A two period model of

Geography, Transparency and Institutions (Mayshar-Moav-Neeman)

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

- "Stick" – threat of dismissal
- "Carrot" – share of output

and explain regional differences in

- Institutions (private vs. state owned land)
- State capacity
- State concentration (center vs. periphery)

The principal-agent model

- The principal designs the contract to maximize its expected income
- Agents are risk neutral and choose their effort level to maximize their expected welfare
- The economy operates during two periods: 1 and 2

Output (per agent, in each period)

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

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

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

γ if effort is high $(e = h)$

Assumptions:

$L \geq \gamma$

(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

$U = I - \gamma$ - agent's periodic utility when exerting effort

1 - the agent's discount factor

V - the value of the agent's employment in the second 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 $\omega = \gamma$ regardless of output

Incentive scheme - the stick

The contract could include dismissal of the agent at the end of period 1 if:

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

(otherwise the agent is retained)

x - the cost of replacing the agent

$$x > \frac{p\gamma}{1-p}$$

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

→ Two types of contracts are possible in period 1

"Pure Carrot"

(denoted by subscript c)

"Stick and Carrot"

(denoted by subscript s)

In period 2, only *"Pure Carrot"* is relevant

The *IC* constraint under *"Pure Carrot"*

$$\omega - \gamma + pb_c \geq \omega$$

Minimizing the cost of incentivizing the agent

$$b_c = \gamma / p$$

The value of employment in period 2

$$V = \omega - \gamma + pb_c = \gamma$$

The cost of employment for the principal under *"Pure Carrot"*

$$Cost_c = \omega + pb_c = 2\gamma$$

The *IC* constraint under *"Stick and Carrot"*

$$\omega - \gamma + pb_s + [p + (1-p)q]V$$
$$\geq \omega + [p(1-q) + (1-p)q]V$$

→ (noting that $\omega = V = \gamma$)

$$b_s = \frac{1-pq}{p}\gamma$$

The cost of employment for the principal under *"Stick and Carrot"*

$$Cost_s = \omega + pb_s + (1-p)(1-q)x$$
$$= (2-pq)\gamma + (1-p)(1-q)x$$

There exists a threshold $\hat{q}$ such that:

$$Cost_s = Cost_c \text{ for } q = \hat{q}$$

$$\hat{q} = \frac{(1-p)x}{(1-p)x + p\gamma}$$

For $q < \hat{q}$ *"Pure Carrot"*

For $q > \hat{q}$ *"Stick and Carrot"*

$x > \frac{p}{1-p}\gamma \rightarrow \hat{q} > 1/2$

Intuition: a principal relying on a “stick” to incentivize 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

$$I_c = \gamma + pb_c = 2\gamma$$

The expected income of the principal

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

Efficient outcome

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

Expected Income - *Stick & Carrot*

The expected income of the Agent

$$I_s = \gamma + pb_s = 2\gamma - pq\gamma = (2 - pq)\gamma$$

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

$$\pi_s = p(H-L) + L - (2-pq)\gamma$$
$$-(1-p)(1-q)x$$

is increasing with q

Lower payment to the agent and lower probability of paying x

Expected Income - *Stick & Carrot*

inefficient outcome

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

inefficiency declines with q

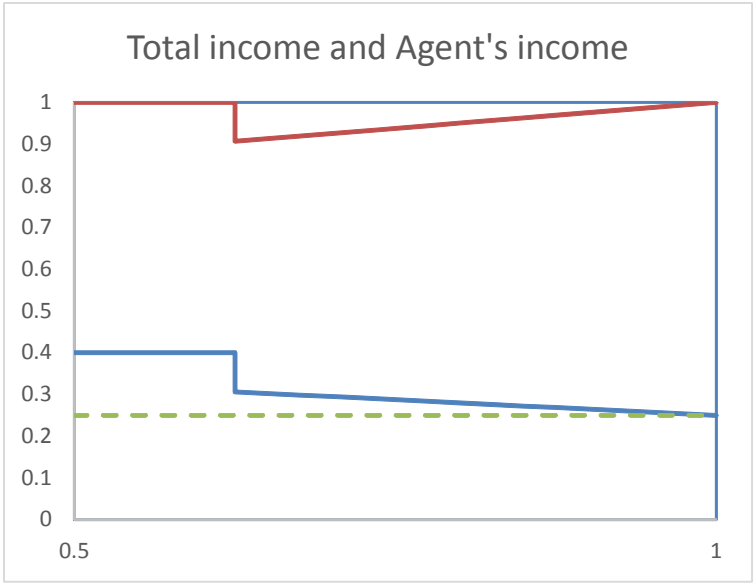
An Illustrative Calibration

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

$p = 0.75$, (a bad harvest occurs about every 4 years)

