Field Experimental Approach to Voluntary Contribution to Public Goods: Social Capital as Regional Public Goods

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Asian Development Bank
Outline

1. Regional public goods, social capital and PD game

2. Social capital as a driver of PG provision

3. Measuring social capital and public goods game

4. Social capital as a source of regional public goods
Regional Public Goods (RPG)

- **Public goods**: goods characterized by non-rivalry (joint use) or non-excludability (non-alienability)

- **Global public goods**: An unlimited number of people can use jointly

- **Local public goods**: limited usage to a particular group, e.g., a village

- **Regional public goods** are located in-between, involving multiple-countries
  - **Positive spillovers**
    - Trade facilitation and FTAs/RTAs
    - Coordinated cross-border transport and power infrastructure
    - Coordinated monetary policies
  - **Negative externalities**
    - Climate change mitigation and adaptation (clean energy and environmental protection)
    - Coordinated disaster prevention and response (flood control such as riparian and watershed management; satellite-based monitoring system; epidemics control)
    - Security (regional peacekeeping; anti-corruption and good governance)
    - Human and drug trafficking
    - Anti-money laundering

<table>
<thead>
<tr>
<th>Attributes of:</th>
<th>Embodied in:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physical goods</td>
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<tr>
<td>Private goods</td>
<td>Private physical capital</td>
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<tr>
<td></td>
<td>= alienable/tradable goods</td>
</tr>
<tr>
<td></td>
<td>e.g., machines &amp; factories</td>
</tr>
<tr>
<td>Local public goods</td>
<td>Social overhead capital</td>
</tr>
<tr>
<td></td>
<td>Local infrastructure:</td>
</tr>
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<td></td>
<td>e.g., village roads, local schools &amp; municipal drainage systems</td>
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<tr>
<td>Global public goods</td>
<td>Global infrastructure:</td>
</tr>
<tr>
<td></td>
<td>e.g., lighthouses &amp; national highways</td>
</tr>
</tbody>
</table>

Source: Hayami (2009) *JDS*
### Regional Public Goods (RPG)

#### Table 1: Regional public goods: typology and examples

<table>
<thead>
<tr>
<th>Aggregation technology</th>
<th>Pure public good</th>
<th>Impure public good</th>
<th>Club</th>
<th>Joint products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summation: Overall level of public good equals the sum of countries’ contributions.</td>
<td>Cleansing a local ecosystem</td>
<td>Treatment of diseased patients</td>
<td>Regional parks</td>
<td>Preserving rain forests</td>
</tr>
<tr>
<td>Weighted sum: Overall level of public good equals a weighted sum of countries’ contributions.</td>
<td>Curbing the spread of an infectious disease</td>
<td>Reducing acid rain</td>
<td>Power network</td>
<td>Eliminating insurgency</td>
</tr>
<tr>
<td>Weakest link: Smallest contribution determines the good’s aggregate level.</td>
<td>Maintaining the integrity of a network</td>
<td>Surveillance of regional disease outbreak</td>
<td>Air-traffic control</td>
<td>Security intelligence</td>
</tr>
<tr>
<td>Weak link: Smallest contribution has the greatest influence on the good’s aggregate level, followed by the second smallest contribution, and so on.</td>
<td>Applying prophylactic measures against a regional disease</td>
<td>Inhibiting the spread of an agricultural pest</td>
<td>Transportation infrastructure</td>
<td>Internet connectivity</td>
</tr>
<tr>
<td>Threshold: Benefits from the public good only arise once the cumulative quantity of the good surpasses a certain level.</td>
<td>Regional flood control</td>
<td>Fire suppression in a region</td>
<td>Crisis-management teams</td>
<td>Regional peacekeeping</td>
</tr>
<tr>
<td>Best shot: Largest contribution determines the good’s aggregate level.</td>
<td>Curing a region-specific disease</td>
<td>Geoclimatic-specific research findings</td>
<td>Satellite-launch facility (Alcántara)</td>
<td>Remote sensing of hurricanes</td>
</tr>
<tr>
<td>Better shot: Largest contribution has the greatest influence on the good’s aggregate level, followed by the second largest contribution, and so on.</td>
<td>Discovering effective vaccine</td>
<td>Cleaning up an oil spill</td>
<td>Biohazard facility</td>
<td>Bioprospecting</td>
</tr>
</tbody>
</table>

