A Model of Equilibrium Institutions

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Motivation

- Institutions are the “rules of the game” — “the humanly devised constraints that shape human interaction” (North, 1990).
- Believed to be important in explaining disparities in income across the globe.

Bad institutions may serve the interest of elites...but why does this give rise to huge economic inefficiencies? (as opposed to just having distributional consequences)

Why is there no political Coase theorem in general?

Under what conditions will elite control of institutions give rise to economic distortions?

This paper builds a model to address these questions.
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- This paper builds a model to address these questions.
First, a model of power and distribution (in an endowment economy, for illustration):

- **Ex-ante identical and self-interested individuals.**
  - In equilibrium, some will be “more equal than others” (the elite).
  - The elite can **create institutions** (rules of the game).

- **Threat of conflict imposes limits on the rules that can be created.**
  - Anyone can join a rebellion to **destroy the institutions.**
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Then we consider environments in which institutions matter for production:

- Provision of public goods;
- Private investment and expropriation.

Related literature

B Guimaraes & K Sheedy (LSE)
Model of power and distribution

- Measure-one population of ex-ante identical individuals (indexed by $i$)
- Utility depends on consumption $C$ and fighting effort $F$:

$$U = u(C) - F, \text{ with } u'(\cdot) > 0, u''(\cdot) \leq 0$$
Model of power and distribution

- Measure-one population of ex-ante identical individuals (indexed by $i$)
- Utility depends on consumption $C$ and fighting effort $F$:
  \[ U = u(C) - F, \text{ with } u'(\cdot) > 0, u''(\cdot) \leq 0 \]

- If individual $i$ is a worker ($i \in W$) then he receives $q$ units of a good
- If individual $i$ is in power ($i \in P$) then he has fighting strength $\delta$
- Those in power can create institutions
- Groups of individuals can launch rebellions (in which anyone can participate) to destroy existing institutions
- No individual can commit to take actions from which there would be an incentive to deviate ex post
Institutions:

- Determine who is in power and the allocation of resources
- Rules laid down by institutions are followed, unless a rebellion occurs
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Formally, institutions are:

- A set of individuals in power $\mathcal{P}$ (the elite)
- A set of workers $\mathcal{W}$ (i.e. those outside the elite)
- Potentially individual-specific taxes $\tau(\iota)$ paid by each worker $\iota \in \mathcal{W}$
- Potentially individual-specific consumption levels $C_p(\iota)$ for each individual in the elite $\iota \in \mathcal{P}$

  In richer versions of the model, institutions also specify public-good provision, capital taxation, other laws and government policies, etc.
In the absence of a rebellion, the rules laid down by the prevailing institutions are followed by all individuals.

Once this point is reached:

- Workers $\mathcal{W}$ produce $q$ units of goods each
- Taxes are paid, transfers are made
- Consumption occurs
Sequence of events

No institutions

New institutions

Rebellion?

Yes

No

Payoffs are realized
Who would join a rebel army?

Suppose a set of institutions already exists.
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Suppose a set of institutions already exists.

Who would join a rebel army? — individuals who:

1. have an expected payoff under the new institutions following the rebellion that exceeds payoff under current institutions

2. and expect a place in the future elite (needed to overcome free-riding and motivate fighting effort in absence of commitment);

They could be outside the current elite, insiders, or a mixture of both.
How much fighting effort?

Maximum fighting effort for an individual $i$ that expects to have a place in the subsequent elite must be individually rational:

$$F(i) = U'_p - U(i)$$

- $U'_p$ = expected payoff of those subsequently in power
- $U(i)$ = utility of individual $i$ under current institutions (known)
- $F$: set of individuals $i$ with $F(i) > 0$. 
Formally, a rebellion is defined as a new elite selection function:

- this is mapping from the size of the subsequent elite $p'$ to the identities $E'(p')$ of whose who will be in that elite;
- does **not** determine **how large** the subsequent elite will be, but does determine **who** the elite will be, conditional on that elite having a particular size.
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The rebel army: $\mathcal{R} = E'(p') \cap \mathcal{F}$
A rebellion

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**The rebel army:** $\mathcal{R} = E'(p') \cap F$

**The incumbent army:** $\mathcal{A} = \mathcal{P} \setminus \mathcal{R}$

- comprises those currently in power who would lose their position in the elite after the rebellion
- the rebels must overcome the defence of the current institutions by the incumbent army
The rebellion succeeds if

\[
\int_{R} F(i) \, di > \int_{A} \delta \, di
\]

where \( \delta \) is an (exogenous) power parameter of the incumbent army.