$x = 1, \gamma = 0.2$

$\rightarrow \hat{q} = 0.625$


Total income and Agent's income
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.5
1

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*

Part 4. Application:
Mesopotamia and Ancient Egypt

Part 4. Application: Mesopotamia and Ancient Egypt

- The Old Testament refers to Egypt as a “house of bondage”

Part 4. Application: Mesopotamia and Ancient Egypt

- The Old Testament refers to Egypt as a “house of bondage”
- This expressed disapproval of Pharaonic land tenure institutions, where farmers were serfs who tilled land that they did not own

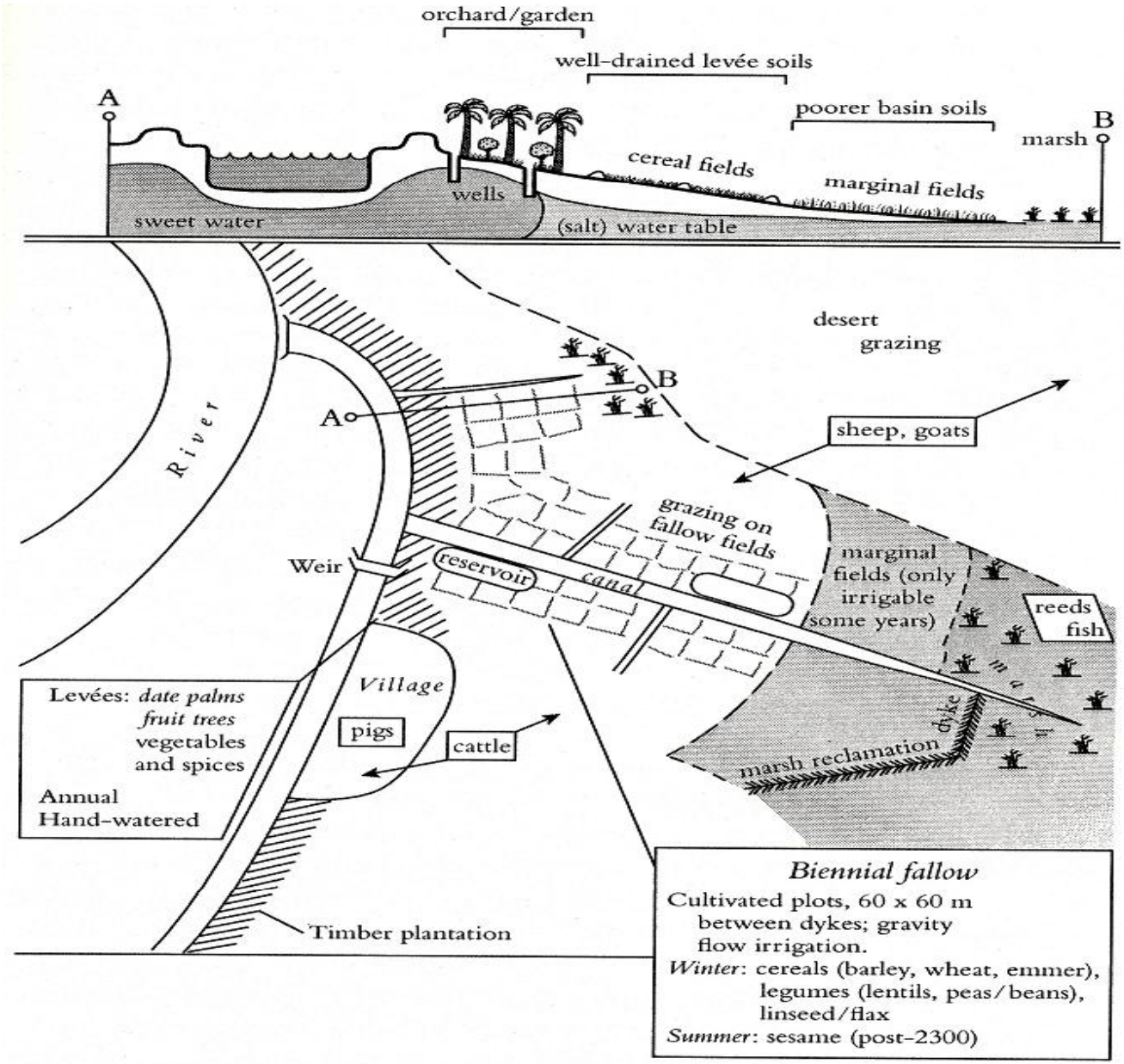
Part 4. Application: Mesopotamia and Ancient Egypt

