

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)
 - Social interactions are ubiquitous and central to the urban economy:
 - 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
- **PART 2.** “Corruption and Rent-seeking in Economic Growth”, with Costas Azariadis
 - Past incidence of rent-seeking and corruption define norms

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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:

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

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

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

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

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

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.

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. $j = 1, \dots, \mathcal{J}$ 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 : $Y = K^\alpha N^{1-\alpha}$

2.2 DEFINITIONS

- Corruption and rent-seeking
 - Popular meanings:** bribery, embezzlement, nepotism, extortion and racketeering, illegal licensing, tax evasion, information misreporting
- Corruption and Rent-seeking:
 - Scientific synonyms:** rent-seeking, predation, appropriation, extraction, involuntary redistribution, property crime and official corruption (Şillegal use of public office for private gainŤ)

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

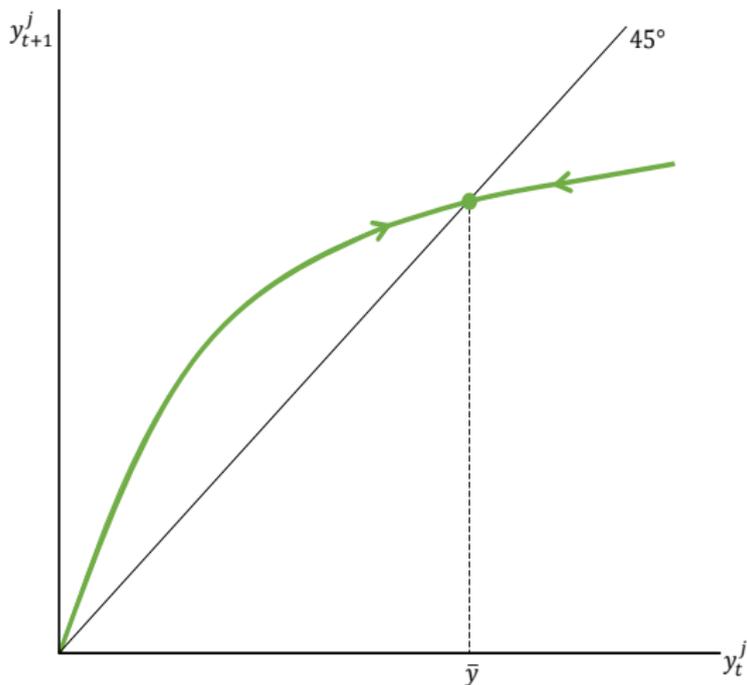


Figure 1: Growth without corruption

(b) Conclusions: without corruption/rent-seeking

- Capital mobility: \Rightarrow 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:

$$y_{1,t}^p = \overbrace{(1 - \phi)[1 - p(z_t)]}^{\text{after social interaction "tax"}}$$

text after tax and "looting" $(1 - \sigma \rho_{t-1})$

$$y_{2,t}^p = \gamma y_1^p$$

where

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

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

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

$$\begin{aligned}
 y^{RS}(\epsilon) &= (1 - \phi) \frac{p(z)}{z} [1 - q(\theta)] \overbrace{(1 - \sigma(1 - \rho_{t-1}))}^{\text{after interactions "tax" ind. soc. effect}} \underbrace{\epsilon}_{\epsilon} \\
 &= \text{producer income} \times \text{Pr}(\text{rent seeker meets producer})(z) \\
 &\quad \times \text{Pr}(\text{rent seeker evades enforcers})(\theta) \\
 &\quad \times (1 - \text{tax or subsidy from norms}) \\
 &\quad \times \underbrace{(1 - \text{tax or subsidy from random social interactions})}_{\text{individual social effect}}
 \end{aligned}$$

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 $\epsilon > 0$:

$$y_t^{RE}(\epsilon) = \overbrace{(1 - \phi)[(1 - \pi)(1 - p(z_t))]}^{\text{own wage income}} \quad \overbrace{(1 - \sigma x_{t-1})}^{\text{net of social interactions "tax"}}$$

$$+ \underbrace{\frac{p(z_t)}{z_t} \frac{q(\theta_t)}{\theta_t} (1 - \sigma(1 - x_{t-1}))}_{\text{loot after social interactions "tax"}}$$

individual social effect
 ϵ

2.6. Occupational Choice

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

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

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

- Define the auxiliary function, convex decreasing:

