Structural Changes in Thailand's Agriculture

Agriculture and the wealth of Nations

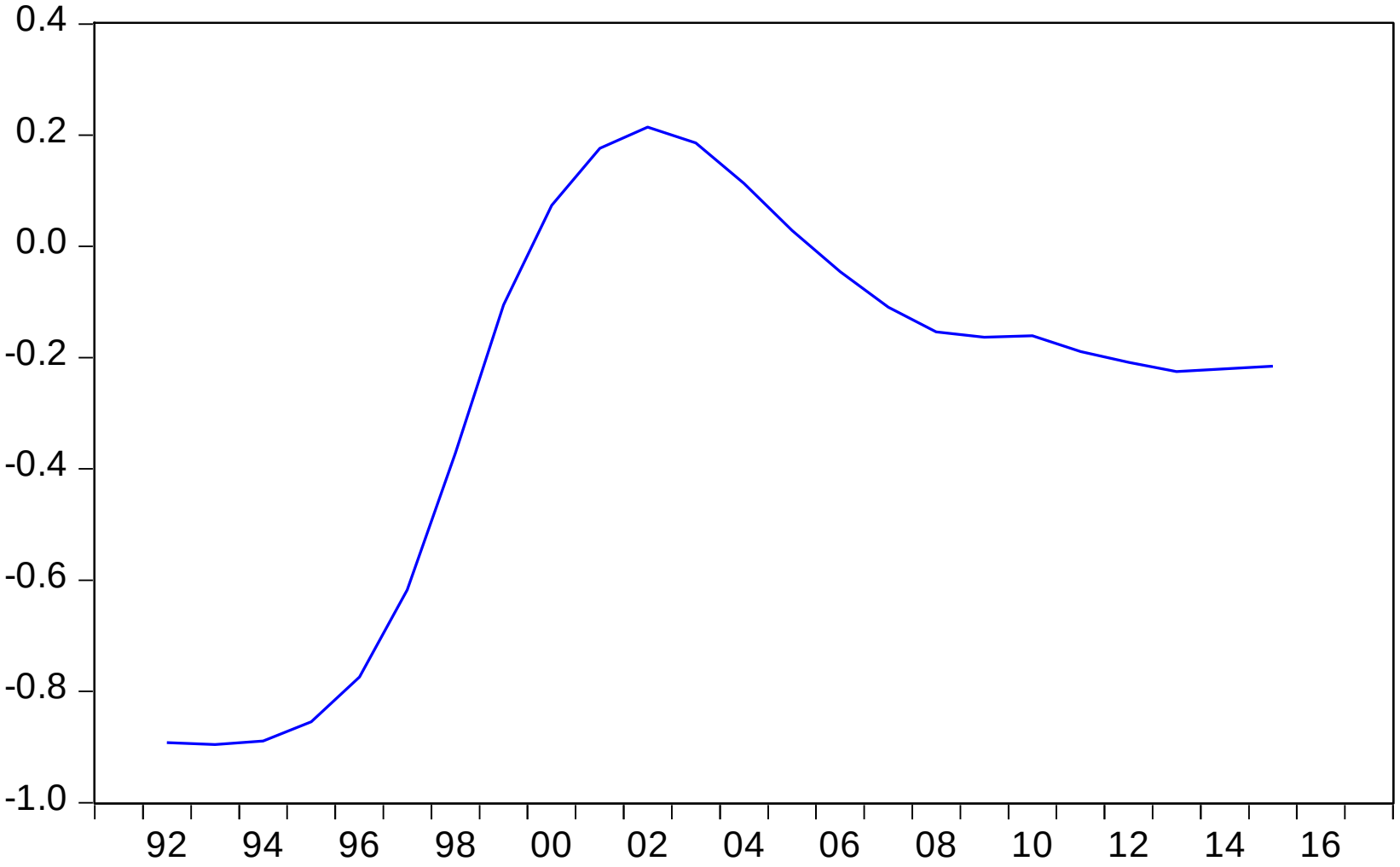
Bhanupong

Lecture 10

A new normal growth path

- GDP growth in 2013 declined to 2.9% from 6.5% in the previous year.
- Investment and exported contracted by 1.9% and 0.2 % respectively.
- What has gone wrong in Thailand?
- In 2014, GDP grew only 0.6 %.
- Is there a China factor explaining Thailand's new normal growth?

