Geography, Transparency and Institutions

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Outline of our research project

Our main thesis:

Geographical conditions/technology

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→ Asymmetric information and storability

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→ Appropriability (the ability of the state to obtain revenue from its subjects)

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→ Asymmetric information and storability

→ Appropriability (the ability of the state to obtain revenue from its subjects)

→ Institutions and state's capacity

Outline of our research project

- State capacity and extractive institutions are related to the ability to tax and expropriate which are affected by geography and technology.

Plan for the Presentation

1. Our research project

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1. Our research project
2. Related paper on the emergence of hierarchy

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3. A principal-agent model explaining regional differences in scale and institutions

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1. Our research project
2. Related paper on the emergence of hierarchy
3. A principal-agent model explaining regional differences in scale and institutions
4. Application of the model to explain institutional differences between ancient Egypt and Mesopotamia

2. The emergence of the state

According to the existing literature:

Neolithic Revolution

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→The emergence of the state

Existing Literature:
recent summaries

Jared Diamond (1997)

> "In short, plant and animal domestication meant much more food … The resulting food ***surpluses*** … were a prerequisite for the development of settled, politically centralized, socially stratified, economically complex, technologically innovative societies."

Existing Literature: recent summaries

Douglas Price and Ofer Bar-Yosef (2010)

> "Cultivation … supported a stable economy with ***surplus*** that resulted in the formation of elite groups…"

Our Criticism

We argue that the surplus explanations are flawed:

- The slow rise in productivity in itself could not have generated surplus since population size adjusts to prevent the creation of such surplus (Malthus)

Malthusian Dynamics: Evidence

Technological improvements before the industrial revolution:

→ positive effect population size

→ no effect on income per capita

(Ashraf and Galor 2011)

Our Explanation

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- Farming requires storage (grain) and is more transparent than foraging
- It was a change in the ability to appropriate that explains the emergence of hierarchy

The emergence of hierarchy: Storage and Transparency

Farming facilitated expropriation

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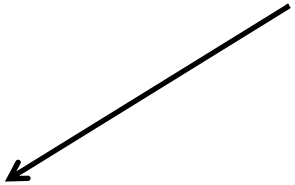
Farming facilitated expropriation



Roving banditry

The emergence of hierarchy: Storage and Transparency

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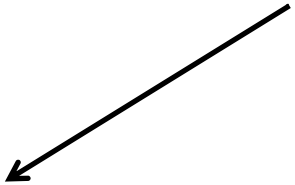

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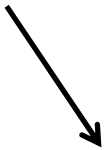
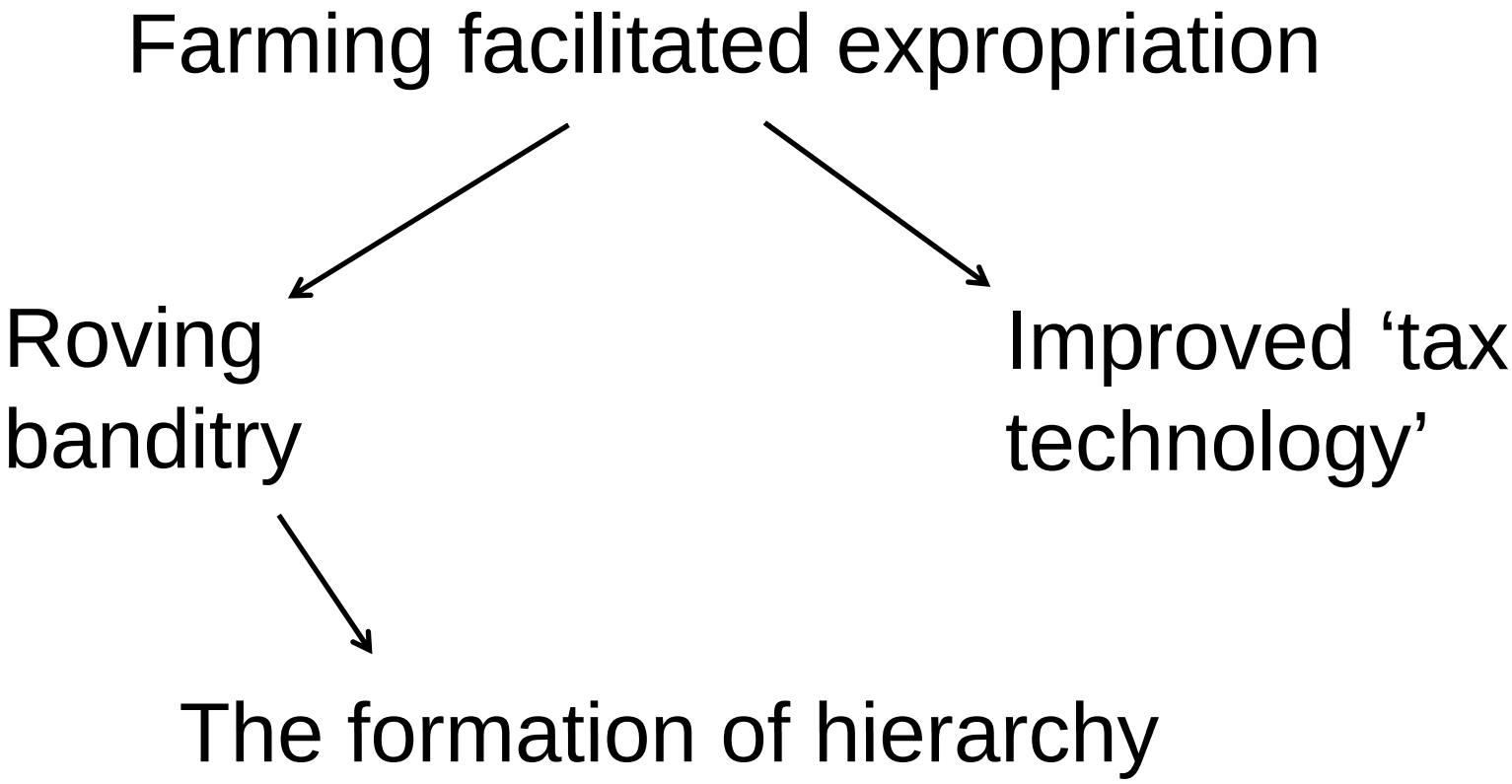


