Conflict, Evolution, Hegemony, and the Power of the State

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Introduction

- game theory: many possible equilibria
- interpretation: many possible stable social norms or institutions
- observation: there is a wide array of different institutions both across space and time
- political systems: from relatively autocratic (exclusive) to democratic (inclusive)
- what does evolutionary game theory tell us about the relative likelihood of these institutions?
    - are efficient institutions more likely than others?
    - if not efficient then what?

Conflict Driven Evolution

- Ely (and some others) show how voluntary migration evolves to efficiency
- historically institutional success has not been through voluntary immigration into the arms of welcoming neighbors
- people and institutions have generally spread through invasion and conflict
- institutional change most often in the aftermath of the disruption caused by warfare and other conflicts
- which institutions are likely to be long-lived when evolution is driven by conflict?

Evolution Driven by Conflict

- long-run favors institutions that maximize state power
- inefficiently high taxes, state power, exclusiveness, earnings of state officials, low welfare, earnings of producers
- tendency towards long periods of hegemony broken by shorter periods of conflict between competing - and possibly more efficient - states

Some Facts About Hegemony

- China: 2,234 years from 221 BCE – hegemony 72% of time, five interregna
- Egypt: 1,617 years from 2686 BCE - hegemony 87% of time, two interregna
- Persia: 1,201 years from 550 BCE - hegemony 84% of time, two interregna
- England: 947 years from 1066 CE - hegemony 100% of time
- Roman Empire: 422 years from 27 BCE - hegemony 100% of time
- Eastern Roman Empire: 429 years from 395 CE – 100%
- Caliphate: 444 years from 814 CE – 100%
- Ottoman Empire: 304 years from 1517 CE – 100%

Remark: in 0 CE 90% of world population in Eurasia/North Africa

Exceptions

- India
- continental Europe post Roman Empire

evolutionary theory: more outside influence, less hegemony

- Europe: Scandinavia 5%, England 8%
- India: Central Asia 5%
- China: Mongolia less than 0.5%

Central Economic Issue for Model

- why do state officials produce “swords”? Why don't they collude to steal all the taxes for their own consumption (“jewelry”)?
- our answer: they need the swords to collect the taxes to pay for their jewelry
- external use of state power largely incidental

institutional issue: can state power be used to collect taxes?

- in democracy many checks and balances
- in autocracy few

model institutional differences by ability to use state power to collect taxes

A Static Example

state officials $i = O$, choose state power $a^O \in [0,1]$, collusive group, moves first

producers $i = P$, choose effort $a^P \in [0,1]$, representative individual, move second

institutions described by exclusiveness parameter $\chi \in [0,1]$, fixed in short run, but subject to evolutionary pressures

tax power: $b = \chi a^O$

tax rate: $\overline{\tau} \equiv \min\{1, \tau b\}$

$\tau > 1$ a technological parameter

Preferences and Equilibrium

producers

$$u^P = (1-\overline{\tau})a^P - [ca^P + (1/2)(1-c)\left(a^P\right)^2] + \xi^P a^O 0 < c < 1$$

normalized so that the marginal cost of a unit of effort is

ξ^P measures usefulness of state power in providing public goods

state officials residual claimants

$$u^O = \overline{\tau}a^P - a^O + \xi^P a^O$$

can be negative for simplicity, $\xi^O < 1$

action profile (a^P, a^O) an *equilibrium* if incentive constraints for both players satisfied

Taxes and Profits

tax-revenue function

$G(b) = \tau b \left[1 - \frac{\overline{\tau}}{1-c}\right]$

profit function of producers

$\Pi(b) = G(b) + u^P - \xi^P a^O = G(b) + \frac{1-c}{2}\left[1 - \frac{\overline{\tau}}{1-c}\right]^2$

welfare $W(b) = u^P + u^O = \Pi(b) - (1 - \xi^P - \xi^O)a^O$

utility of state officials $G(b) - (1 - \xi^O)a^O$

Proper Economies

$G(b) = 0 \text{ at } b = 0$ and for $b \geq \bar{b} \equiv (1 - c)/\tau$

for $0 \leq b \leq \bar{b}$

$G(b)$ twice continuously differentiable with $G''(b) < 0$

$G'(0) > 1$ since $\tau > 1$

$G'(b) + bG''(b)$ decreasing

$\Pi(b)$ twice continuously differentiable, decreasing

$\Pi''(b) < 0$

$\Pi(b) - G(b)$ decreasing

for $b \geq \bar{b}$ $\Pi(b) = 0$

Institutions, State Power and Welfare

Theorem: *In a proper economy there is a unique equilibrium level of state power $a^O(\chi)$, and it is single peaked in χ; so there is a unique argmax $\chi_2 > 0$. There is a unique welfare maximizing level of exclusivity χ_1, and $\chi_1 \leq \chi_2$. There is a $\bar{\xi} \geq 1$ such that if $\xi^P + \xi^O \leq \bar{\xi}$ then $\chi_1 < \chi_2$.*

state power maximization leads to greater exclusiveness than welfare maximization