Changes in trend GDP growth



Main themes

- Stylized facts of economic development
- A pessimistic view
- Output volatility and long-term trend
- Agricultural productivity
- Agricultural output since 2005

Urbanization and agricultural productivity

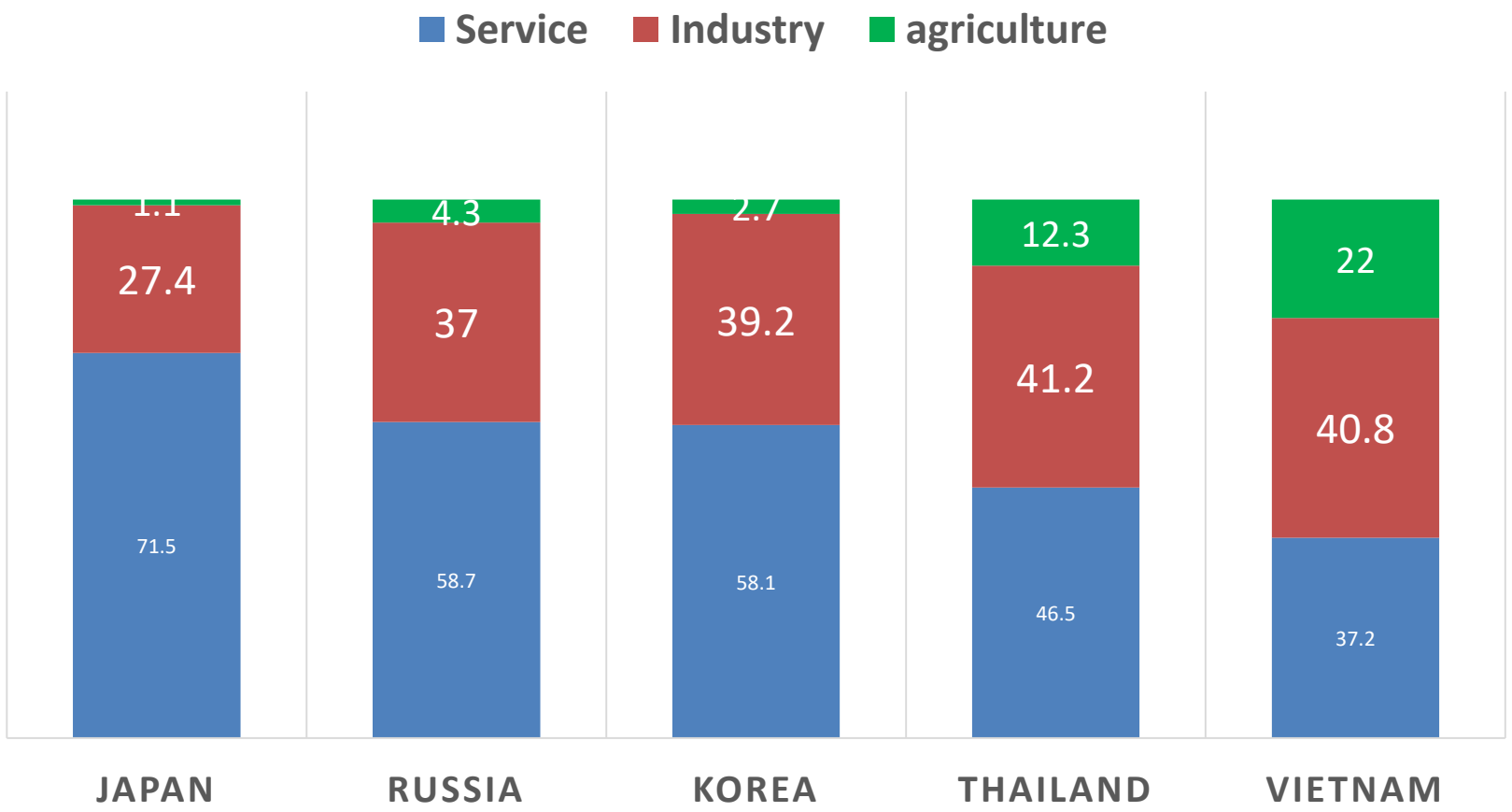
- The rapid urbanization and growth of the total population of the developed countries that occurred in the 19th century was made possible by very great improvements in agri- cultural labor productivity.
- The urban population in the United Kingdom in 1900 was 68 percent of the total compared to 19 percent in 1800, while on the continent it was 33 percent urban in 1900 and only 11 percent in 180