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

Conditions for honest behavior, simplified:

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

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

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

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

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

Rewriting,

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

where

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

$$B(\theta) = [1 - q(\theta)] \left(\frac{\bar{\epsilon}}{\gamma A}\right) \leq 1 \quad (5a)$$

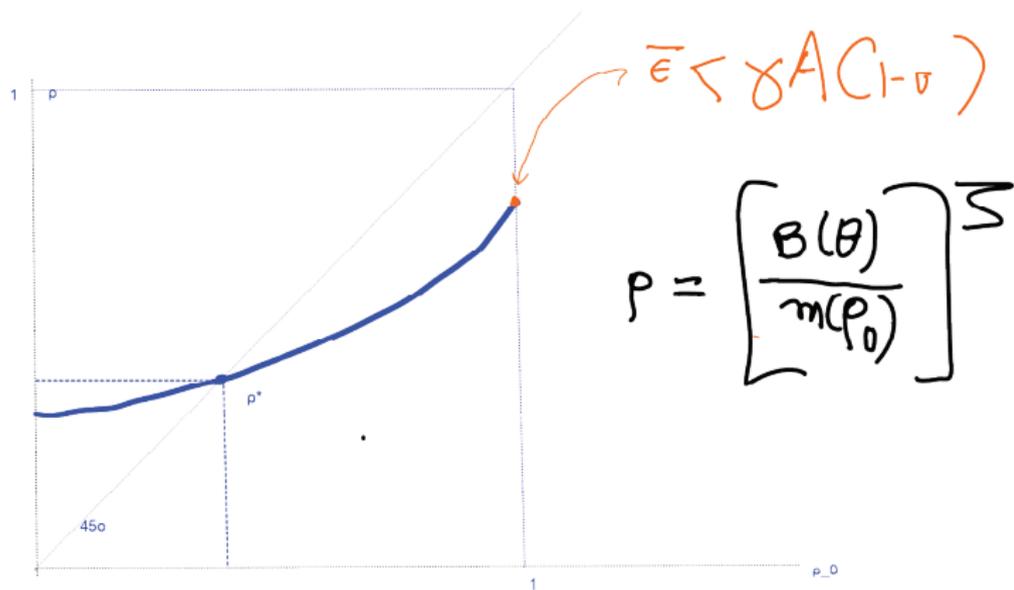
$$m(\rho_{t-1}) = \frac{1 - \sigma\rho_{t-1}}{1 - \sigma + \sigma\rho_{t-1}} \quad (2)$$