Source: Sandler (2006), Table 1.
**Contribution to PG**

- **Public goods (PG) contribution in N person PD games**
  - **Examples:** Free trade regime (against tariff war); Int’l policy coordination (against competitive devaluation/against natural & biological disasters/grab race); Resource management (against tragedy of commons/pollution control); Tax payment
  - **A market failure model:** *Laissez faire* leads to suboptimal outcome

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<table>
<thead>
<tr>
<th></th>
<th>Player (Country) A</th>
<th>Player (Country) B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C</strong></td>
<td>C</td>
<td><strong>4, 4</strong></td>
</tr>
<tr>
<td><strong>D</strong></td>
<td><strong>5, -1</strong></td>
<td><strong>0, 0</strong></td>
</tr>
</tbody>
</table>
```

- **Social optimum:** 4, 4
- **Nash equilibrium:** 0, 0
Contribution to PG: How?

1. Third party enforcement
   - Rules set by the government
     • Lindahl Equilibrium
     • Groves Clark mechanism
     • Groves Ledyard mechanism
   - But government failures

2. Repeated interactions, facilitating self-enforcing cooperation
   - Long-term bilateral relationship
   - Summit meetings (Robert Putnam); regional forum; community norm (Michi Kandori)
   - International organizations with multilateral long-term relationship in fostering supply of PG (Sandler, 2006)

3. Social capital
   - Other-regarding preferences (or repeated interactions *a la* Kandori)
   - How can we facilitate social capital accumulation? - “Artifacts” such as infrastructure and institution can glue people (countries) together
The Trinity of Market, State, and Community

• **SC complements** market transactions and the government’s public goods provisions (Hayami, 1989, 2009, *JDS*; Bowles and Gintis, 2002 *EJ*)

![Diagram](image)

Source) Hayami (2009)

Figure 2. The community, the market, and the state in the economic system
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Social Capital (SC)

- The informal forms of institutions and organizations based on social relationships, networks and associations that create shared knowledge, mutual trust, social norms, and unwritten rules [Durlauf and Fafchamps (2004)]

- Network within/across rural communities and firms as well as SNS (FB etc)

- Plays an important role in supplying and maintaining regional PG

- Three modes:
  - Bonding SC
  - Bridging SC
  - Linking SC

• Extensive studies on SC in political science, sociology, public health, and economics.
  – Political science: Robert Putnam
  – Sociology: James Coleman
  – Economics: Glenn Loury
  – Public Health: Ichiro Kawachi and S. V. Subramanian

• *Mancur Olson*: “Dark side” of SC-- SC can generate negative impacts.

  – Kenneth Arrow, Robert Solow, and Elinor Ostrom criticized the ambiguity of definition of SC although they all agree the importance of “trust” in real life.
  – Ken Arrow: To be called “capital,” (a) extension in time; (b) deliberate sacrifice in the present for future benefit; and (c) alienability (transferability of property rights) are needed. SC does not meet these, especially (b).
• Barro regression using a subjective question on SC (GSS trust) by Knack and Keefer (1997)
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Measuring SC?

I) Subjective assessments/response:
• Attitudinal measures
  – GSS (trust, fair, and help)
• Behavioral measures
• Participation measures

II) Proxy variables
• Ex) # of blood donations & crime rate

III) Lab or Artefactual Field Experiments
• Monetary-incentivized

Source) Anderson et al. (2004)
III) Lab and Artefactual Field Experiments

- A field experiment is defined as a scientific method to experimentally examine the effect of an (policy) intervention in the real world rather than in the laboratory.

- Largely speaking, there are three categories of field experiments: artificial, framed, and natural field experiments.
  - Fig. 1 of Levitt and List (2009) shows three field experiments in the middle:


<table>
<thead>
<tr>
<th></th>
<th>Controlled Data</th>
<th>Naturally-Occurring Data</th>
</tr>