- In France the amount of wheat produced by a man-day of labor more than doubled between 1800 and 1892
- The increase in labor productivity in the United Kingdom must have been even greater, since agriculture's share of total employment declined from 36 percent in 1800 to 8.5 per- cent during 1900-1910.
- By the beginning of this century the United Kingdom was importing approximately half of its food, but during the same period its population nearly tripled.

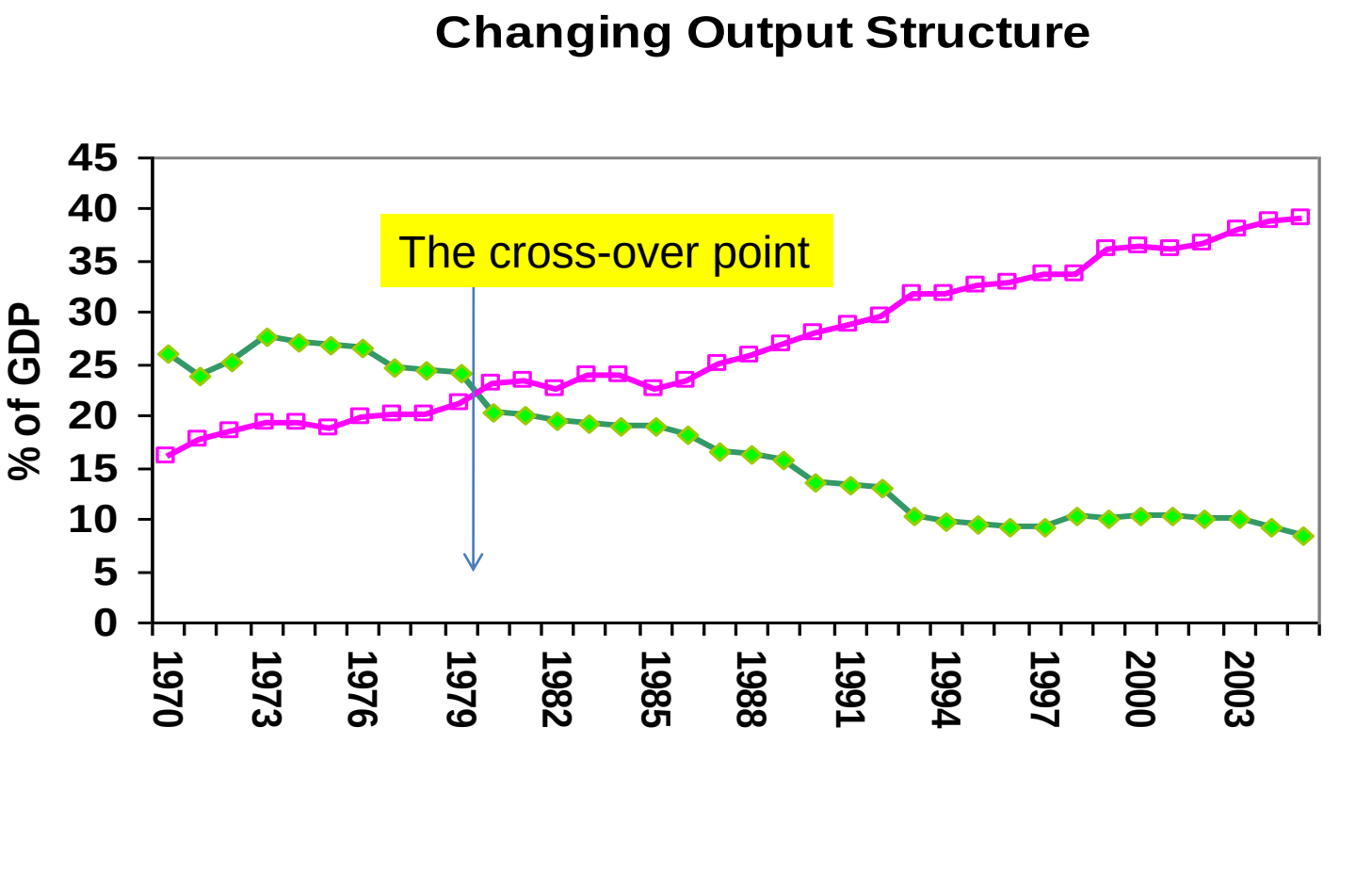
Stylized facts of Economic Development

- **Shares of agriculture output in GDP and agricultural exports in total exports have been declining continuously over the past four decades.**
- **Share of employment in agriculture has gradually declined.**