- The Old Testament refers to Egypt as a “house of bondage”
- 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

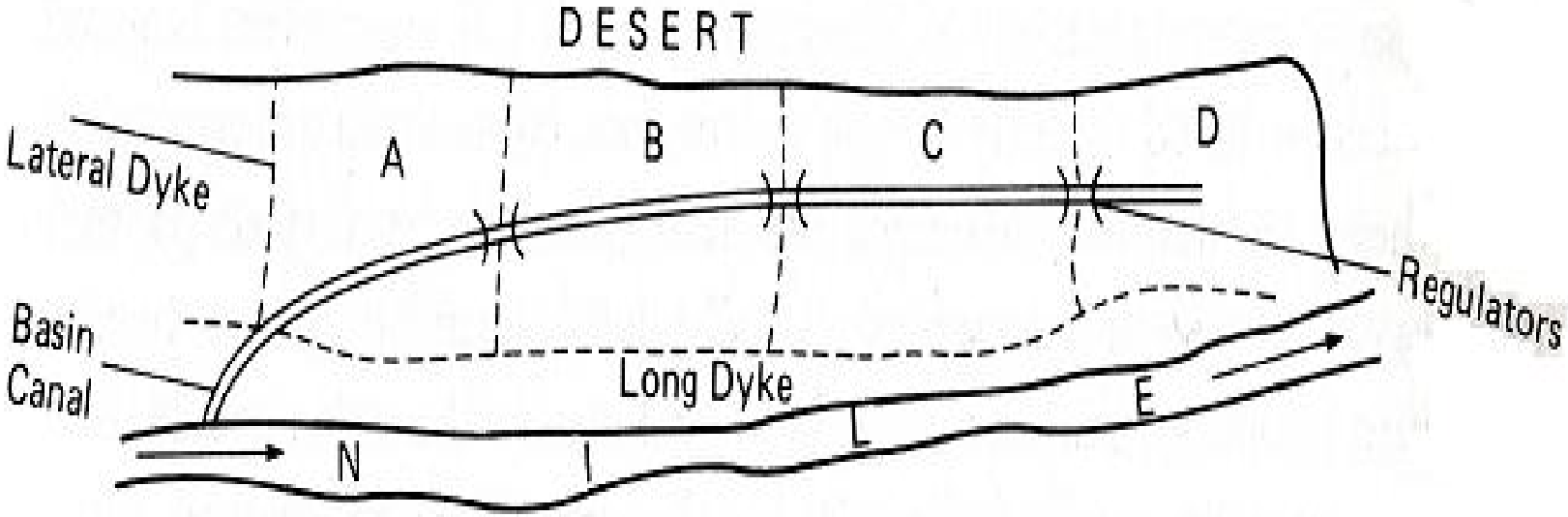
Part 4. Application: Mesopotamia and Ancient Egypt

- The Old Testament refers to Egypt as a “house of bondage”
- 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