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<tbody>
<tr>
<td>Lab</td>
<td>AFE</td>
<td>FFE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NFE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NE, PSM, IV, STR</td>
</tr>
</tbody>
</table>
III) Lab and Artefactual Field Experiments

- Dictator Game to elicit altruism
- Trust game to elicit trust and trustworthiness
- Public goods game to elicit voluntary cooperation
- Ultimatum game to elicit guilt aversion and envy aversion

Other games:
- Risk game to elicit risk aversion
- Time preference game to elicit time discounting rate
Initially, each participant receives 10 coins of 10 PHP to put into the public pot.

Then decides *secretly* how much to keep and how much to contribute to the pot (public goods).

Total amount put in the pot will be doubled.

Then *equally divided back* to each participant.
\[ \pi_i = \text{Total payoff of a person } i \]
- \( Y_i = \text{contribution amount by a person } i \)
- Values:
  - \( E = 100 \) PHP
  - \( \rho = 2 \)
  - \( N = 4 \)
- \( \partial \pi_i / \partial Y_i = -1 + (\rho / N) < 0 \) when \( 1 < \rho < N \).
- Nash equilibrium: \( Y_i = 0 \ \forall \ i \), so \( \pi_i > 0 \) shows voluntary reciprocal cooperation

### Table 1. Cooperation in developing countries

<table>
<thead>
<tr>
<th>Game</th>
<th>Study</th>
<th>Location</th>
<th>Students</th>
<th>Mean cooperation</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCM</td>
<td>Andreoni (1995)</td>
<td>United States</td>
<td>Yes</td>
<td>33% of endowment</td>
</tr>
<tr>
<td>VCM</td>
<td>Barr (2001)</td>
<td>Zimbabwe</td>
<td>No</td>
<td>43% of endowment – old</td>
</tr>
<tr>
<td>VCM</td>
<td>Barr and Kinsey (2002)</td>
<td>Zimbabwe</td>
<td>No</td>
<td>48% of endowment, 52%a</td>
</tr>
<tr>
<td>VCM</td>
<td>Carpenter et al. (2004a)</td>
<td>Vietnam</td>
<td>No</td>
<td>53% of endowment – women</td>
</tr>
<tr>
<td>VCM</td>
<td>Gaechter et al. (2004)</td>
<td>Russia</td>
<td>Yes</td>
<td>72% of endowment, 76%a</td>
</tr>
<tr>
<td>VCM</td>
<td>Henrich and Smith (2004)</td>
<td>Peru</td>
<td>No</td>
<td>61% of endowment, 73%a</td>
</tr>
<tr>
<td>VCM</td>
<td>Karlan (2005)</td>
<td>Chile-Mapuche</td>
<td>No</td>
<td>58% of endowment</td>
</tr>
<tr>
<td>VCM</td>
<td></td>
<td>Chile-Huinca</td>
<td>No</td>
<td>33% of endowment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peru</td>
<td>No</td>
<td>58% of endowment</td>
</tr>
</tbody>
</table>

Source: Cardenas and Carpenter (2008)
(a) English speaking

(b) Protestant Europe

(c) Orthodox/ex-Communist

(d) Confucian

(e) Southern Europe

(f) Arabic speaking

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**Culture and cooperation  S. Gächter et al.  (2010)**
GSS and PGG

- PGG can be implementable only with smaller number of subjects. Do we have a good proxy?
- Anderson et al. (2004) *AER*: a total of 48 students were recruited from undergraduate classes at the College of William and Mary to participate in public goods (PG) game
  - Frequently employed measures of social capital are significant determinants of contribution levels in a canonical PG experiment

<table>
<thead>
<tr>
<th>Survey question</th>
<th>Mean</th>
<th>Marginal effect</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attitudinal Measures of Trust:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most people can be trusted</td>
<td>0.313</td>
<td>0.697 (2.63)</td>
</tr>
<tr>
<td>Most people try to be fair</td>
<td>0.333</td>
<td>0.588 (3.36)</td>
</tr>
<tr>
<td>Most people try to be helpful</td>
<td>0.313</td>
<td>−0.918 (3.71)</td>
</tr>
<tr>
<td>You can’t trust strangers anymore</td>
<td>0.521</td>
<td>−1.791 (5.96)</td>
</tr>
<tr>
<td>I am trustworthy</td>
<td>0.917</td>
<td>−1.036 (4.21)</td>
</tr>
<tr>
<td><strong>Behavioral Measures of Trust:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Often leave door unlocked</td>
<td>0.438</td>
<td>−1.200 (5.65)</td>
</tr>
<tr>
<td>Ever loan money to strangers</td>
<td>0.188</td>
<td>0.935 (3.91)</td>
</tr>
<tr>
<td>Often loan money to friends</td>
<td>0.646</td>
<td>−0.789 (1.77)</td>
</tr>