OUTPUT STRUCTURE (% GDP)
IN SEARCH OF CREATIVE ECONOMY

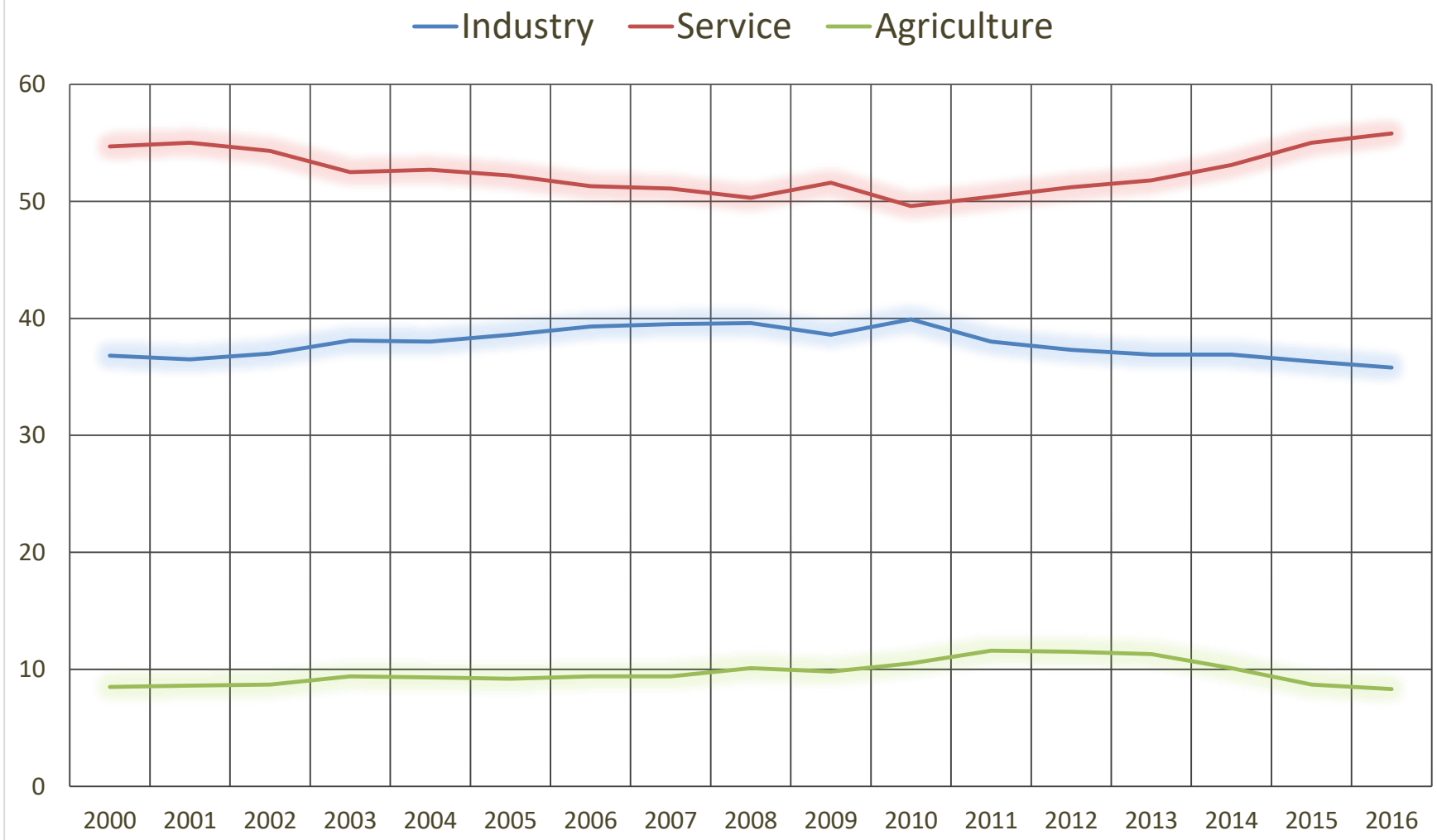


1. Thailand's output structure