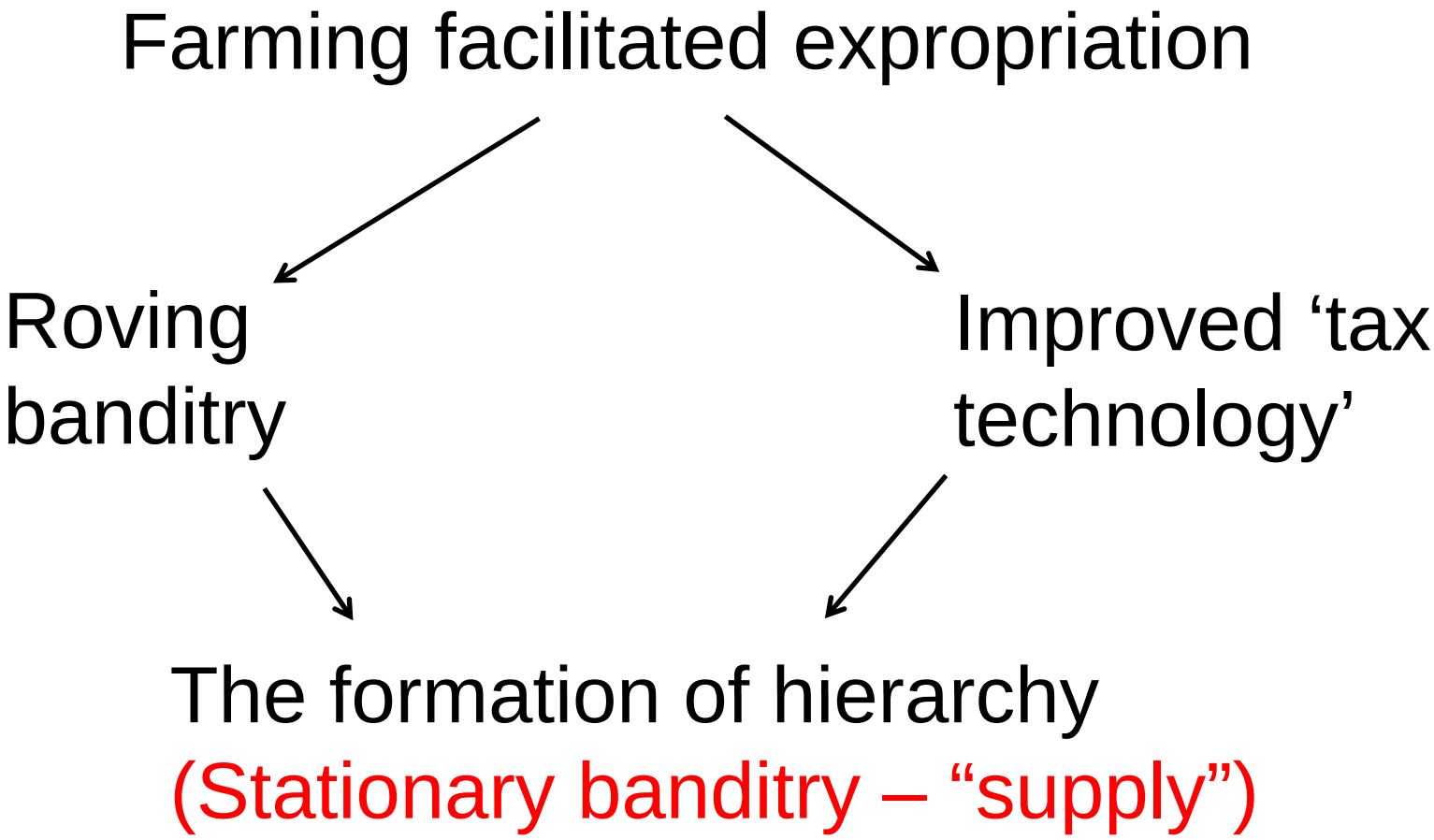
The formation of hierarchy

(Demand for protection)

The emergence of hierarchy: Storage and Transparency



The emergence of hierarchy: Storage and Transparency



Adam Smith: “Among nations of hunters… where there is no property… civil government is not so ***necessary”***

Robert Allen (1997): Following the surplus approach argues that the perishability of the food produced by foragers rendered them non-exploitable. Agriculture made it ***possible*** *for the* state to exploit its inhabitants as food was much more storable

Summary of our contribution to the emergence of hierarchy

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Mainstream theory: productivity

→ surplus → hierarchy & institutions

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Mainstream theory: productivity

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Our approach: transparency/storability

→ hierarchy & institutions → surplus & state

3. Today’s presentation:
Transparency and Institution

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The role of transparency in explaining regional differences in:

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The role of transparency in explaining regional differences in:

1. Institutions (private vs. state owned land)

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2. State capacity

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The role of transparency in explaining regional differences in:

1. Institutions (private vs. state owned land)

2. State capacity

3. State concentration (center vs. periphery)

Explaining regional differences: a principal-agent model

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- Principal – the government
- Agents – the subjects/farmers

Explaining regional differences: a principal-agent model

- Principal – the government
- Agents – the subjects/farmers

Key assumption

- The degree of transparency varies across regions

Explaining regional differences: a principal-agent model

We study the impact of transparency on two standard elements in the (implicit) contract:

- “Stick” – threat of dismissal
- “Carrot” – share of output

Explaining regional differences: a principal-agent model

We study the impact of transparency on two standard elements in the (implicit) contract:

- “Stick” – threat of dismissal
- “Carrot” – share of output

And the implied:

- State scale and concentration
- Tenancy institutions

Model

The principal-agent problem

The principal designs the contract to maximize its expected income

Agents are risk neutral and choose their effort level to maximize their expected welfare

Output (per agent):

$$Y = \begin{cases} H & \text{if } e = h \text{ and } \theta = G \\ L & \text{otherwise} \end{cases}$$

$e \in \{h, l\}$ - effort

$\theta \in \{G, B\}$ - state of nature

$p \in (0, 1)$ - the probability that $\theta = G$

Information

$\sigma \in \{\tilde{G}, \tilde{B}\}$ - a public signal about the state of nature

Signal accuracy $q \geq 1/2$

$$q = \Pr(\tilde{G}|G) = \Pr(\tilde{B}|B)$$

$$1 - q = \Pr(\tilde{G}|B) = \Pr(\tilde{B}|G)$$

σ is observed after effort decision

Interpretation of the signal

a. Observation of output in other plots provides information about the state of nature at a specific plot depending on the correlation across plots.

Interpretation of the signal

b. An observable signal, such as the ‘Nilometer’ that measures the amount of water in the Nile.

