necessarily decreasing GDP p.c.

  Results confirm it: “Bad norms tend to reproduce themselves.”

  - lagged corruption: strong negative effect, almost always, often strengthened when second lag included
  - lagged GDP p.c.: strong positive effect, weakened when second lag is included, which has positive effect typically overwhelming the first lag. Often both lags positive effects.
  - collectivism: strong negative effect when included, even with RE
  - human capital: often negative effect, puzzlingly, with some exceptions (WJP_cte, WJP_ce, WJP_enf, BTI _poa, ICRG_lo)

2.11. OUTLINE OF EMPIRICAL RESULTS: Joint Determination of Institutions

- Vector of institutions as a function of lagged: corruption, GDP p.c., human capital, as SURE regressions, pooled sample

$$\textbf{Institutions}_{j,t-1} = b + \mathbf{b}_{cpi} \cdot \text{CPI}_{j,t-1} + \mathbf{b}_{y} \cdot y_{j,t-1} + \textbf{beta}_{cu} \cdot \text{culture}_{j,t-1}$$

$$+\mathbf{b}_{h} \cdot \text{human capital}_{j,t-1} + D_t + \varepsilon_{j,t},$$

  - Effects of lagged corruption typically negative, even with second lag
  - Effects of lagged GDP p.c. typically positive,even with second lag
  - Effects of collectivism most often negative
  - Effects of human capital most often positive
  - Several groupings of institutions, due to sparsity of time observations: similar effects
  - Institutions highly persistent, but regressions in first differences not informative