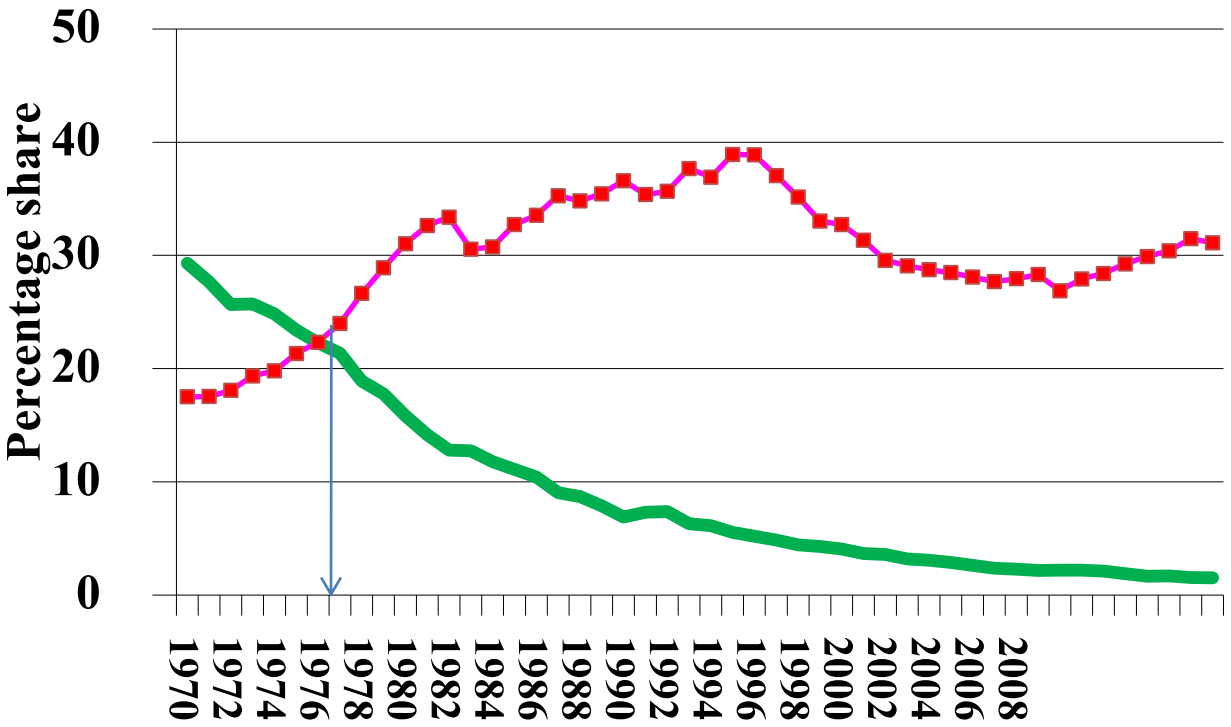


Source: Bank of Thailand, Quaterly Report

Thailand's Output Structure (% GDP)