Theorem: *in a proper economy profits $\Pi(\chi a^O(\chi))$ are decreasing in χ, while tax revenues $G(\chi a^O(\chi))$, tax power $\chi a^O(\chi)$, and the utility of state officials $u^O(\chi, a^O(\chi))$ are all increasing in χ. For $\chi \geq \chi_1$ producer utility is decreasing in χ and if $\xi^P + \xi^O < 1$ so is welfare. If $\xi^P + \xi^O \geq 1$ the welfare is decreasing for $\chi_1 \leq \chi \leq \chi_2$.*

greater exclusiveness means higher extractiveness in the sense of Acemoglu and Robinson

Dynamics with Two Societies

two societies, both proper economies, constrained to choose equilibrium action profiles, same technology, differ only in inclusiveness χ

societies $j = 1, 2$ compete over an integral number L units of land

constant returns to scale in land

$a_j^O > 0$ units of state power per unit of land, $a_1^O \leq a_2^O$

time t society j controls integral number $L_{tj} \geq 0$ units of land where $L_{1t} + L_{2t} = L$

Markovian Dynamics

state variable L_{1t}

transition probabilities determined by conflict resolution function

conflict may result in one of the two societies losing a unit of land to the other: $|L_{jt+1} - L_{jt}| \leq 1$, loss of a unit of land called *disruption*

conflict resolution probabilities depends on power of the two societies

probability of disruption (loss by j) π_{jt}

Conflict Resolution

if $L_{-j} > 0$ then $\pi_{jt} = p$ with $0 < p < 1/2$

hegemony depends on three parameters $a_0, \alpha > 0$ and $1 > \epsilon > 0$

$\pi_{jt} = p\epsilon^{\max\{0, a^O L^\alpha - a_0\}}$

Here $a^0 L^\alpha$ is aggregate state power of hegemonic state with $L_j = L$ units of land

$\rho = \max\{0, a^O L^\alpha - a_0\}$ called *hegemonic resistance*

$a_0 > 0$ strength of outside forces safe behind geographical barriers

Summary of Process

society j

- no land: $p\epsilon^{\rho_j}$ chance of getting one unit
- at least one unit of land, but not hegemony: p of getting another unit p chance of losing one
- hegemony $p\epsilon^{\rho_{-j}}$ chance of losing one

No Noise

$\epsilon = 0$

hegemonic states $L_1 = L$ or $L_1 = 0$ are absorbing

non-hegemonic states $0 < L_1 < L$ transient

in the long-run a hegemony

initial condition uniform over L_1, each society has an equal chance of having the long-run hegemony

With Noise

$\epsilon > 0$ all states are positively recurrent so a unique stationary probability distribution representing the frequency with which each state occurs

a simple birth-death chain, stationary of society j having a hegemony

$$\sigma_j = \frac{1}{1 + (L-2)\epsilon^{\rho_{-j}} + \epsilon^{\rho_{-j} - \rho_j}}.$$

average frequency of time the system spends in hegemony:

Theorem: *Theorem 3. If $a_0 \geq a^O$ the stationary distribution over states is uniform regardless of ϵ. If $a_0 < a^O$ then as $\epsilon \to 0$ we have $\sigma_1 + \sigma_2 \to 1$ If $a^O > a^O$ then in addition $\sigma_2 \to 1$ and $\sigma_1 \to 0$. For fixed $\epsilon > 0$ time spent in hegemony $\sigma_1 + \sigma_2$ declines with outside influence a_0 and as $\rho(\chi_1) \to 0$ it approaches $2/L$.*

with strong outsiders there is no tendency towards hegemony, with weak outsiders there is and it is a hegemony of the stronger state; better ability to aggregate state power also favors hegemony

Generalized Model

an arbitrary finite list of societies $j = 1, \ldots, M$

society j has a set of players $i = 1, 2, \ldots, N_j$

each player has a finite set of actions $a_{ij} \in A_{ij}$

do not explicitly model utility and incentive constraints

assume for each society a set of equilibrium profiles $E_j \subset A_j$

allow the possibility that E_j is empty

a map from profiles to state power: $\gamma_j : A_j \to \Re_+$

Evolutionary Dynamics

at a moment of time $t = 1, 2, \ldots$ society j plays an action profile a_{jt} and controls an integral amount of land L_{jt} where $\sum_{j=1}^{M} L_{jt} = L$

if $L_{jt} > 0$ we refer to a society as active, otherwise it is inactive

drop assumption that action profiles constrained to lie in E_j

note: in the example $E_j = A_j$ is a singleton

learning process by which individuals modify their actions and expectations over time

