Institutional Development, Capital Accumulation, and the Emergence of Civilizations

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Ever since Solow (1956), economists have understood the role played by capital accumulation in economic growth. But factor accumulation is only a proximate driver of economic activity. Recent research has begun to explore the competing influences of fundamental drivers. Geographical environment (Diamond 1997; Gallup, Sachs & Mellinger 1999), Trade integration (Dollar & Kraay 2003; Frankel & Romer 1999), Political-economic institutions (Acemoglu, Johnson & Robinson 2001; North, Wallis & Weingast 2009).
Proximate versus Fundamental Determinants of Growth

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  - Trade integration (Dollar & Kraay 2003; Frankel & Romer 1999)
  - Political-economic institutions (Acemoglu, Johnson & Robinson 2001; North, Wallis & Weingast 2009)
Seek to explore the contribution of these fundamental factors to the emergence of civilizations

- Independently-emergent civilizations in ancient history: Mesopotamian, Egyptian, Harappan, Sinic
- Exclude Mesomaerican and Andean (and Greek!) civilizations on American continent
- Utilize textual, artifactual, and archaeological evidence

Central argument: Well-defined property rights were crucial in providing incentives for peasants to adopt hydraulic tools and technologies

- Such agricultural capital enabled increased food output and supported surpluses necessary for civilizational emergence
- Coincident development of writing alongside the consolidation of property rights regimes
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- Address inability to directly introduce controls for geography and trade by research design
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Related Research on (Very) Long-Run Growth

- Fundamental versus proximate drivers of growth (Acemoglu, Johnson & Robinson 2005; Decker & Lim 2008; Glaeser et al 2004; Rodrik, Subramanian & Trebbi 2004)
  - But limited to econometric analysis of 20th-century data

- Growth over the very long run: empirical (Kremer 1993; Maddison 2001) and theoretical (Galor & Weil 2000; Hansen & Prescott 2002)
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- Coevolution of political and economic transitions (Acemoglu & Robinson 2001; Acemoglu, Johnson, Robinson & Yared 2009)
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- Drivers of state formation (Tilly 1992; Levi 1989; Putnam:1993; Steinmetz:1999)
  - Civilizational emergence is likely to be multifaceted, we offer institutional view
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Some Definitions

- **Capital**
  - Agricultural capital \( k \) are structures, tools, and machinery of hydraulic engineering for food production
  - Encompasses irrigation/drainage tools and embedded technology

- **Property rights**
  - Property rights regimes with *de jure* or *de facto* system of ownership attribution whose strength is measured by \( \theta \in (0, 1) \)

- **Civilization**
  - Civilizations have attained high level of capital accumulation and technological advancement, specialization in production, agricultural surpluses to support urban settlement, and political institutions
  - Emerge with probability \( \mu (f(k)) \).
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Agricultural Capital: Egyptian *Sakia* and Chinese *Longguche*
Falsification Research Design

- Compare settlements in geographically-similar regions (riverine valleys with fertile plains) along major ancient trade routes (c. 3000, 500 BCE and 0 CE)
  - Incorporating later routes allows for potential errors of identification of routes while raising the bar necessary for successful falsification
**Example**: Absence of civilizations emerging in Southern China

- Many riverine settlements along Southern Silk Route along Middle (Qujialing) and Lower (Liangzhu) Yangtze
- These proto-states never coalesced into civilizations
- This in spite of superior climatology for rice cultivation in South
- Significant settlement expansion and agricultural capital accumulation only in late Shang and Zhou (after absorption into greater Sinic civilization)
Limited Transfer of Agricultural Capital via Trade

- Trade can stimulate growth not just directly but also indirectly via capital and technology transfer
  - Example: Egypt-Mesopotamia trade not accompanied by broad-based capital/technology transfer
    - Trade relations only established in time of Sargon II (721–705 BCE)
    - Trade via Wadi Hammamat mostly reflected Heckscher-Ohlin-type factor abundance (gold, myrrh) rather than Ricardian productivity differentials
    - Irrigation practices of Tigris-Euphrates (silting led to routine abandonment) distinct from those of Nile (sustained channels to exploit cyclical flooding)
    - Later trade practices did demonstrate capital/technology transfer (Egyptian shaduf adapted from Mesopotamia in New Kingdom period)
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Property Rights in Mesopotamia

- **Code of Hammurabi** spells out rights and obligations of agricultural land ownership (§46, §§55–57):
  
  "If an owner has rented the field...the tenant and the owner of the field shall divide the grain which is in the field according to agreement...if a man open [sic] his canal for irrigation and neglect [sic] it...and the water carry [sic] away improvements of an adjacent field, he shall measure out [compensation]."

- Other collections of Mesopotamian laws (Eshunna, Ur-Nammu, and Lipit-Ishtar) also discuss property rights.