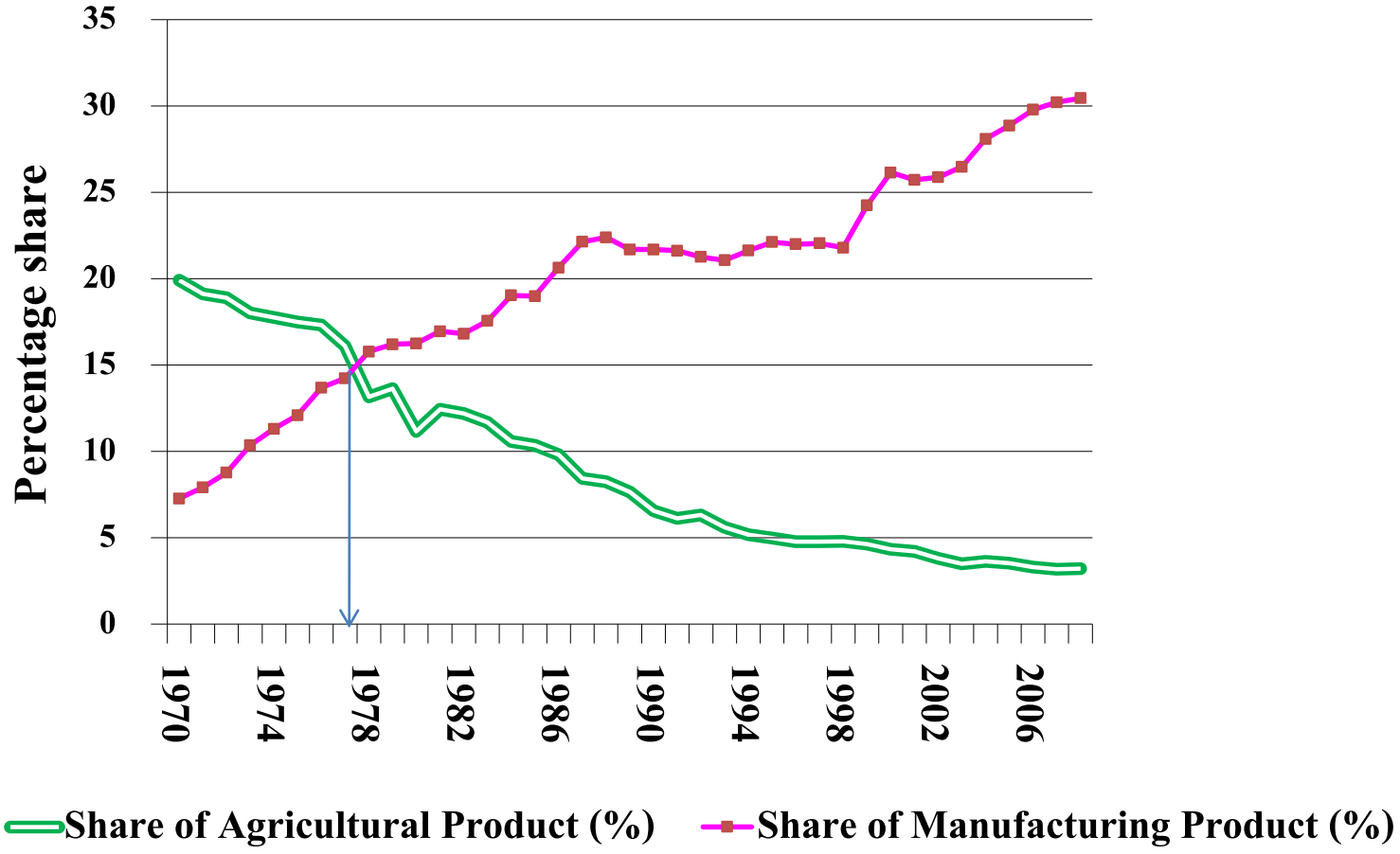