<tr>
<td>Ever victim of a crime</td>
<td>0.313</td>
<td>−1.607 (4.48)</td>
</tr>
<tr>
<td>Never lie to parents, friends, etc.</td>
<td>0.596</td>
<td>0.866 (3.89)</td>
</tr>
</tbody>
</table>
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SC as RPG

1. Existing literature on cross-border (cross country/cross-cultural) public goods
   - Heterogeneities in PG contribution across countries/ethnicities/cultures (Gatcher et al, 2010)
   - High levels of country/ethnic diversity lead to low levels of public goods provision (Castroab, 2008; Cadsby et al., 2006)/

2. Specific mechanisms to stimulate contribution?
   - Enforcement devices (punishment opportunities)
   - Enabling “artifacts”
     - Habyarimana et al. (2007) *APSR*: By comparing “preferences,” “technology,” and “strategy selection” mechanisms, a technology mechanism is important among co-ethnics
SC as RPG: Measurement?

**Empirical strategy**: To identify causal relationship from access to “artifacts (A)” to RPG contribution (RPG) capture by SC:

\[ Y = f(RPG), \]
\[ RPG = g(A), \]

where \( Y \) is a set of outcomes, e.g., trade, growth, poverty reduction etc..

**Data**:
- **Artifacts** = access to infrastructure, treaties, agreements, institutions
- **RPG** = GSS trust and related proxies for regional public goods supply
Relevant Data Sets

• Asian Barometer
• World Values Survey

• Demographic and Health Surveys
• Economist Intelligence Unit
• European Social Survey
• International Country Risk Guide
• International Social Survey
• London School of Economics Annual Civil Society Yearbook

* Some of these data sets can be accessed through “Indices of Social Development”
Asian Barometer Survey

- The **Asian Barometer Survey (ABS)** is an applied research program that aims to gauge public opinion on issues such as political values, democracy, and governance across Asia.

- **Country coverage:**
  - South Asia: (1) India; (2) Bangladesh; (3) Nepal; (4) Pakistan; (5) Sri Lanka
  - East Asia: (6) Taipei, China; (7) People’s Republic of China; (8) Japan; (9) Republic of Korea; (10) Mongolia; (11) Hong Kong, China; (12) Philippines; (13) Thailand; (14) Indonesia; (15) Singapore; (16) Malaysia; (17) Viet Nam; (18) Cambodia; (19) Myanmar

- **Year coverage:** 2001–2016

- A model Asian Barometer Survey has a sample size of **1200 respondents**, which allows a minimum confidence interval of plus or minus 3 percent at 95 percent probability.
World Values Survey

• The World Values Survey (WVS) is a global research project that explores people’s values and beliefs, how they change over time, and what social and political impact they have. Thousands of political scientists, sociologists, social psychologists, anthropologists, and economists have used these data to analyze such topics as economic development, democratization, religion, gender equality, social capital, and subjective well-being.
• Country coverage: nearly 100 countries which contain almost 90% of the world’s population
• Year coverage: 1981–2014
• Minimum sample size – i.e., the number of completed interviews which are included into the national data-set in most countries – is 1200.
Remarks

1. How to overcome PD, i.e., a market failure (and government failure)?
2. Third party enforcement by treaties
3. Repeated interactions by regional forum
4. Nurturing social capital by “artifacts” e.g., infrastructure and institution
5. Methodologically, “field experiments” very powerful and insightful (e.g., PGG)
6. Social capital as a source of regional public goods, quantifiable using large-scale socio-economic data sets
• Appendix
SC Captured by “Trust” in Trust Game and Poverty and Inequality

* Trust game is an experiment based on a PD game

Source: Cardenas and Carpenter (2009) JDS
Social Rate of Returns to SC

- Ishise and Sawada (2009) estimate social rate of returns to SC:
  - Low in high income countries, “dark side”
  - High in low income countries, complementing market and government failures-“Trinity” of market, state, and communities


**Fig. 6.** Log of GDP per capita (2000) and return to social capital (NEWS).