The cost of maintaining the agent

$m > 0$ if effort is low $(e = l)$

$m + \gamma$ if effort is high $(e = h)$

$\gamma > 0$ is the cost of high effort

Assumptions:

$L \geq m + \gamma$

(low output is larger than the maintenance cost)

$p(H - L) > \gamma$

(effort is efficient)

Agent's Income and Utility

I - agent's expected income

$U = I - (m + \gamma)$ - agent's periodic utility when exerting effort

δ - the agent's discount factor

δV - the value of the agent's employment in the next period

$zero$ - agent's value of unemployment

Incentive scheme - the carrot:

The principal pays the agent:

a bonus $b \geq 0$ if output is high ($Y = H$)

a basic wage $\omega \geq m + \gamma$ regardless of output

Incentive scheme - the stick:

$d \in \{0,1\}$ - the probability the agent is dismissed if:

$$Y = L \text{ and } \sigma = \tilde{G}$$

(otherwise the agent is retained)

x - the cost of replacing the agent

In the paper's appendix we show that the qualitative results hold:

1. if $d \in [0,1]$
2. if dismissal could depend on past output and signals

–> Two types of contracts are possible:

$d = 0$ *“Pure Carrot”*

and

$d = 1$ *“Stick and Carrot”*

The optimization implies that $\omega = m + \gamma$

→ An employment contract is fully described by b and d

(a carrot and a stick)

We assume that:

$$x > \frac{\delta p \gamma}{(1 - \delta/2)(1 - p)} > \frac{\delta p \gamma}{1 - p}$$

–> dismissing the agent when $\sigma = \tilde{B}$ is dominated by never dismissing

The value of employment (The Bellman equation)

$$V = pb + \Pr(retained) \cdot \delta V$$

$\rightarrow$

$$V = \frac{pb}{1 - \delta \Pr(retained)}$$

The principal's objective function - OF:

$$\pi = \max_{b \geq 0, d \in \{0,1\}} p(H-L) + L - (m+\gamma) - pb - (1-p)(1-q)dx$$

subject to the agent's incentive compatibility constraint - IC:

$$p(b+\delta V) + (1-p)[q + (1-q)(1-d)]\delta V + \omega - (m+\gamma)$$

$$\geq p(q(1-d) + (1-q))\delta V + (1-p)[(q + (1-q)(1-d)]\delta V$$

$$+\omega - m$$

Rewrite the agent's IC:

$$pb + pqd\delta V \geq \gamma$$

Intuition:

The return to effort: the expected rise in income, pb, and the increase in the probability to maintain the job pqd, multiplied by its value, δV, is larger than the cost of effort.

Solution

The IC is binding (the contract is designed by the principal)

$$b = \frac{\gamma}{p} - qd\delta V$$

Stick & Carrot: $(d = 1)$

$$V_s = \frac{\gamma}{1 - \delta(p + q - 2pq)} > 0$$

Pure Carrot: $(d = 0)$

$$V_c = \frac{\gamma}{1 - \delta}$$

(We find b as a function of V from the IC and replace in the value function)

The two contracts:

"Pure Carrot"

$$d_c = 0, \quad b_c = \frac{\gamma}{p}$$

or

"Stick & Carrot"

$$d_s = 1, \qquad b_s = \frac{\gamma}{p} - q\delta V$$

$$= \frac{\gamma}{p} - \frac{q\delta\gamma}{1 - \delta(p + q - 2pq)}$$

By replacing b from the IC in the OF, if:

$$q < \hat{q}$$

→*Pure Carrot*

Otherwise

→ *Stick & Carrot*

The threshold $\hat{q}$ is given by:

$$\frac{\hat{q}}{(1-\hat{q})} = \frac{(1-p)x}{p\delta\gamma}[1-\delta(p+\hat{q}-2p\hat{q})].$$

- This quadratic equation has one root strictly inside the unit interval $0 < \hat{q} < 1$
- For $x > \frac{\delta p\gamma}{(1-\delta/2)(1-p)}$: $\hat{q} > 1/2$

–> For some set of parameters the ‘pure carrot’ contract is optimal

Intuition: a principal relying on a “stick” to incentivise the agent has to incur the cost of dismissal x with probability:

$$(1-p)(1-q)$$

→ The expected cost of using the “stick”:

$$(1-p)(1-q)x$$

is decreasing with the quality of information q

Property rights and transparency

We interpret the “pure carrot” contract as a regime in which farmers pay taxes but are de-facto owners of the land they cultivate

→ Greater productive opacity leads to property rights

Expected Income - *Pure Carrot*

The expected income of the agent

$$I_c = m + 2\gamma$$

The expected income of the principal

$$\pi_c = p(H - L) + L - (m + 2\gamma)$$

Efficient outcome:

$$I_c + \pi_c = p(H - L) + L$$

Expected Income - *Stick & Carrot*

The expected income of the Agent

$$I_s = m + 2\gamma - \frac{pq\delta\gamma}{1 - \delta(p + q - 2pq)}$$

is decreasing with q

The intuition for the decline of I with q above $\hat{q}$:

Holding constant the bonus, b, a higher q implies a lower probability of dismissal, increasing the value of employment. Therefore, as q increases b has to decline to hold the incentive constraint binding.

Expected Income - *Stick & Carrot*

The expected income of the principal

$$\pi_s = p(H-L) + L - (m + 2\gamma) + \frac{pq\delta\gamma}{1-\delta(p+q-2pq)} - (1-p)(1-q)x$$

is increasing with q

Expected Income - *Stick & Carrot*

inefficient outcome:

$$I_s + \pi_s = p(H - L) + L - (1 - p)(1 - q)x$$

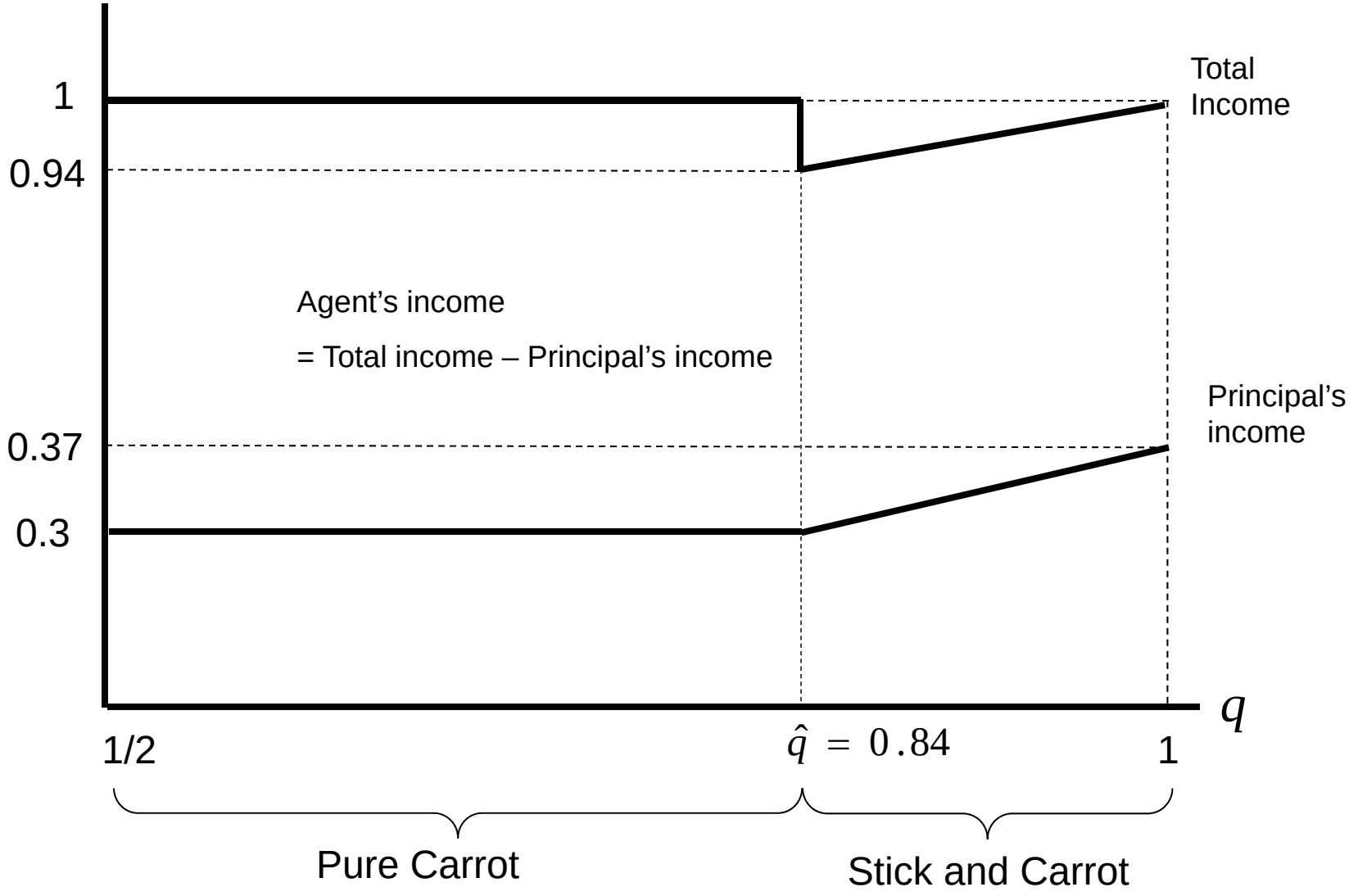
inefficiency declines with q

An Illustrative Calibration

$E(Y) = pH + (1-p)L = 1$ (representing about 1.5 tons of net grain)

$H = 1.1, L = 0.6$ and $p = 0.8$, (a bad harvest occurs about every five years)

$x = 2, m = 0.5, \gamma = 0.1$ and $\delta = 0.8$.


1
0.94
0.37
0.3
Total
Income
Agent's income
= Total income – Principal's income
Principal's
income
q
1/2
$\hat{q} = 0.84$
1
Pure Carrot
Stick and Carrot

Extension: State Concentration

A key aspect of state government is the multi-tiered hierarchy of control

- Our model can be interpreted as a series of principal-agent interactions at the different tiers of the hierarchy – each tier like the one we analyze

Extension: State Concentration

Outcome depends on who knows what

Two main cases:

1. Local farming is transparent to both local officials and the state

- “stick & carrot” farming contract and “stick & carrot” contract to local officials
- peripheral centers are *weak*

Extension: State Concentration

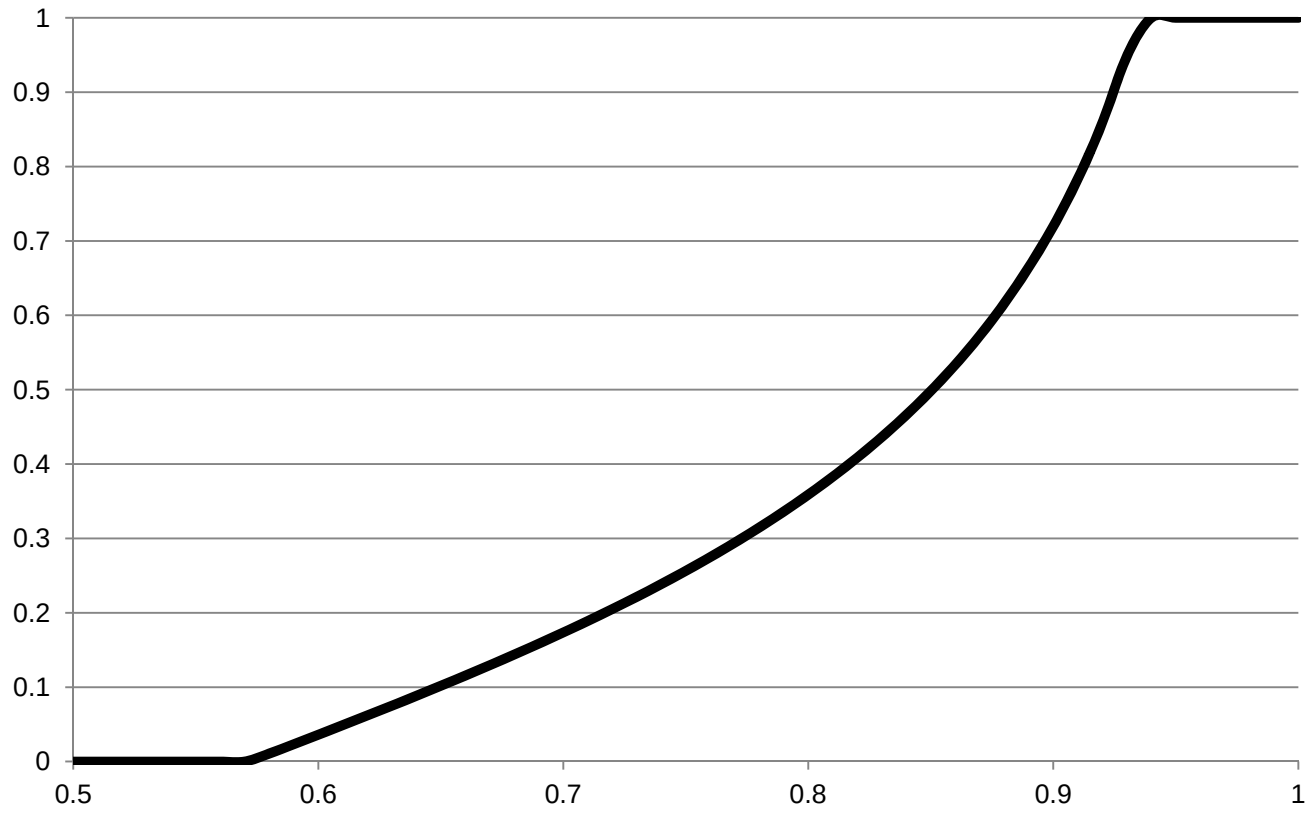
Outcome depends on who knows what

Two main cases:

