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ECONOMIC GOVERNANCE 2 – SOME FORMAL MODELS

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Modeling Choices

[1] Player's strategy choices individual (non-cooperative) or joint (cooperative)?
Usual: non-cooperative game; ask if Nash eq'm has implicit cooperative outcome.

[2] How much rationality (individuals' knowledge of rules of game, consistent objective function, perfect calculating ability)?
Choice here: individuals rational; but Nash equilibrium often suboptimal.

[3] Equilibrium (of one-shot or repeated game as relevant) versus disequilibrium or evolutionary dynamics.
Here: focus on equilibrium; add informal discussion of dynamics.

[4] Nature of games and what is needed to achieve good outcomes:
Assurance – focal points. Prisoners' dilemma – punishments or rewards.
Bargaining / battle of sexes – assignment of roles and rights; enforcement

[5] Good case studies have a lot of rich detail. A lot remains even after someone has modeled a part of it theoretically.

1. For-Profit Contract Enforcement

Based on Dixit Lawlessness Ch.4, Econometrica 2003
Key issues in resolution of prisoners' dilemma problems –
collection and transmission of information; punishment of cheaters
These also a profit-opportunity for someone who can solve them
(Every economic problem is an economic opportunity.)
Like solving double-coincidence-of-wants problem
by issuing money and collecting seignorage

Often done by organized crime, in niches where
government fails, or chooses not to enforce
Gambetta's "generic mafioso" Don Peppe offers both kinds of services
Both sides of the transaction willingly use him
Fees for enforcement larger than for information
Obvious cost-side explanations, but Peppe has territorial monopoly
and prices above cost, so need demand-side explanation.

Converts one-shot games between anonymous matched pairs
into pairs of bilateral repeated games of him with the two traders
But cannot offer all-or-nothing deal to whole group,
so no Coase Theorem optimum either

Prisoners' dilemma stage game

		Player 2	
		Honest	Cheat
Player 1	Honest	H , H	L , W
	Cheat	W , L	C , C

Outside option 0; assume $W > H > C > 0 > L$
(If $C < 0$, then no play if no enforcement; payoff 0.)

Everyone plays every period but few/no repeat pairs.
Effective discount rate r includes pure discounting
as well as the players' survival probabilities

Dixit Econometrica (2003) has model with asymmetric payoffs, types.

Intermediary

Contestable profit-motivated monopolist, keeps track of cheating,
sells information or enforcement services

Intermediary's honesty not guaranteed or enforceable
need conditions to rule out deviation

Information intermediary (Info)

For appropriate fees, he can:
Reveal – to customer his private info about previous actions of partner
Double-cross – take fee from customer on one side, and another
from the other side in return for letting him cheat the customer
When someone cheats a non-customer, Info keeps no record of this,
thereby automatically avoids "free-riding" on his existence.

All-customer, honest equilibrium

Conditions (bounds on Info's fee) to rule out deviations:
Customer's cheating: $F \leq (H - C) - r(W - H)$)
Info's double-crossing: $F \geq r(W - H)$
Each side must have enough share of rent / surplus
If monopolist Info sets fee, will set it at upper bound
If group hires Info, fee at lower bound. Or intermediate – Nash bargaining.
Conditions harder to satisfy if r larger, which happens if
individuals more impatient or have higher mortality probabilities
So enforcement harder if "cutthroat competition" among rival mafias

Enforcement intermediary (Enfo)

Enfo can punish any trader who cheats his customer
Assume punishment sufficiently severe to be effective deterrent
So not used, but Enfo needs reputation for credibile threat
Condition to rule out double-crossing similar to Info's
In all-customer equilibrium, Enfo's fee must satisfy $F \leq H$
This exceeds Info's fee (fits Gambetta's evidence). Demand-side reasons:
[1] Enfo does not have to share any rent
[2] Enfo's customers have worse outside opportunities if $C > 0$
Deviant non-customers cannot get C; must opt out of game
But Enfo mode not dominant: entry cost may be higher than for Info

Social optimum comparisons

Social gain from honesty vs. cheating $= H - C$
Info's fee $= (H - C) - r(W - H) <$ social gain
Enfo's fee $= H >$ social gain when $C > 0$ (else equal)
But individuals trapped, cannot switch equilibrium
Related to Bandiera's idea of negative externality.

