“THE NEEDHAM PUZZLE: WHY THE INDUSTRIAL REVOLUTION DID NOT ORIGINATE IN CHINA”

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Plan

1. The Needham Puzzle.
2. Possible explanations:
    1. Failure of the demand for technology
    2. Failure of the supply for technology:
        1. Model of technological invention
        2. Why the scientific revolution didn't occur in China?
3. Results of the analysis

What is the problem?

Agriculture	½ XI c.	Dryland crops => wetland rice 3 crops/year => Highest yields in the world Improved plow, share plow, deep-tooth harrow
Technology	By IX c.	Gunpowder, magnetic compass, paper, printing
Industry	By XIII c.	Water-powered reeling machine for spinning thread Iron production

1. Why had China been so far ahead of other civilizations before the XIV century?
2. Why isn't China now ahead of the rest of the world?

Failure of the demand for technology

Arguments against this hypothesis

- Labor shortages always existed during the peak season
- Can't be supported empirically
- Historical data:

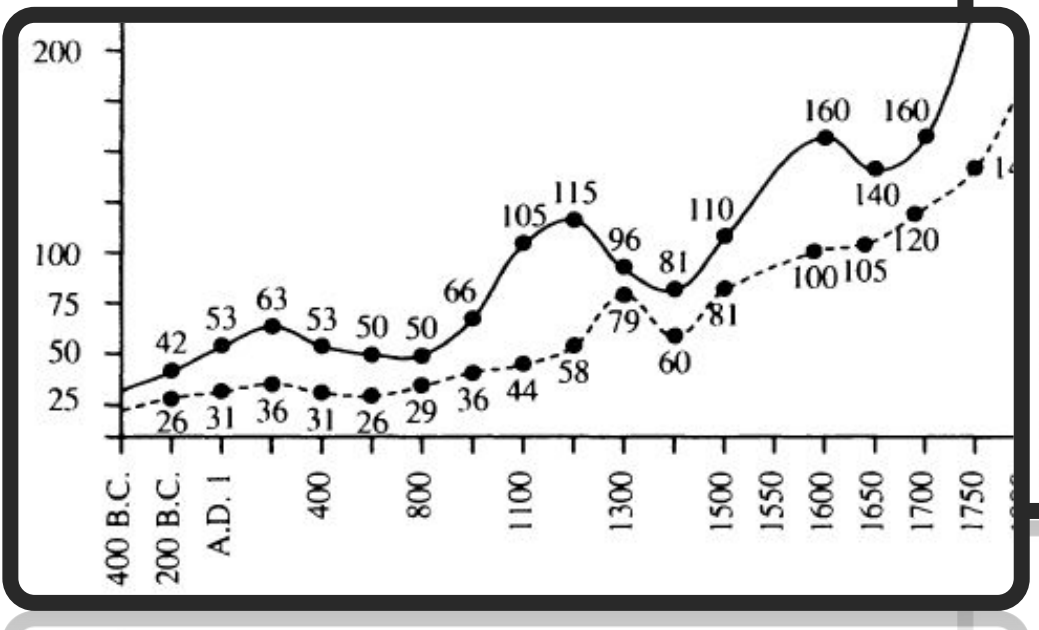


TABLE 1

PER CAPITA ACREAGE OF CULTIVATED LAND, A.D. 2–1887

CULTIVATED LAND		POPULATION		
Year	Amount (Million Mu)	Year	Number (Million)	PER CAPITA ACREAGE (Mu)
2	571	2	59	9.67
105	535	105	53	10.09
146	507	146	47	10.78
976	255	961	32	7.96
1072	666	1109	121	5.50
1393	522	1391	60	8.70
1581	793	1592	200	3.96
1662	570	1657	72	7.92
1784	886	1776	268	3.30
1812	943	1800	295	3.19
1887	1,154	1848	426	2.70

SOURCE.—Kang Chao, *Man and Land in Chinese History: An Economic Analysis* (Stanford, Calif.: Stanford University Press, 1986), p. 89.

Failure of the supply-side of technology

- How the technology is discovered?

Pre-modern times	Modern times
From experience	From experiment
Size of population – main determinant!	Socioeconomic institutions – main determinant!