- Asymmetry between attack and defence: necessary for the notion of being “in power” to make any sense
- Functional form chosen for simplicity
- No uncertainty about outcome
- If \( A = \emptyset \), rebellion is costless
Different types of rebellions

The formal definition of a “rebellion” captures many cases in a parsimonious way.

Examples include (not exhaustive):

- A “popular uprising”: $\mathcal{R} \cap \mathcal{P} = \emptyset$
- A “coup d’état” or a “dissolution of parliament”: $\mathcal{R} \subset \mathcal{P}$ and $\mathcal{R} \cap \mathcal{W} = \emptyset$
- A “suspension of the constitution”: $\mathcal{R} = \mathcal{P}$
- A “revolution” backed by some insiders from existing regime: $\mathcal{R} \cap \mathcal{P} \neq \emptyset$ and $\mathcal{R} \cap \mathcal{W} \neq \emptyset$
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Establishing institutions

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**Constraints:** Avoid all possible rebellions (and respect budget constraint)

**State variable:** Selection function for new elite — apart from this rule for determining the identities of those who will form the new elite, **history is irrelevant.**
Maximization of average elite payoff with respect to:

- **Allocation of power**: size of the elite $p$
- **Allocation of resources**: tax distribution $\tau(\cdot)$ and consumption distribution $C_p(\cdot)$ within the elite

Given the choice of $p$, the identities of the new elite are determined by the selection function $E(p)$ set by the previous rebellion (or randomly by nature at the beginning of the game).
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**Choice of size of elite:**

- Elite size increases until there is no incentive at the margin for those already in to share power with one more individual.
- Distribution of power reflects the interest of those in power, not the welfare of society.
Formally, the new institutions solve the maximization problem

\[
\max \frac{1}{p} \int_{\mathcal{E}(p)} U_p(\nu) d\nu
\]

subject to

\[
\int_{\mathcal{E}'(p') \cap \mathcal{F}} (U'_p - U(\nu)) d\nu \leq \int_{\mathcal{E}(p) \setminus (\mathcal{E}'(p') \cap \mathcal{F})} \delta d\nu
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- Solution depends on beliefs about \( U_p' \) and \( p' \)
- The problem of establishing institutions is purely forward looking
How are $U'_p$ and $p'$ determined?

- Once a rebellion occurs, new institutions are determined according to an identical constrained maximization problem.
- After each potential rebellion, history is payoff irrelevant — the cost of conflict is sunk.
- No fundamental reason why elites would make different choices of institutions at different points.
- Natural to focus on Markovian equilibria.
Formally, a Markovian equilibrium is:

- $p$, $\tau(\cdot)$ and $U_p(\cdot)$ maximize the average payoff of those in power.
- $p = p'$.
- Distributions of taxes over workers $\tau(\cdot)$ and $\tau'(\cdot)$ are identical.
- Distributions of consumption of the elite $C_p(\cdot)$ and $C'_p(\cdot)$ are identical.
Any Markovian equilibrium must have the following properties:

1. Equalization of workers’ payoffs: $U_w(\iota) = U_w$, $\forall \iota$
2. Sharing power implies sharing rents: $U_p(\iota) = U_p$, $\forall \iota$
3. Maximizing subject to avoiding any rebellion is equivalent to maximizing subject to the following single “no-rebellion constraint”:

$$U_w \geq U_p' - \delta \frac{p}{p'}$$

4. Power determines rents: $U_p - U_w = \delta$
Proposition

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In a simple endowment economy, equalization of workers' payoffs entails tax equalization \( (\tau(\nu) = \tau) \).
The basic trade-off