2. Local farming is transparent to local officials *but not* to the state

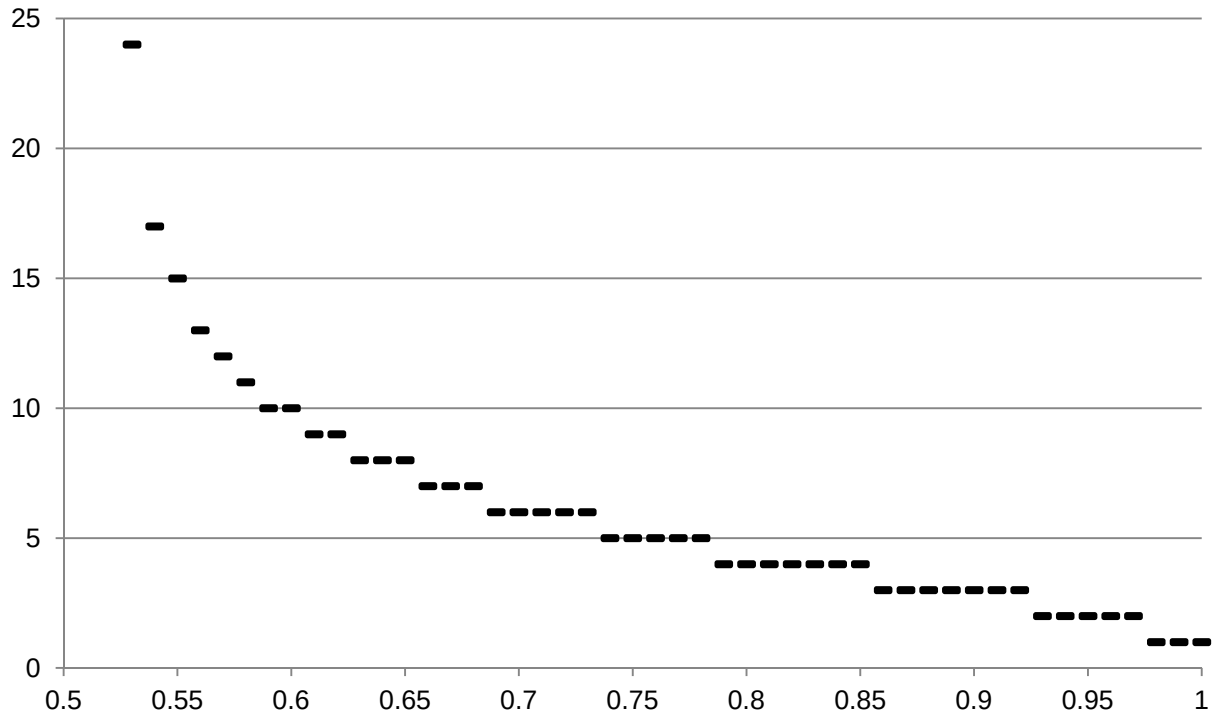
- "stick & carrot" farming contract and "pure carrot" contract to local officials
- peripheral centers are *strong*

The dismissal probability *d* as a function of *q* when *d* is continuous



Warnings are possible:

The optimal number of times in which output is low and the signal is good leading to the dismissal of the agent as a function of *q*