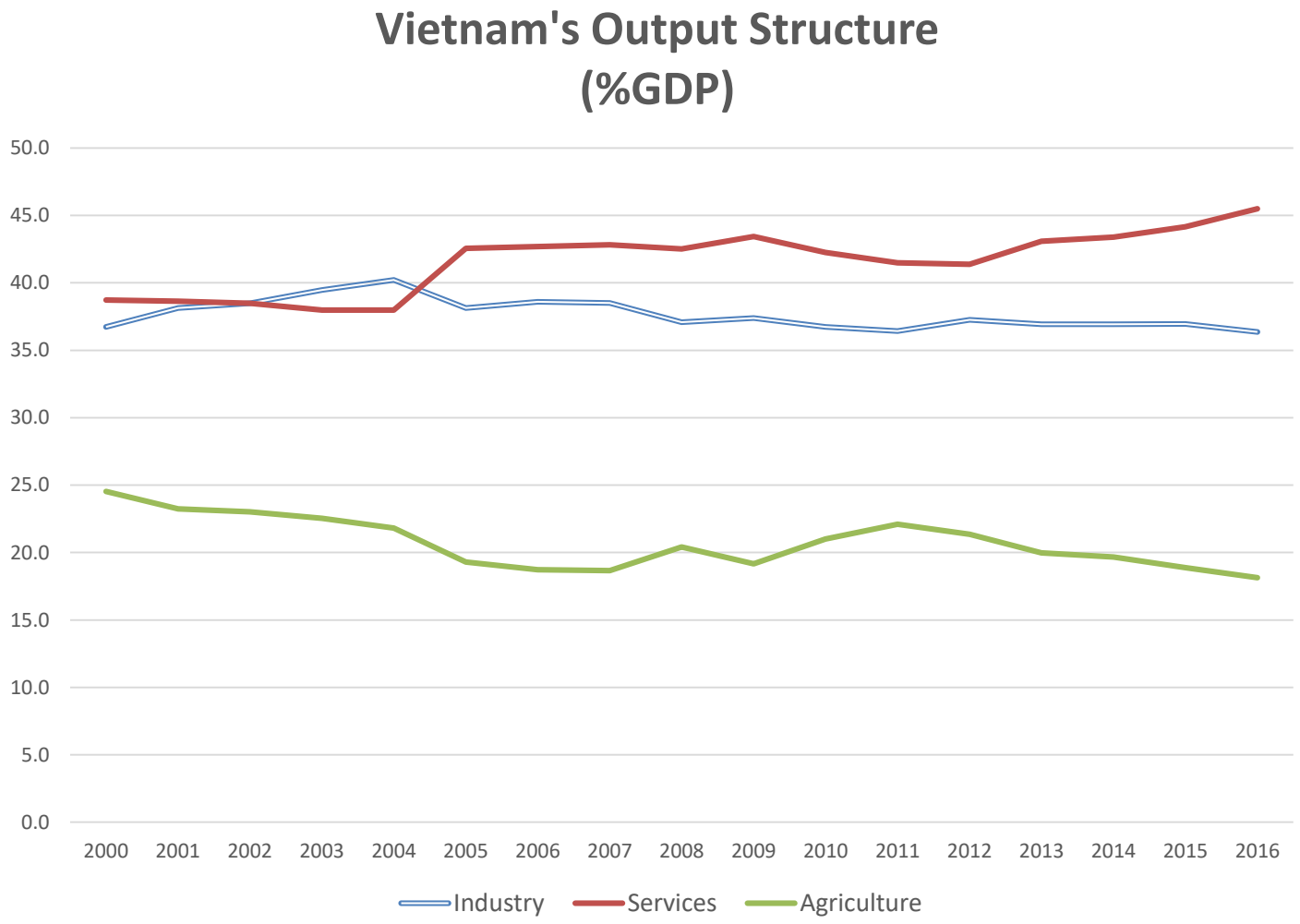
Taiwan