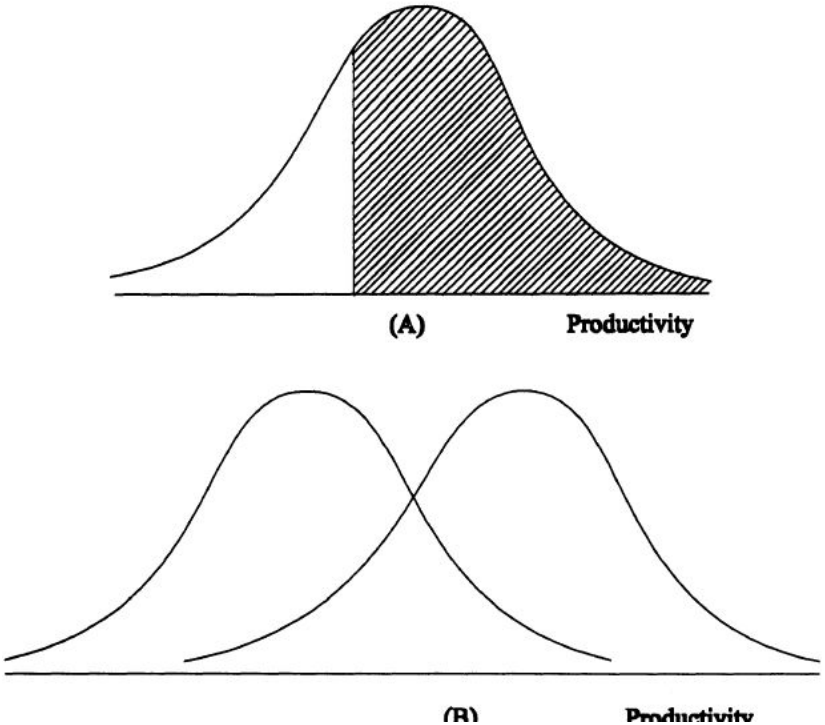
- *China did not shift from experience-based to experiment-based*

Model of technical invention

- Better technology ≈ higher productivity
- Supply of technology comes from inventive activity
- "Trial and Error":

<u>Implications:</u>

- Trials ↑↑ P(better technology)
- P(better technology) ↑↓ level of existing technology
- Scientific knowledge ↑↑ P(better technology)



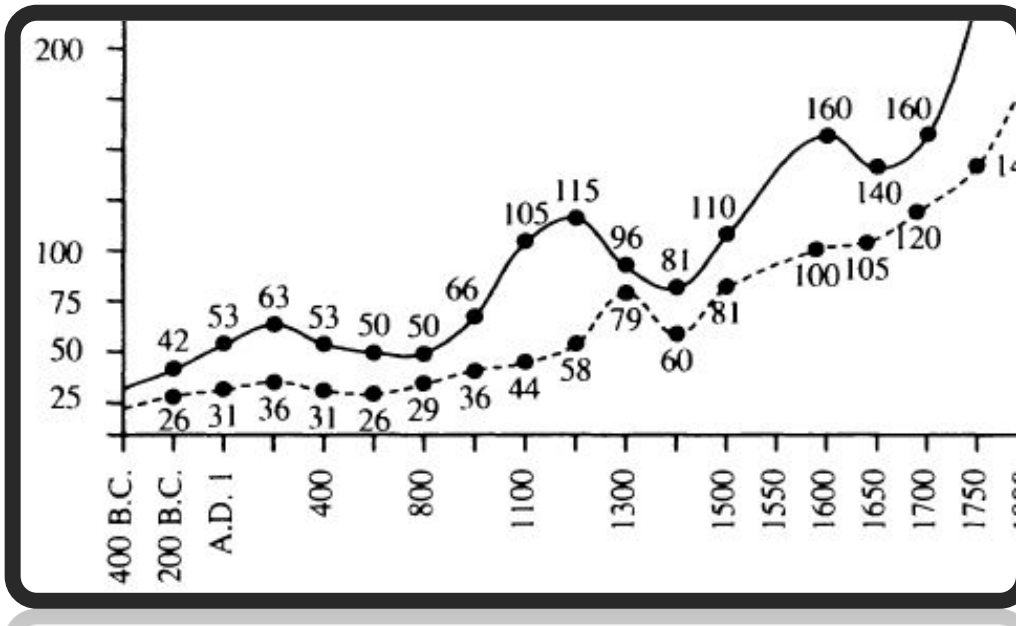
Experience-based vs Experiment-based

- Exponential growth of population: 1400 - …

DMR → P (great inventions)↓

- Europe – scientific revolution →experiment-based method dominates

- *China began losing ground to Europe only after the scientific revolution in Europe*



Why the scientific revolution didn't occur in China?

- "Bureaucratic system" inhibited the emergence of mercantilistic values
- Intolerance of merchants and artisans; merchants – the lowest social class
- Incentive structure: entry into the ruling bureaucracy – final goal of upward mobility

Field for further study

- Are the probabilities of discovering new technology really were that different among countries, or is there some other unknown supply-side factor that contributed to the “China’s Puzzle”?
- How traditions and customs could have influenced the braking of development?
- Was the socioeconomic structure of China’s pre-modern society really as unimportant as it was claimed to be?