- More people in power makes the elite more secure
- More people in power means that rents have to be shared out more thinly
There is a technology for converting units of output into public goods:

- Extent of public good provision is a choice variable when institutions are established
- The model is otherwise identical

\[
\text{Output available for consumption: } (1 - p)q - g + f(g)
\]

A benevolent social planner would choose \( g \) such that:

\[
\frac{\partial f(g)}{\partial g} = 1
\]

Does a political Coase theorem arise in this setting?
There is a technology for converting units of output into public goods:

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- Converting $g$ units of goods per person yields public goods of value $f(g)$ per person.
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Application I: The provision of public goods

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The provision of public goods

- Institutions determine \( g \).
- People take \( g \) into account when deciding whether to rebel.
The provision of public goods

- Institutions determine $g$.
- People take $g$ into account when deciding whether to rebel.
- First-order condition with respect to $g$:
  \[
  \frac{\partial f(g^*)}{\partial g} = 1
  \]

**Result**: The equilibrium institutions provide the Pareto-efficient amount of the public good

- Even though the elite is purely self-interested, it acts as a meaningful government in its provision of public goods.
- Similar result has been found in other models — a benchmark case.
Individuals take the public good provision as well as taxes into account when deciding whether to rebel:

- provision of public goods slackens the no-rebellion constraint;
- taxes raised to finance them tighten the constraint.
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Result is consistent with a “political Coase theorem”:
- setting down rules analogous to contracting;
- threat of rebellion: there is a price attached to policy actions;
- efficient outcome, transfers ensure constraints are respected.
Application II: Investment

- Effort can be exerted to acquire capital in the future
- Institutions can set a capital tax
- Rebellions can take place either before or after investment occurs
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Diagram:

1. No army
2. New institutions
3. Rebellion? (Yes or No)
4. Producers can invest (Yes or No)
5. Production, taxes, payoffs
6. New institutions
7. Rebellion? (Yes or No)
Investment stage

- A fraction $\phi$ of individuals receives an investment opportunity ($\phi < 1$).
- Effort requirement $\theta$ is individual-specific draw from some distribution.
  - Assume a uniform distribution of $\theta$: $\theta \sim U[\theta_L, \theta_H]$.
- Those who make the effort receive $\kappa$ units of output ("capital") at the final production stage.
- Capital is observable, effort is not.

For tractability, $u(C) = C$. 
Equilibrium institutions must survive rebellion at all points:

To characterize the equilibrium:

1. We start by analysing the possibility of a rebellion at the post-investment stage.
2. Then we determine the institutions chosen at the pre-investment stage.
A rebellion at the post-investment stage

If a rebellion were to occur at the post-investment stage, and there were $K$ units of capital in the economy in total:

$\hat{p} = \frac{\delta}{q + 2\delta}$

$\hat{U}_p = \frac{(q + \delta)^2}{q + 2\delta} + K$

$\hat{U}_w = \frac{(q + \delta)^2}{q + 2\delta} - \delta + K$

- $\hat{p}$ does not depend on $K$.
- All capital would be confiscated and equally distributed.
A rebellion at the post-investment stage

If a rebellion were to occur after investments have been made:

- Capital tax would be 100% (full expropriation).
A rebellion at the post-investment stage

If a rebellion were to occur after investments have been made:

- Capital tax would be 100% (full expropriation).
- Why? — Sunk effort cost of investing does not influence decisions about rebelling.
- Equalization of workers’ payoff minimizes the maximum amount of effort a rebel army is willing to make.
- Power determines payoffs.
Pre-investment stage

Institutions determine the elite (size $p$) and taxes:

- $\tau_q$: tax on $q$, lump-sum
- $\tau_\kappa$: tax on $\kappa$, that determines
  - $s$: fraction of investors
  - $\theta^*$: threshold for effort cost

They are chosen to maximize the average payoff of those in power, subject to no rebellions from any group, at any stage.
Proposition

In a Markovian equilibrium with $s > 0$:

1. The binding rebellions comprise elite members and/or workers (who did not invest) in the post-investment stage.

2. Power is shared among more people than would be optimal ex post.

\[ p^* = \frac{\delta \hat{p} + s \theta^*}{\delta + s \theta^*} > \hat{p} \]
How does this work?