- Sumerian map tablets include property rights demarcations.
  
  Yields correlated with land tenure strength (temple/palace > kinship collectives/tenant sharecrops > buffer land (edin))
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Institutions and Civilizations

Janus & Lim

Introduction
Motivation
Objective
Contribution
Relevant Literature

Empirical Approach
Definitions
Research Design

Results
Falsification
Verification

Theoretical Explanation
Model

Conclusion
Summary

Sumerian Tablet of Nippur with Property Boundaries and Ownership Rights in Cuneiform
Property Rights in Harappa

- Pervasiveness of small stone seals, used to denote ownership rights, discovered across Harappan archeological sites
  - Diacritic modifiers to scripts suggest ownership in sharecropping arrangement (e.g. crops ($\psi + \text{upper share}$ ($\wedge$)) $\Rightarrow$ share of produce due to landlord ($\hat{\psi}$)
- Extensive adoption of drainage mechanisms in Harrapan farming sites
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Harappan Steatite Seal from Mohenjo-Daro Used to Mark Ownership
In theory, all Egyptian property belonged to Pharaoh, but in practice, deviation from this ideal

- Abundant records of land transfers to temples
- Textual evidence of land conveyancing from later Ptolemaic period suggest use of demotic contracts that continued older practices of land tenure
- Temple-based landholding involved sharecropping (Eyre 1997, pp. 368–9)

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As in Egypt, all property in China technically belonged to the Emperor, holdings accrued to vassals in reality

Conferral of land to a loyal subject recorded in Daya and Xiaoya of the Shijing

Agricultural property distinguished between private and public property, with significant agency to farming practices (Datian, Poem 212)

Various are the toils which fields so large demand!
We choose the seed; we take our tools in hand.

The clouds o’erspread the sky in masses dense,
And gentle rain down to the earth dispense.
First may the public fields the blessings get,
And then with it our private fields we wet!
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Coincident Development of Writing Technologies

- Coincident development of independent writing systems in civilizations corroborates
  - Proto-Cuneiform and Cuneiform (Uruk-Ubaid)
  - Archaic Chinese on Anyang oracle bones (early Shang)
  - Pre-Hieroglyphic symbols and hieroglyphic/hieratic scripts (Predynastic/Early Dynastic)
  - Early logographic inscriptions (early Harappan-Transitional)

- Other writing systems had Mesopotamian or Egyptian precedents
  - Increased demand for a method for recording the myriad intra- and inter-civilizational transactions probably supported writing development
  - Given centrality in property rights recordation, absence of writing in other non-civilizations is indirect evidence against property rights in those societies
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A Two-Equation Model of Property Rights

- Yeoman agricultural producer indirect utility
  \[ v = z + \theta \left[ af \left( k (i + i_0), l \right) - z \right] - c (i + l) \]

- Elite objective function
  \[ w = (1 - \theta) \left[ af \left( k (i + i_0), l \right) - z \right] \]

- Probability of civilizational emergence
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Property Rights Promote Capital Investment

Proposition

*With no initial irrigation needs* ($i_0 = 0$), *for interior optima, more secure property rights promotes greater investment in agricultural capital and labor input*. That is, $\frac{dk}{d\theta} > 0$ and $\frac{dl}{d\theta} > 0$.

- Optimum balances the marginal benefit of higher output from more agricultural capital against the marginal (effort) cost of allocating labor toward accumulating such capital.
  - If relationship between changes in irrigation-directed labor and property rights is positive (not output).
  - Satisfied by the diminishing marginal product of labor and the (partial) complementarity of capital and labor.
- Even controlling for geography and trade (captured by $a$), stronger property rights stimulate agricultural capital accumulation in ancient civilizations.
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Higher Initial Irrigation Needs Leads to Weaker Property Rights Regimes

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For nonzero initial irrigation needs $i_0 > 0$, if $i$ and $l$ are linear in $\theta$, the property rights regime will be weaker if this initial level is greater as long as the response of labor with respect to property rights is sufficiently elastic. More precisely, $\frac{d\theta}{di_0} < 0$ if $l'_{\theta} > \frac{2}{1-\theta}$.

- Larger initial water management needs $i_0$, the higher will be final agricultural output.
- The larger is $i_0$, the larger (and less elastic) is the “tax base”.
- Greater initial water management facing farmers in Egypt and China should therefore result in weaker property rights, relative to Harappa and Mesopotamia.
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Policy Implications

- Provided more evidence of the important, and often causal, role of institutions as a fundamental determinant of economic growth
- In particular, a simple institutional mechanism (property rights regime) can make a first-order difference to capital accumulation
- For developing countries with weak overall institutional environments, policymakers can narrow down from a huge checklist of potentially significant policy fixes
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