Part 4. Application:
Mesopotamia and Ancient Egypt

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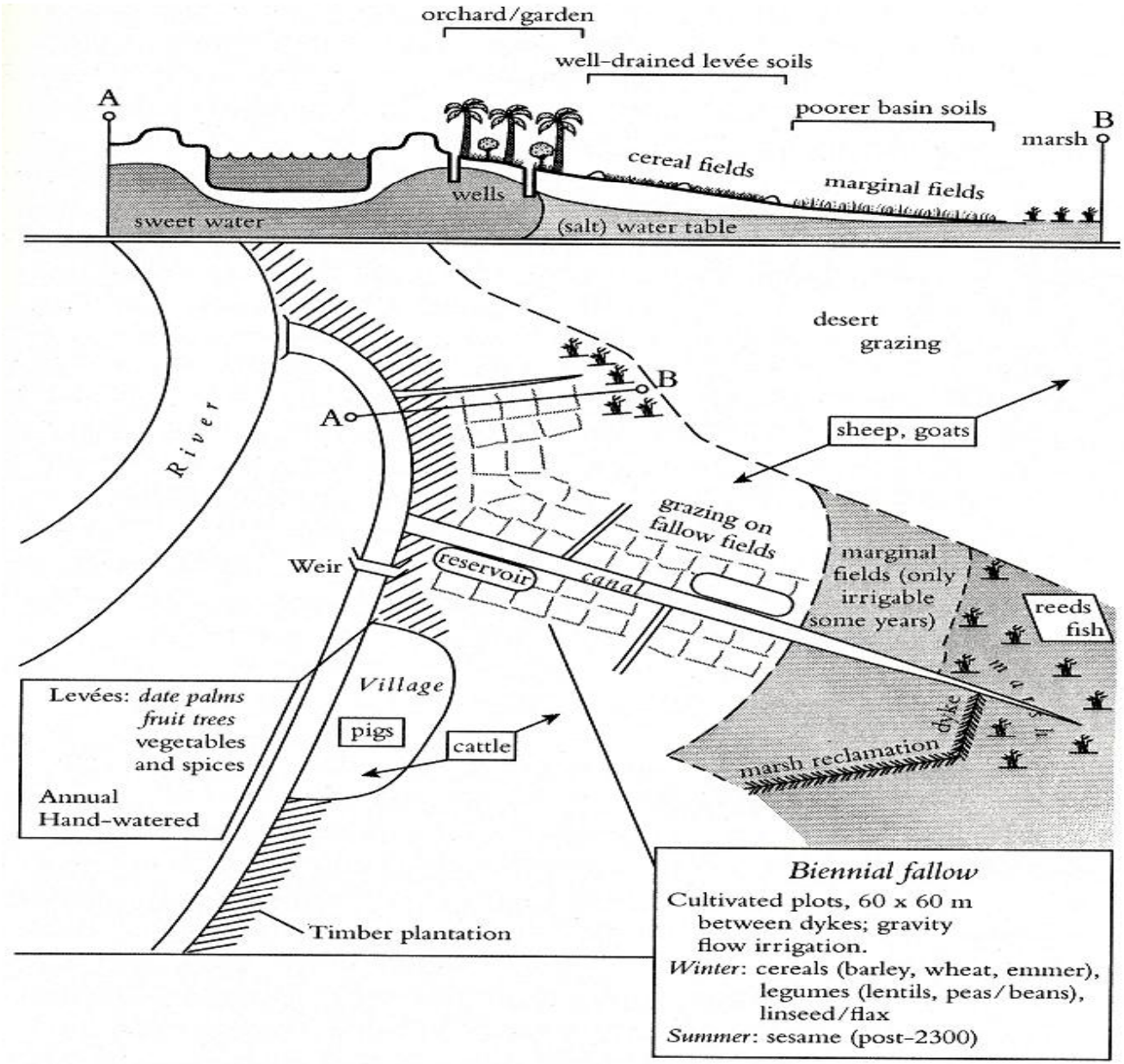
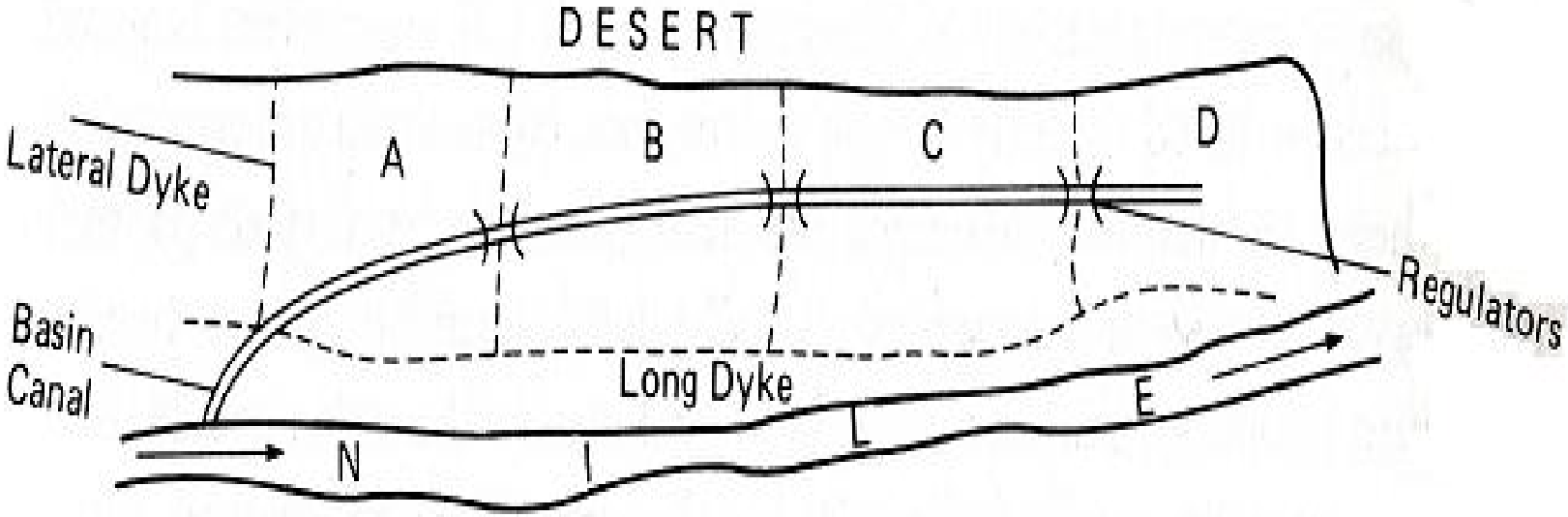
- This expressed disapproval of Pharaonic land tenure institutions, where farmers were serfs who tilled land that they did not own
- In ancient Israel and Upper Mesopotamia, owner-operated farming was common and sometimes the norm
- Land tenure in Southern (lower) Mesopotamia was more like in Egypt

Mesopotamia – typical irrigation system



Egypt – typical irrigation system



Nilometer

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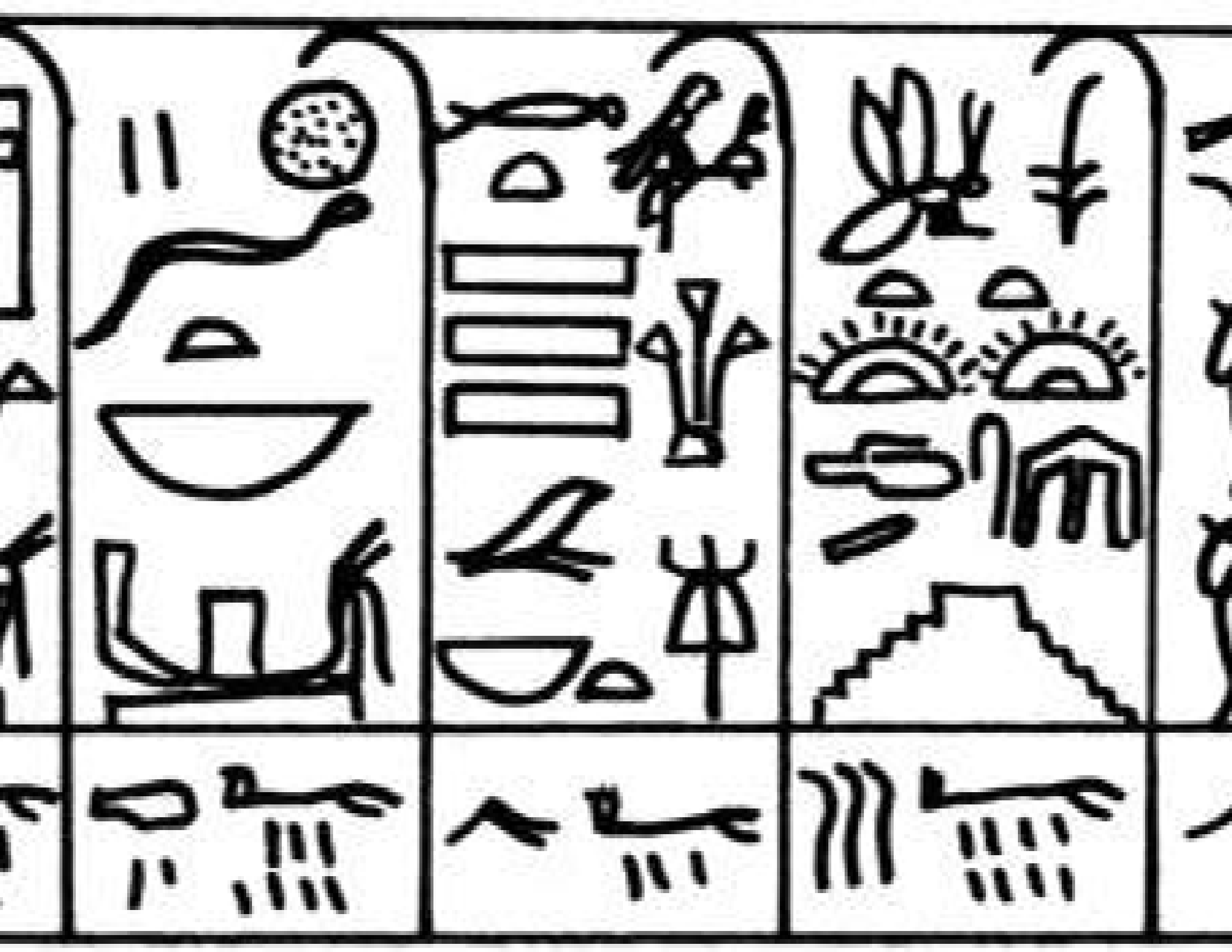
- Cooper (1976:366): “On the basis of the Nile flood recorded by the Nilometer, the government knew in advance what revenue to anticipate.”