What is a Steady State of the Learning Process?

players should expect that today will be the same as yesterday

given that expectation, it should be optimal to play the same way as yesterday

so: yesterday should be an equilibrium, and that equilibrium should be expected to recur today

learning says that the expectation that today should be the same as yesterday should be based on having observed that in the past this has been true

not yet in a steady state but yesterday was an equilibrium so that $a_{jt-1} \in E_j$ and today is the same as yesterday so that $\mathrm{a}_{jt} = a_{jt-1}$

simple model of learning assert that there is a chance $1 > \psi_j > 0$ that expectations of tomorrow are that it will be the same as today

Stability of a Society

state variable b_{jt} takes on two values, 1 for steady state expectations and 0 otherwise; when $b_{jt} = 1$ we say that society j is *stable*

$a_{jt} \notin E_j$ then necessarily $b_{jt} = 0$

If $L_{j,t+1} > 0, a_{jt} \in E_j$ and $b_{jt} = 1$ then $a_{j,t+1} = a_{jt}$ and $b_{j,t+1} = b_{jt} = 1$ that is, once an active society achieves a steady state it stays there as long as it remains active.

Unstable Societies

Active unstable societies in which $b_{jt} = 0$ have transition function $P(a_{jt+1}|a_{jt}) > 0$ putting positive weight on all profiles

When people are unsure about the future there is a degree of randomness in their behavior - charismatic leaders may arise, populist nonsense may be believed and so forth

inactive societies play null action profile $a_j = 0$ with $\gamma_j(0) = 0$

if $E_j = A_j$ then $b_j = 1$ otherwise society is unstable upon entry and initial profile is chosen randomly according to $P(a_{j,t+1}|0) > 0$

inactive societies becoming active represent experiment with new institutions it makes sense in the context to suppose that new action profiles are experimented with at the same time.

a simplified version of Foster and Young

Markov Process

state vector at time $s_t = \{a_{jt}, L_{jt,} b_{jt}\}_{j=1}^{J} \in S$

evolves according to a Markov process $M(\epsilon)$ depends upon $\epsilon \geq 0$

must indicate how land is gained and lost.

Conflict Resolution Function

continue to assume that at most one unit of land changes hands in any given period

probability that society j disrupted and loses a unit of land
$\pi_{jt} = \pi(b_{jt}, \gamma_{jt}, L_{jt}, \gamma_{-j,t}, L_{-j,t})[\epsilon]$

since only one unit of land can change hands we must have
$\sum_{j=1}^{M} \pi_{jt} \leq 1$ and the shocks must be correlated

unit of land that lost is gained by a society chosen randomly according to the function $\lambda(k|j, \gamma_t, L_t) > 0$ for $k \neq j$ and $\lambda(j|j, \gamma_t, L_t) = 0$

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Assumptions About Conflict

- for $\epsilon > 0$ have $\pi(b_j, \gamma_j, L_j, \gamma_{-j}, L_{-j})[\epsilon] > 0$
- symmetric in γ_{-j}, L_{-j} - names of the societies do not matter
- monotone: non-increasing in γ_j, L_j non-decreasing in γ_{-j}, L_j
- assume unstable society always has appreciable chance of losing land: $\pi(0, \gamma_j, L_j, \gamma_{-j}, L_{-j})[\epsilon] > 0$ independent of ϵ

Resistance

$$r(\gamma_j, L_j, \gamma_{-j}, L_{-j}) \equiv \lim_{\epsilon \to 0} \frac{\log \pi(1, \gamma_j, L_j, \gamma_{-j}, L_{-j})[\epsilon]}{\log \epsilon}.$$

exists and is regular

$$\text{if } r(\gamma_j, L_j, \gamma_{-j}, L_{-j}) = 0 \text{ then } \lim_{\epsilon \to 0} \pi(1, \gamma_j, L_j, \gamma_{-j}, L_{-j})[\epsilon] > 0.$$

Assumptions about Resistance

resistance is non-zero assumed to be strictly monotone: strictly increasing in γ_j, L_j and strictly decreasing in γ_{-j}, L_j

rule out stalemate where societies are effectively unable to disrupt each other: assume weakest active society always has appreciable chance of losing land: for any $\gamma_j, L_j, \gamma_{-j}, L_{-j}$

$$\min_{L_{j'}>0} r(\gamma_{j'}, L_{j'}, \gamma_{-j'}, L_{-j'}) = 0$$

for any profile $\gamma_j, L_j, \gamma_{-j}, L_{-j}$ for which j and at least two opponents are active define profile $\tilde{\gamma}_{-j}, \tilde{L}_{-j}$ in which all enemy land belongs to the strongest opponent j'; better to face divided opponents than unified:

$$r(\gamma_j, L_j, \gamma_{-j}, L_{-j}) \geq r(\gamma_j, L_j, \tilde{\gamma}_{-j}, \tilde{L}_{-j})$$