Investment proceeds increase incentives for rebellions.

If \( p = \hat{p} \), a “suspension of the constitution” is costless:

- If all members of the elite support the rebellion, rewriting the rules entails no cost
- The elite has full discretion to change laws ex post

Now if \( p > \hat{p} \), it is costly to change institutions

- Elite cannot commit not to reoptimize institutions along all dimensions
- Degree of power sharing reoptimized as well as tax system
- Rebellion is now a coup d’état that shrinks the elite
- Some people know they will lose their status and rents if the rebellion succeeds — these people will be in the incumbent army
Commitment requires sharing power

Sharing power among a wider group allows the elite to act as a government committed to policies that would otherwise be time inconsistent.

- So even though all individuals act with discretion, overcoming the time-inconsistency problem is feasible.
- An endogenous “commitment technology”.
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Cannot achieve it through transfers:

- Taxes and transfers can only redistribute disgruntlement from one individual to another.
- Higher taxes decrease rebellion incentives for the elite, but raise them for workers.
Two key assumptions:

1. Institutions cannot be modified without a rebellion:
   - In principle, elites can create institutions that lay down rules to be followed by all.
   - Institutions survive everything — except the collapse of the whole system.
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1. Institutions cannot be modified without a rebellion:
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   - Institutions survive everything — except the collapse of the whole system.

2. Were a rebellion to occur, there can be no enforcement of deals made prior to the rebellion.
   - Optimization along *all* institutional variables.
   - No “meta-institutions” to enforce deals concerning the choice of institutions themselves.
The fraction of investors is given by $s^*$:

$$s^* = \sqrt\left( \frac{q + 2\delta}{k} \right)^2 + \frac{\phi}{\theta_H - \theta_L} \left( \delta - (q + 2\delta) \frac{\theta_L}{k} \right) - \frac{q + 2\delta}{k}$$

(as long as $s^* \in [0, 1]$)

Does that correspond to the efficient level of investment?
The efficient choice of capital taxes

Efficiency benchmark (constrained efficient, not first best):

- Taxes on capital $\tau_k$ are chosen by a benevolent agent to maximize total welfare.
- $p$ and $\tau_q$ are chosen to maximize $U_p$ subject to no rebellion.
The efficient choice of capital taxes

Efficiency benchmark (constrained efficient, not first best):

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- $p$ and $\tau_q$ are chosen to maximize $U_p$ subject to no rebellion.

To solve the problem:

- We find equilibrium contingent on a given $\tau_K$.
  - Restrictions determine $p$ and $\tau_q$, given $\tau_K$.
- And choose $\tau_K$ to maximize total welfare.
The efficient choice of capital taxes

Efficient choice of $\tau_K$:

- $s^\diamond$ maximizes

$$U = U_p - (1 - p)\delta + (1 - p)s\frac{\theta^* - \theta_L}{2}$$

- as opposed to maximizing $U_p$,
- subject to the same constraints.
Efficiency?

No “political Coase theorem” in this case.

**Proposition**

- Unless $s^\diamond$ and $s^*$ are both at the same corner, $s^\diamond > s^*$.

- The efficient $s^\diamond$ and equilibrium $s^*$ choices are very different

- Equilibrium $s^*$ always on the “bad side” of the Laffer curve
Two distortions

First (and more interesting) distortion: too little power sharing.

- Protection of property rights require a larger elite ($p^* > \hat{p}$).
- Sharing power implies sharing rents, which goes against the interests of those in the elite.

Second distortion: elites do not consider investors’ surplus.