Application:
Ancient Egypt and Mesopotamia

Land ownership

Our theory can explain why:

- Egyptian farmers were tenant-serfs, without title to the land that they cultivated
- Much of the land in Upper Mesopotamia was cultivated by its direct owners

  (Records for private real estate transaction and loan contracts, that would be typically secured by land, are abundant in ancient Mesopotamia and hardly exist in ancient Egypt)

Legal Disputes

Our theory can explain why legal disputes were resolved:

- in Egypt by local noblemen without legal codes
- in Mesopotamia by court process, guided by law codes issued by the state

State Concentration

Our theory can explain why:

- The local nobles and the regional governors in Egypt were agents of the Pharaoh, subject to dismissal
- The cities in Egypt were administrative centers
- The cities in Mesopotamia retained much power, controlled by the local elite

State Capacity

Our theory can explain why the central state in Egypt:

- rose much faster than in Mesopotamia
- was much more stable
- could siphon off a greater share of the country's produce

  (This enabled the construction of the great pyramids in the mid-third millennium)

Are Kings Gods?

Our theory can explain why:

- The Pharaohs were considered as incarnations of the gods
- The kings of Mesopotamia (with a single exception in early Akkad) were only considered as envoys of the gods

Conclusions

- The prevailing view is that asymmetry of information is a hindrance for efficiency

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- We argue that lack of transparency could protect the freedom and well-being of agents

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- The existing literature abstracts from the role of appropriabililty in explaining differences in state capacity, concentration, and institutions

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- We argue that geographical differences affect the degree of transparency and thereby state’s capacity, concentration and institutions

Application to the recent increase in the scale of the state

- Mainstream public finance literature (following Wagner 1883) focuses on the increased demand for public goods and the transition to democracy

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- The political economy literature emphasizes the redistributive nature of government spending

We argue

- The appetite of autocratic governments could not have been smaller than that of the modern democratic government

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- The shift to mass production by hired labor entailed a massive accounting paper trail. This increased the state's ability to tax by making private companies into tax collection agents and by introducing income tax

Conclusion

- Anthropologists and archaeologists argue that by and large economic theory is inapplicable to the study of antiquity.
- In these disciplines it has become standard since the 1950's to replace the ideas of Adam Smith with the ideas and terminology of Karl Polanyi (1944)

According to Polanyi:

- The basic tenet of economists about exchange in impersonal markets is inapplicable to the ancient world

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- The basic tenet of economists about exchange in impersonal markets is inapplicable to the ancient world
- The social exchange that prevailed in pre-modern societies was based either on gift reciprocity, or, at a more complex stage, on “redistribution.”

Our contribution

- We apply economic theory to the analysis of non-market relations in antiquity

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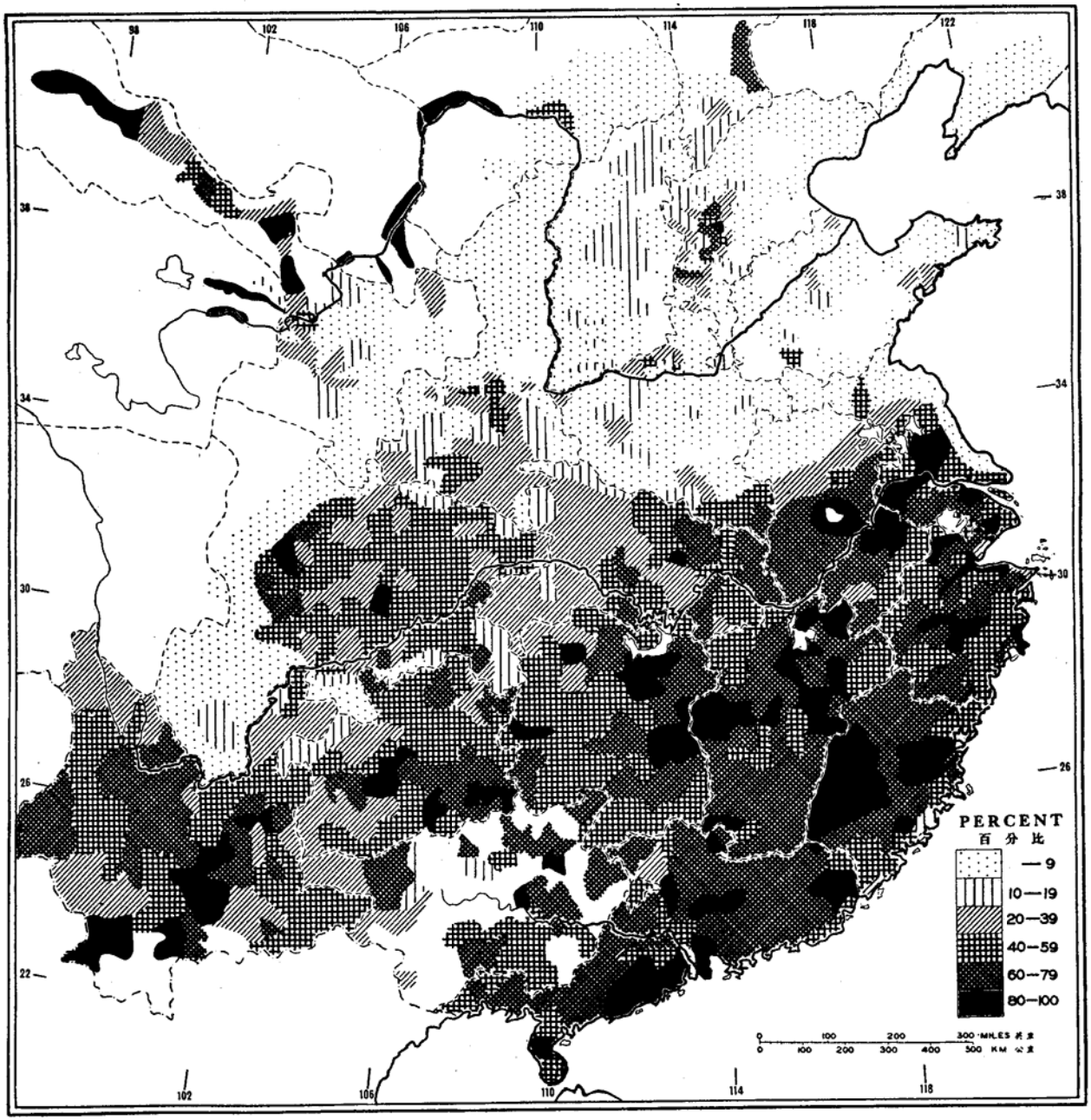
- We show that Polanyi's celebrated claim that the economy is "embedded" in social institutions does not have to mean that social institutions ought to be taken as exogenous
- We propose a less 'romantic' interpretation of the role of the state