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

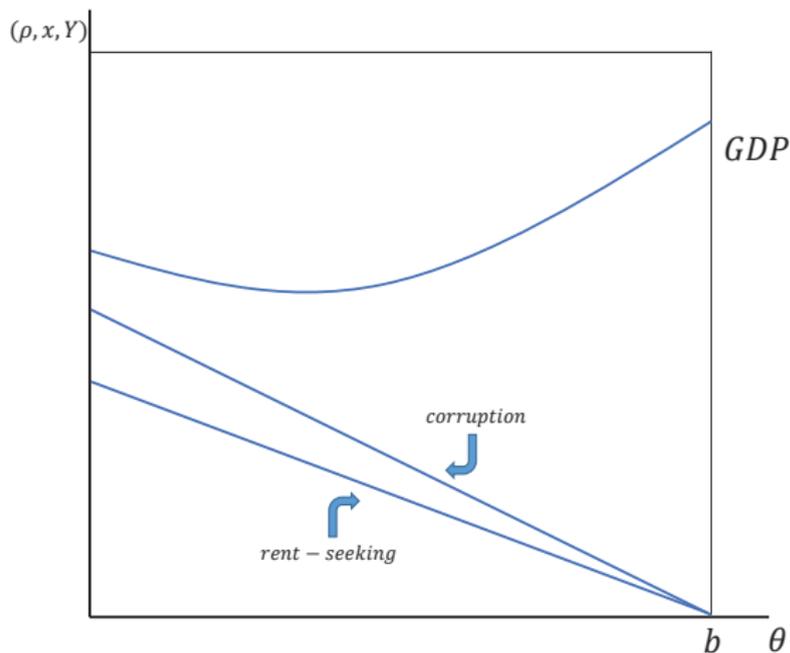
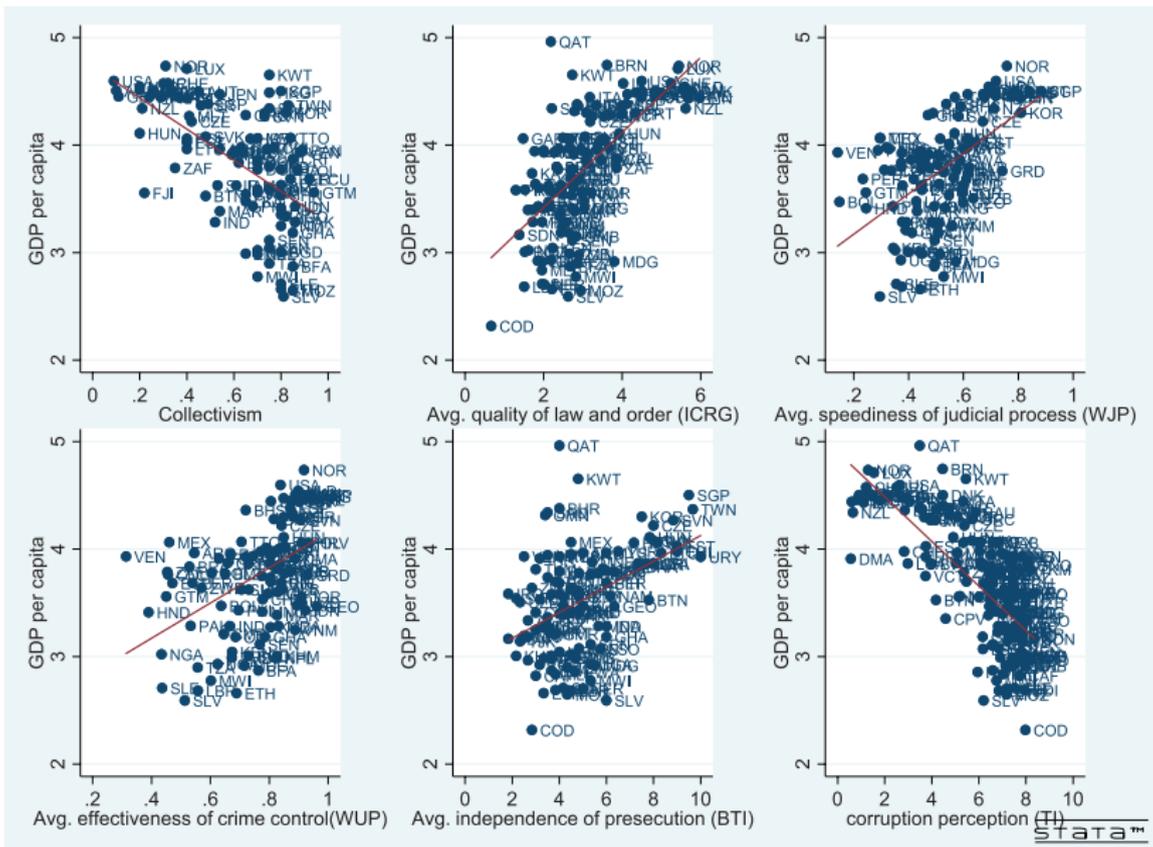


Figure 3: Institutions vs. (x, ρ, Y)

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: $\theta, \pi, q(\cdot), \gamma, \bar{e}$.
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:

$$y_{j,t} = b + b_{cpi} \cdot CPI_{j,t-1} + b_I \cdot Institution_{i,j,t-1} + \beta_{cu} \cdot culture_{j,t-1} \\ + b_h \cdot human\ capital_{j,t-1} + D_t + \varepsilon_{j,t},$$