- No-rebellion constraint of those with capital is slack.
- No incentive for the elite to choose $\tau_K$ on the “good side” of the Laffer curve.

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The political Coase Theorem breaks down

1. Inseparability of power and rents.
   - Endogenous limit on the set of possible transfers.
   - It is not feasible to add individuals to the elite but pay them the same as an outsider: those elite members would rebel.

2. Unobservability of each investor’s surplus.
   - Limits to contracting.
Analogy: Parliaments

- The extra individuals in the elite might be interpreted as a parliament.
- Parliaments represent those who elected them...
- ... but so do democratically elected presidents.
- Power sharing makes institutions more stable by making it costly for a group within the elite to launch an attack on those institutions.
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- Power sharing makes institutions more stable by making it costly for a group within the elite to launch an attack on those institutions.
- “Princes who have wanted to make themselves despotic have always begun by uniting in their person all magistracies” — Montesquieu, *The Spirit of the Laws.*
Related historical examples: Glorious Revolution

- After the Glorious Revolution, England could borrow much more, at lower rates.

North and Weingast (1989): led to secure property rights and elimination of confiscatory government.

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  - Sharing power allows for institutions that credibly protect property rights.

Good for the King... but earlier kings fought hard to avoid sharing power.
Related historical examples: Glorious Revolution

- After the Glorious Revolution, England could borrow much more, at lower rates.
  - Sharing power allows for institutions that credibly protect property rights.
- Good for the King... but earlier kings fought hard to avoid sharing power.
  - Sharing power requires sharing rents.
Related historical examples: Roman Empire

- Malmendier (2009): Roman’s societas publicanorum were the earliest precursors of modern corporations.
- Their demise coincided with transition from the Roman Republic to the Roman Empire.
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Their demise coincided with transition from the Roman Republic to the Roman Empire.

Possible reason: while power was decentralized in the Republic, it was possible to have rules that guaranteed property rights.

But once power is centralized, protection against expropriation is not possible anymore.
Related historical examples: *Podesteria*

- Many medieval Italian cities employed a *podestà*.
- *Podestà*: a leader coming from another city, with military power, who would rule the city for one year.
- Generously paid.
- Having such a ruler allowed for inter-clan cooperation and investment.
- The *podestà* had to be sufficiently strong otherwise he could be easily defeated.
Empirical evidence: threat of government expropriation of property is an important issue in development.

Acemoglu and Johnson (2005) suggest “property rights” institutions are more important than “contracting institutions”.

Model: protection against government expropriation is not optimally provided.

The elite can create such institutions...

but that requires sharing power...

which requires sharing rents.
And Samuel told all the words of the Lord unto the people that asked of him a king.
And he said, This will be the manner of the king that shall reign over you: He will take your sons, and appoint them for himself, for his chariots, and to be his horsemen; and some shall run before his chariots. . . . And he will take your daughters to be confectionaries, and to be cooks, and to be bakers. . . . He will take the tenth of your sheep: and ye shall be his servants. And ye shall cry out in that day because of your king which ye shall have chosen you; and the Lord will not hear you in that day.
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And ye shall cry out in that day because of your king which ye shall have chosen you; and the Lord will not hear you in that day.
Nevertheless the people refused to obey the voice of Samuel; and they said, Nay; but we will have a king over us;
That we also may be like all the nations; and that our king may judge us, and go out before us, and fight our battles.
Concluding remarks

- This paper: world of self-interested agents, where those in power can create institutions, and everyone can fight to destroy institutions.

- Sharing power allows for commitment to rules that would otherwise be time-inconsistent.

- As sharing power requires sharing rents, there is too little commitment, too little protection of investment.
Related literature

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  - A vast literature on political economy has developed.
  - Much of that focuses on elections, assuming a particular set of institutions for allocating power.
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- **Work with a similar motivation to the current paper:**
  - Acemoglu and Robinson (2006, 2008);
  - Besley and Persson (2009, 2010);
Coalition formation (Ray, 2007):
- Non-cooperative process to establish rules, which are implemented by assumption.
- Modelling of rebellions related to blocking in coalitions.
- Distinguishing feature: the “rebellion technology”.