Land Tenure
Evidence from China

John Lossing Buck *Land Utilization in China* (University of Chicago Press, 1937)

A survey of 16,786 farms and 38,256 farm families in the Chinese farm economy

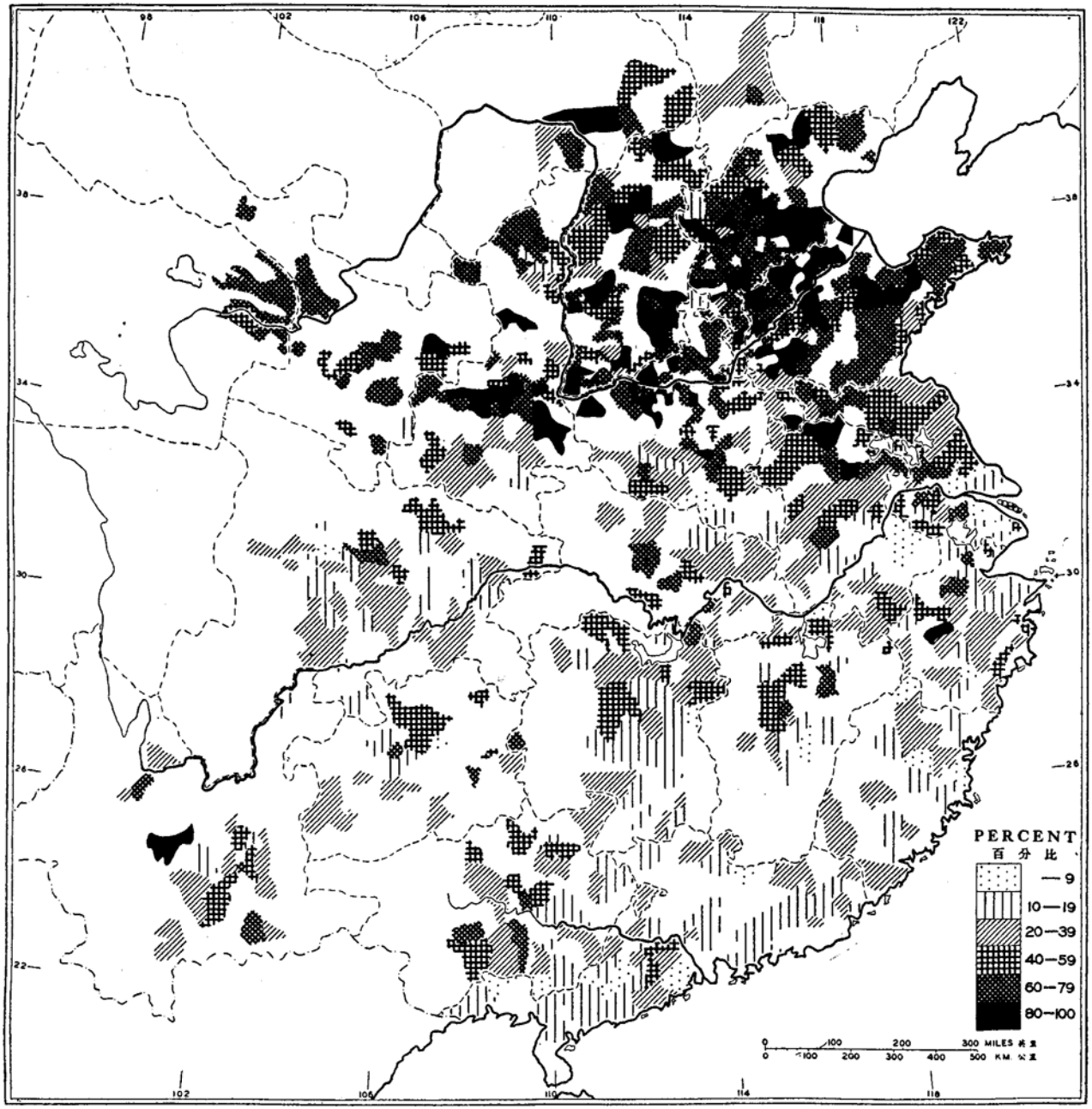


MAP 4. PERCENTAGE OF THE CULTIVATED LAND WHICH IS IRRIGATED

Rice is the main irrigated crop. Many places in the Rice Region have no

第四圖 耕地內灌溉面積之百分比

稻係主要灌溉作物. 在水稻地帶內, 若干地方, 除水稻外, 並無其他灌溉作物, 故其稻田面積之百分比, 卽等於灌溉面積之百分比. 小麥地帶, 因水



MAP 6. PERCENTAGE OF FARMERS WHO ARE OWNERS

第六圖 自耕農之百分比

中國農民，管有自耕之田地者，佔百分之五四．小麥地帶，四分之三以