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

$$CPI_{j,t} = b + b_{cpi} \cdot \tanh(CPI_{j,t-1}) + b_I \cdot Institutions_{j,t-1} + \beta_{cu} \cdot culture_{j,t-1} + b_h \cdot human\ capital_{j,t-1} + D_t + \varepsilon_{j,t},$$

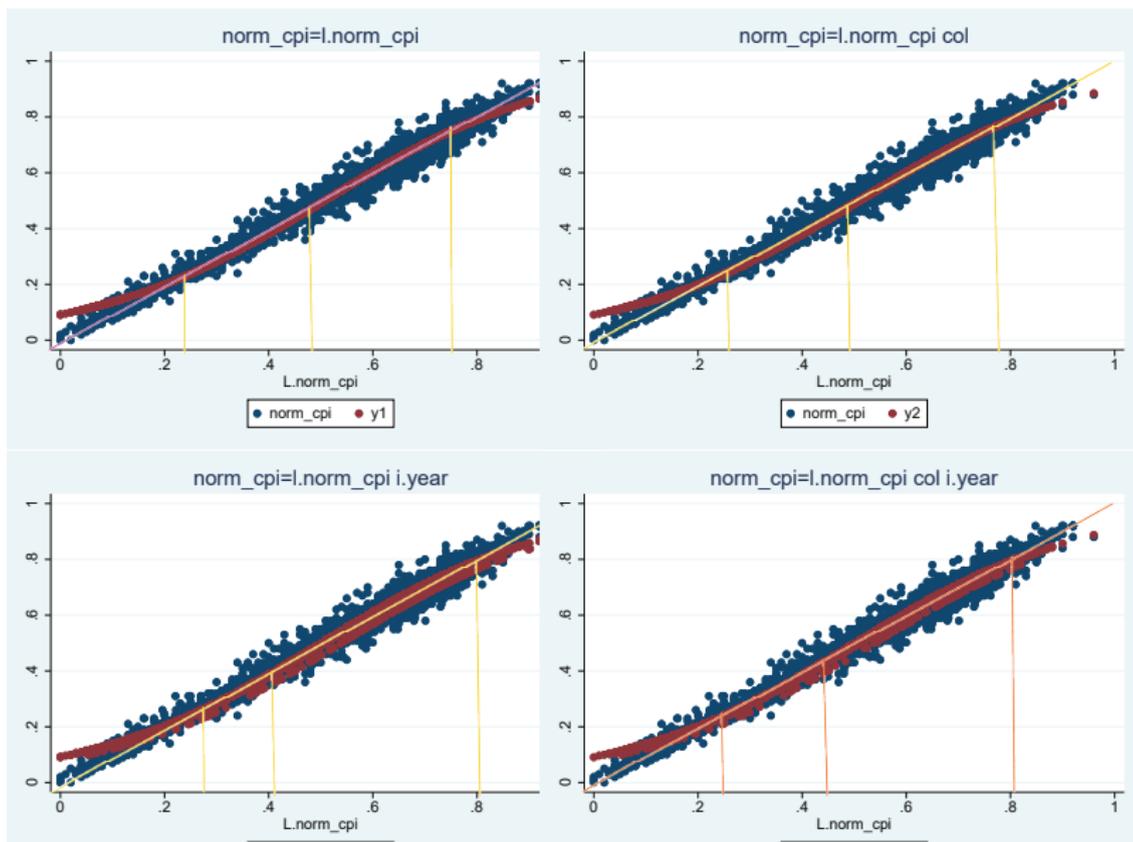
Function $\tanh(\cdot)$, a transformation of the logistic function:

$$\tanh(bx) = \frac{e^{bx} - e^{-bx}}{e^{bx} + e^{-bx}}.$$

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_{*j*}, 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

$$\mathbf{Institutions}_{j,t-1} = b + \mathbf{b}_{cpi} \cdot \text{CPI}_{j,t-1} + \mathbf{b}_y \cdot y_{j,t-1} + \mathbf{beta}_{cu} \cdot \text{culture}_{j,t-1} \\ + \mathbf{b}_h \cdot \text{human capital}_{j,t-1} + D_t + \varepsilon_{j,t},$$

- 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