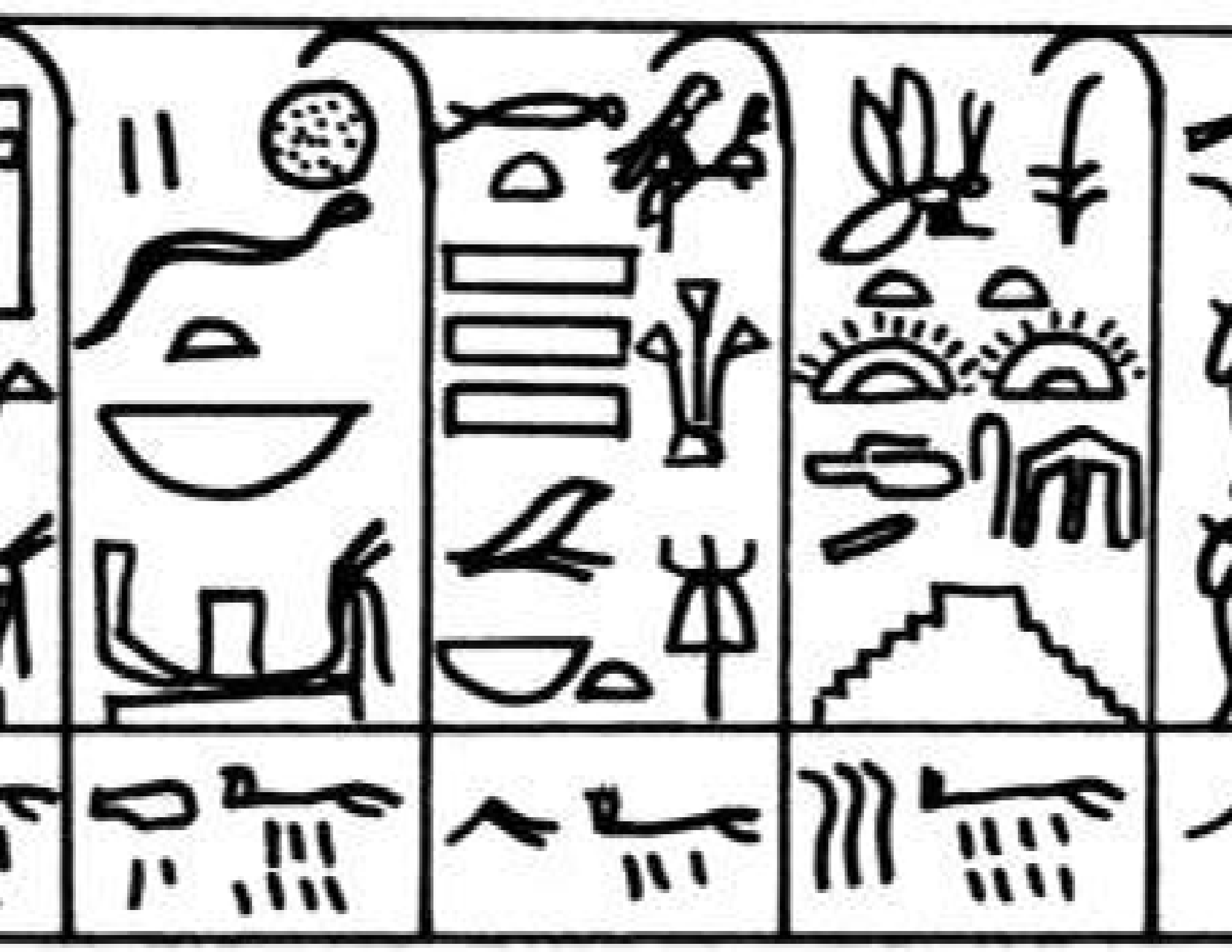


Nilometer

- The Nilometer: indicator for the inundation height of the Nile

Nilometer

- The Nilometer: indicator for the inundation height of the Nile
- 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

Conclusions

- The prevailing view is that asymmetry of information is a hindrance for efficiency
- We argue that lack of transparency could protect the freedom and well-being of agents

Conclusions

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

Conclusions

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

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
- 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

We argue

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

According to Polanyi:

- 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

Our contribution

- We apply economic theory to the analysis of non-market relations in antiquity
- We show that Polanyi's celebrated claim that the economy is "embedded" in social institutions does not have to mean that social institutions should be taken as exogenous

Our contribution

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