strict if $r(\gamma_j, L_j, \tilde{\gamma}_{-j}, \tilde{L}_{-j}) > 0$

Hegemonic Classes

fully specified $M(\epsilon)$ on state space S

identify certain states as *hegemonic*

hegemony s_t at (j, a_j) means $a_{jt} = a_j \in E_j$, that society j is stable , $b_{jt} = 1$ and that society j has all the land $L_{jt} = L$

assume that there is at least one hegemonic class (E_j is nonempty for at least one j)

for hegemonic state (j, a_j) define hegemonic resistance $\rho(a_j) = r(\gamma(a_j), L, 0, 0)$

depends on strength of outside forces

Characterization of the Stationary Distribution

stationary distribution $\mu(\epsilon)$ of the Markov processes $M(\epsilon)$

Main Theorem: *For $\epsilon > 0$ there is a unique $\mu(\epsilon)$ that places positive weight on all states. As $\epsilon \to 0$ there is a unique limit μ. If $\max_{j,a_j \in E_j} \rho(a_j) = 0$ then μ places positive weight on all states (hegemonic or not). If $\max_{j,a_j \in E_j} \rho(a_j) > 0$ then μ places weight only on hegemonic states j, a_j that have maximal equilibrium state power $\gamma_j(a_j) = \max_{j',a_{j'} \in E_{j'}} \gamma_{j'}(a_{j'})$.*

Zealots and Transitions

assume $\max_{j,a_j \in E_j} \rho(a_j) > 0$ and ϵ small (so hegemonies commonplace)

assume $\max \gamma_j(a_j) > \max_{j,a_j \in E_j} \gamma_j(a_j)$

k, a_k that achieves the max called *zealots*

non-weak hegemonies have some resistance to zealots after losing a unit of land $r(\gamma_j(a_j), L-1, \gamma_k(a_k), 1, 0, 0) > 0$

hegemony at j, a_j falls if it loses L_- units of land without first returning to hegemony

zealots have an essential role if during the transition there is a period of time and zealots k, a_k such all the land not held by the hegemony during that period is held by the zealots

Q_f probability that hegemony falls and zealots have essential role during the transition versus other types of fall Q_{-f}

Zealots and the Fall of Societies

Theorem 5. *For a non-weak hegemony and any* $L \geq L_- > 1$ *we have* $\lim_{\epsilon \to 0} Q_f / Q_{-f} \to \infty$.

Conclusion

- tendency towards hegemony when outside forces are weak - but less so when they are strong
- these hegemonies tend to maximize state power and that this results in inefficiently high exclusiveness which in turn determines inefficiently high extractiveness, that is high taxes, high income for state officials, low income for producers, and low welfare

The Role of Luck

- dynamics driven by “luck”
- to successfully overcome a large powerful hegemonic society requires a considerable amount of luck
- the larger and more powerful the hegemonic society is, the more luck is required, and so the more persistent it is likely to be.
- strong outside influences to support the rebels less luck is required

Short Lived Empires

intuition for short-lived empires of Alexander the Great, Ghengis Khan or Tamurlane

- best kind of luck to have in order to successfully overwhelm a powerful neighbor:
- a strong military organization, good technology - and charismatic and brilliant leader
- even better luck: the leader convinces followers to set aside their incentive constraints
- won't last long - eventually warriors or their descendants will prefer to follow their incentives and consume “jewelry” rather than “swords”
- can last long enough to conquer the relevant world

the key role of zealots in transitions

Speculation

- Hong Kong and Singapore: libertarian success stories of Milton Friedman protected from outside influence
- do small geographically protected areas have a broader range of social arrangements - both efficient and inefficient - than smaller areas? New Guinea may be a case in point
- Democracy and military spending: between welfare maximization and state power maximization theory predicts positive relationship between exclusiveness and state power. robust finding in the empirical political science literature that democracies spend less than autocracies on defense
- Hoffman Rosenthal: transition from absolute to constitutional monarchy in Europe determined by the higher tax revenue to be employed for military purposes which a parliament could generate

    in our model if technological change increases the efficiency of tax collection τ in which case it will reduce the optimal degree of exclusiveness

Even More Speculation

Nationalism: add dimension in which institutions may differ in the extent to which tax revenue is checked in being used as external state power (Japan)

include another multiplier “nationalism” which converts portion of tax revenue devoted to state power to actual (external) state power

no implication for welfare

state power is maximized when coefficient of nationalism is one

Current Affairs

- most modern institutions very recent – post WWII
- exception is the U.S. has high level of military expenditure together with hegemony over North American continent for 237 years
- ocean barriers between America and Eurasia still substantial – unlikely U.S. will establish hegemony there or vice versa
- will U.S. play in Eurasia the role of England in continental Europe of preventing hegemony and preserving competition?