Evaluation – Achievements

Explains some basic facts:
  Both sides use and pay for intermediary services
  Fee for enforcement higher than that for information service
Generates some new results that can be tested:
  Enforcement mode more likely to result in bad equilibrium

Shortcomings and Research Opportunities

Touches on only small fraction of rich case / ethnographic detail
Endogenize occupation choice between trading and protecting
  including issue of vertical integration by mafia
Mafia may offer protection only to selected subset of traders
  and use deliberate "regulated injection of distrust"
Should examine [1] Links among multiple functions of intermediation
  improving search and matching, connection between different networks, ...
  [2] Internal structure of mafia; reputation-building, information flow

2. Relational and Formal Contracts

Example of private ordering "in the shadow of the law"
Dixit Lawlessness Ch. 2, Baker, Gibbons, and Murphy QJE 1994

General idea: Private ordering can use better inside information, but
must be self-enforcing, based on repeated relationship, reputation

Less precise but verifiable public information exists
Formal contract enforceable in court can be based on this
Revert to this if cheating in relational system

Incentive compatibility (IC) constraint for relational contract

$$V(\text{cheat}) + \frac{V(\text{formal contract})}{r} \leq V(\text{honest}) + \frac{V(\text{honest})}{r}$$

Better to use relational contract if $V(\text{formal contract}) < V(\text{honest})$
But lock-in to wrong equilibrium remains possible.

Partial improvement in quality of formal system tightens IC constraint;
this worsens performance of relational contract

This analysis is one aspect of the Coase-Williamson question:
"What determines boundary between firm and market?"

More generally, for any repeated game with outside option

3. Limits of Self-Governance

Case studies of self-enforcing trade or cooperation in communities
emphasize importance of interactions and information transmission
Greif's contrast between Maghribi and Genoese traders
and Li's findings in E. Asia, Ostrom's cases show that
increase in size of groups leads to decay of these
Construct model to understand this process and its implications

The model

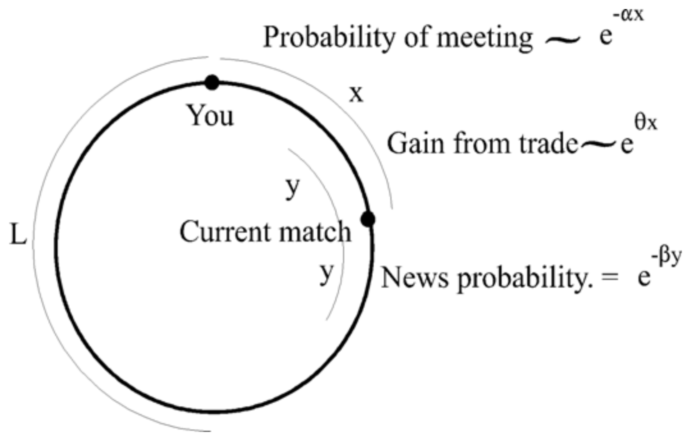
From Dixit Lawlessness Ch.3, J. Pol. Ec. 2003
Continuum of traders along circle, circumference $2L$
Two periods, random IID pairings in each period
Distance from current partner x

Localization of meetings: Probability of match at x is $\propto e^{-\alpha x}$

Localization of information: Probability of news spreading $= e^{-\beta y}$

Desirability of expansion: Size of potential gain is $\propto e^{\theta x}$

Figure illustrates the concepts



Random matches in first period play prisoner's dilemma game
If cheat, the news may spread, leading to worse payoff
in game with random second-period partner
Condition for self-enforcing honesty : immediate gain
should be less than expected future loss, which is
complicated expression integrating along circle

Extra payoff from sustaining first-period honesty up to X is

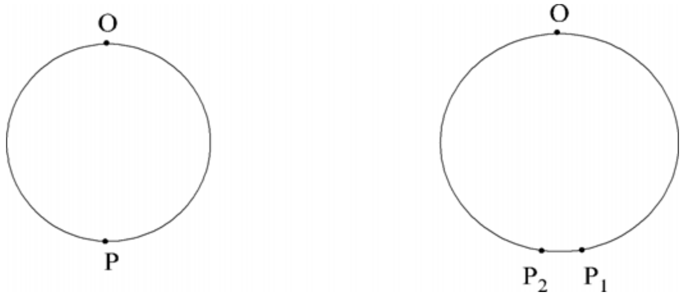
$$V(X, L) = \frac{\alpha}{\alpha - \theta} \, \frac{1 - e^{-(\alpha-\theta)\,X}}{1 - e^{-\alpha\,L}}$$

In particular, graph of $V(L, L)$

Need $\alpha > \theta > 0$

General results

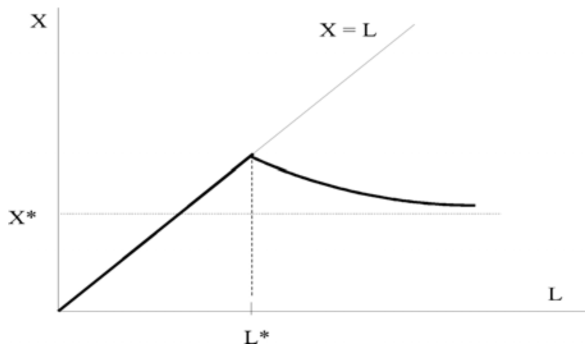
[1] $X = L$ possible for $0 \leq L \leq L^*$
[2] As $L \uparrow$ beyond L^*, maximal $X \downarrow$ unless β is small relative to θ
Intuitution seen from figure:



Circle on left of critical size L^*. O when meeting P is indifferent between honesty and cheating
Circle on right is somewhat larger;
$\text{OP}_1 = \text{OP}_2 = L^*$, with added people between

If O cheats P_1, Prob$\{P_2$ finds out$\}$ now < 1; was $= 1$.
This lowers cost of cheating. The larger is β, the bigger this effect
If O cheats P_1, he risks his period-2 meetings between P_1 and P_2
This raises cost of cheating. The larger is θ, the bigger this effect
Numerical calculations show that for plausible values, former effect bigger

[3] As $L \uparrow \infty$, maximum possible $X \downarrow X^*$;
if β is large, $X = 0$ for finite L
Typical picture:

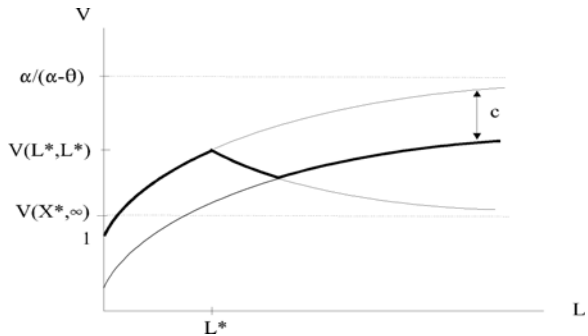


[4] Allow external governance at cost c per unit arc length of circle,

Benefit of self-governance as a function of L is $V(L, L)$ for $0 \leq L \leq L^*$,
then decreases, asymptotes to $V(X^*, \infty)$

Benefit of external governance $= V(L, L) - c$ for all L.

Take the upper envelope of these:



For small L, self-governance is optimal.
For large L, external governance may become optimal if c is small enough
But payoff may not rise back to $V(L^*, L^*)$ – "anti-globalization theorem" :-)
Middle range of L too large for self-governance and too small for external

Evaluation – Achievements

Explains some basic facts:
Explains limit on size of multilaterally self-governing groups
in terms of parameters of information and communication technology
Generates some new results that can be tested:
Intermediate size worse for governance than either extreme

Shortcomings and Research Opportunities

Uses comparative statics methodology instead of proper dynamics
of transition, with expectation, collective action, and lock-in problems
Other models of evolutionary dynamics exist, but compensate
by simplifying the underlying transaction game, communication etc.
Should link multiple functions of trading groups:
improve search and matching, combine with social activities, ...
Should explore more formally how trade can occur between
Greif's collectivist and individualist (Li's relation and rule based)
societies: Does one have an advantage? Role for intermediaries?
Alternative approaches: Disjoint groups; discrete networks

Network-theory modeling

Individuals are at discrete nodes; may be linked to other nodes
Random graph theory of Erdős and Renyi:
Probability that any two nodes are linked is p
Then in network with n nodes, probability that
two given individuals have a common acquaintance is

$$A(n) = 1 - \left(1 - p^2 \right)^{n-2}$$

As $n \to \infty$, $A(n) \to 1$ "large world" theorem!
Now suppose $p = p(n) \propto n^{-\theta}$, consider large n
If $\theta > 1/2$, then $A(n) \to 0$
If $\theta = 1/2$, then $A(n) \to$ limit > 0 and < 1
If $\theta < 1/2$, then $A(n) \to 1$
Can do similar calculations for longer links etc.

Recent work on non-random graphs leading to power laws etc. See
A-L. Barbasi, Linked: The New Science of Networks, 2002
D. Watts, "The new science of networks," Ann. Rev. Soc. 2004
and the references cited there.

Some measures/properties of non-randomness:

[1] Local clustering – a measure of local link density
What fraction of my links have direct links with each other?
[2] Average shortest path length between two nodes
Over broad range of parameter spanning extremes of order and randomness,
high clustering compatible with short average paths (small world networks of the "six degrees of separation" fame).
[3] Probability of link p varies $\propto r^{-\gamma}$; parameter measures localness
[4] Searchability – can navigate best path to distant node
using only local information at each step
This can require coincidence of γ and network dimension
[5] Power laws: In many networks, Prob(given node has k links) is $\propto k^{-\alpha}$.
This yields a few well-connected nodes and many with few links

Raja Kali, "Social embeddedness and economic governance,"
http://www.idei.fr/doc/conf/jjl/papers/105kali.pdf
uses a small-world network for model similar to the circle above.
Potential use for better models of matching and information flow.