Myerson (2009) application of Schelling (1960):
Institutions as the focal point that determines allocation of resources once production has taken place.

Conflict (Grossman and Kim, 1995; Hirshleifer, 1995):
People fight to establish the rules, not over what has been produced. People fight in groups, not as isolated individuals.
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- **Conflict (Grossman and Kim, 1995; Hirshleifer, 1995):**
  - In the current paper, people fight to establish the rules, not over what has been produced.
  - People fight in groups, not as isolated individuals.
**Model with linear utility**

- $U(C) = C$.
- **Problem:**

  $$\max_{p, \tau} \frac{(1 - p)^\tau}{p} \quad \text{s.t.} \quad C'_p - \delta \frac{p}{p'} \leq q - \tau$$
How we solve it

\[ \max_{p, \tau} \frac{(1 - p)\tau}{p} \quad \text{s.t.} \quad C_p' - \delta \frac{p}{p'} \leq q - \tau \]

- Constraint yields an expression for \( \tau \).
- We substitute it into the objective function.
- First order condition with respect to \( p \).
- Impose equilibrium \((p = p', C_p = C_p')\)
Solution

\[ p^* = \frac{\delta}{q + 2\delta} \]

\[ C_p = \frac{(q + \delta)^2}{q + 2\delta} , \quad C_w = \frac{(q + \delta)^2}{q + 2\delta} - \delta \]

- In equilibrium, \( C_p - C_w = \delta \).
- Results for \( \delta/q < (1 + \sqrt{5})/2 \) (otherwise consumption of workers is 0).
The model with linear utility

\[ \delta \]

\[ a \]

\[ C_a \]

\[ C_p \]
Model with log utility

- $U(C) = \log(C)$.
- Problem:

$$\max_{p, \tau} \log \left( \frac{(1 - p)\tau}{p} \right) \quad \text{s.t.} \quad \log(C'_p) - \delta \frac{p}{p'} \leq \log(q - \tau)$$
Solution

\[ p^* = \frac{2\delta e^{-\delta}}{1 + 2\delta e^{-\delta} + \sqrt{1 + 4\delta e^{-\delta}}} \]

\[ C_p = \frac{(1 - p)}{p + (1 - p)e^{-\delta}} q, \quad C_w = \frac{e^{-\delta}(1 - p)}{p + (1 - p)e^{-\delta}} q \]

- \( p^* \) is independent of \( q \).
- Log utility: cost of conflict is proportional to \( q \).
Model with log utility
Rebellions

Suppose a set of institutions already exists. A successful rebellion would destroy these institutions and clear the way for the creation of new ones.

But the rebels cannot commit to create particular institutions ex post:
- who would enforce such deals? — no meta-institutions;
- subsequent institutions will solve a fresh maximization problem starting from a “blank slate”;
- however, expectations about what institutions would be created following a rebellion influence incentives to rebel.

Who will fight in the rebel army?
- fighting is costly;
- so expecting a higher payoff under the new institutions than under the current ones is a necessary condition to fight;
- but not sufficient: free-riding problem since no single individual is pivotal in determining the outcome of the conflict;
- hence rebel army must provide credible incentives for individuals to exert fighting effort.
Incentives to rebel

What incentives can be offered to take part in the fighting?

- “The carrot”: a promise to pay out of the subsequent elite’s resources
- “The stick”: a promise to punish those who shirk

Both suffer from the problem that once the fighting is over, bygones are bygones: the effort cost of fighting is sunk.

- apart from past promises, the continuation utility of someone who fought is identical to someone who shirked;
- this puts a limit on which punishments and rewards can be credible;
- the only credible reward is the higher payoff that can be commanded by being in power under the subsequent institutions, and the only credible threat is that of being denied such a position;
- credible because new institutions will need defending;
- other rewards and punishments for fighting imply losses for those subsequently in power so are not credible;
- size of group subsequently in power = upper bound for rebel army