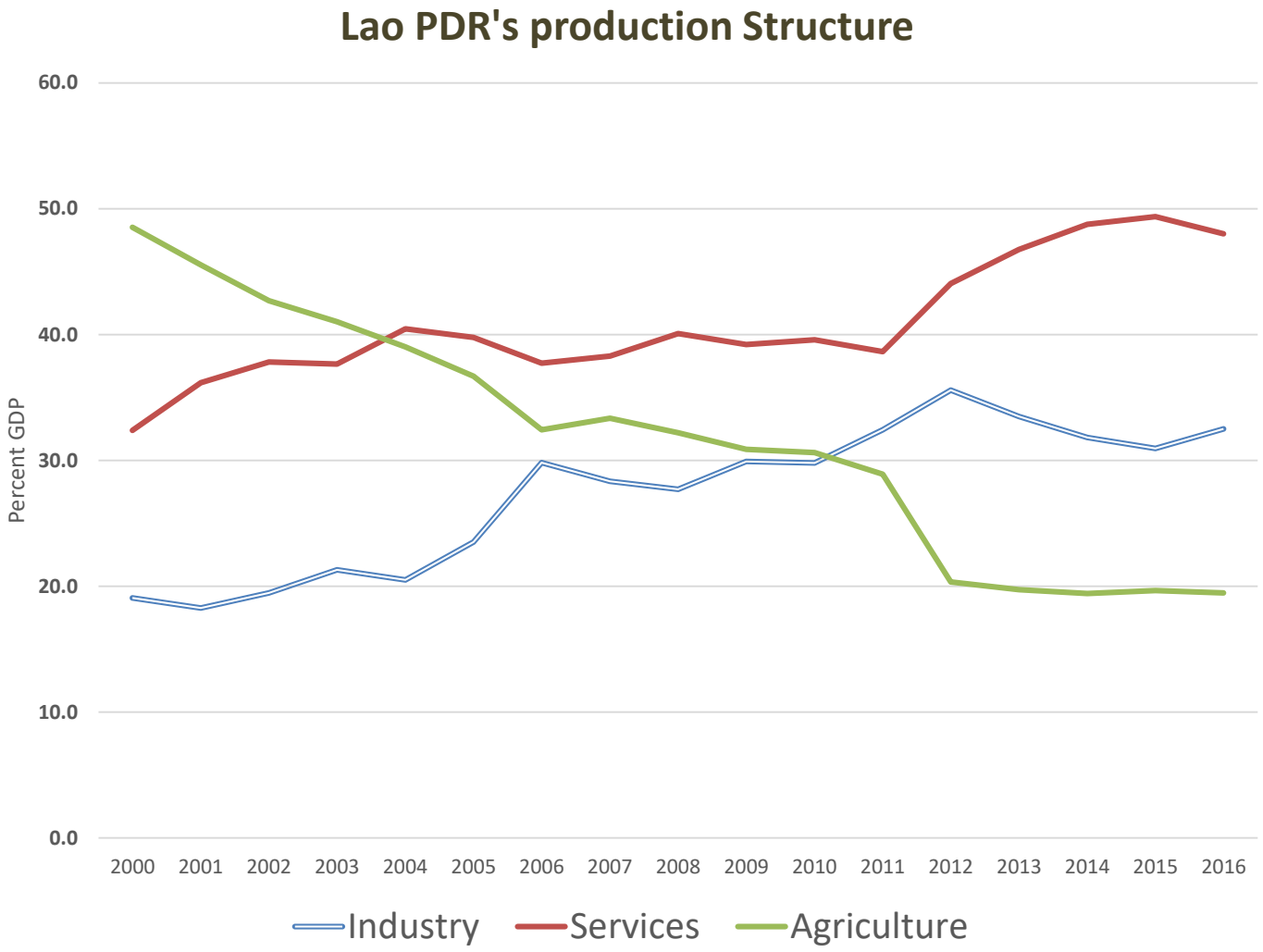


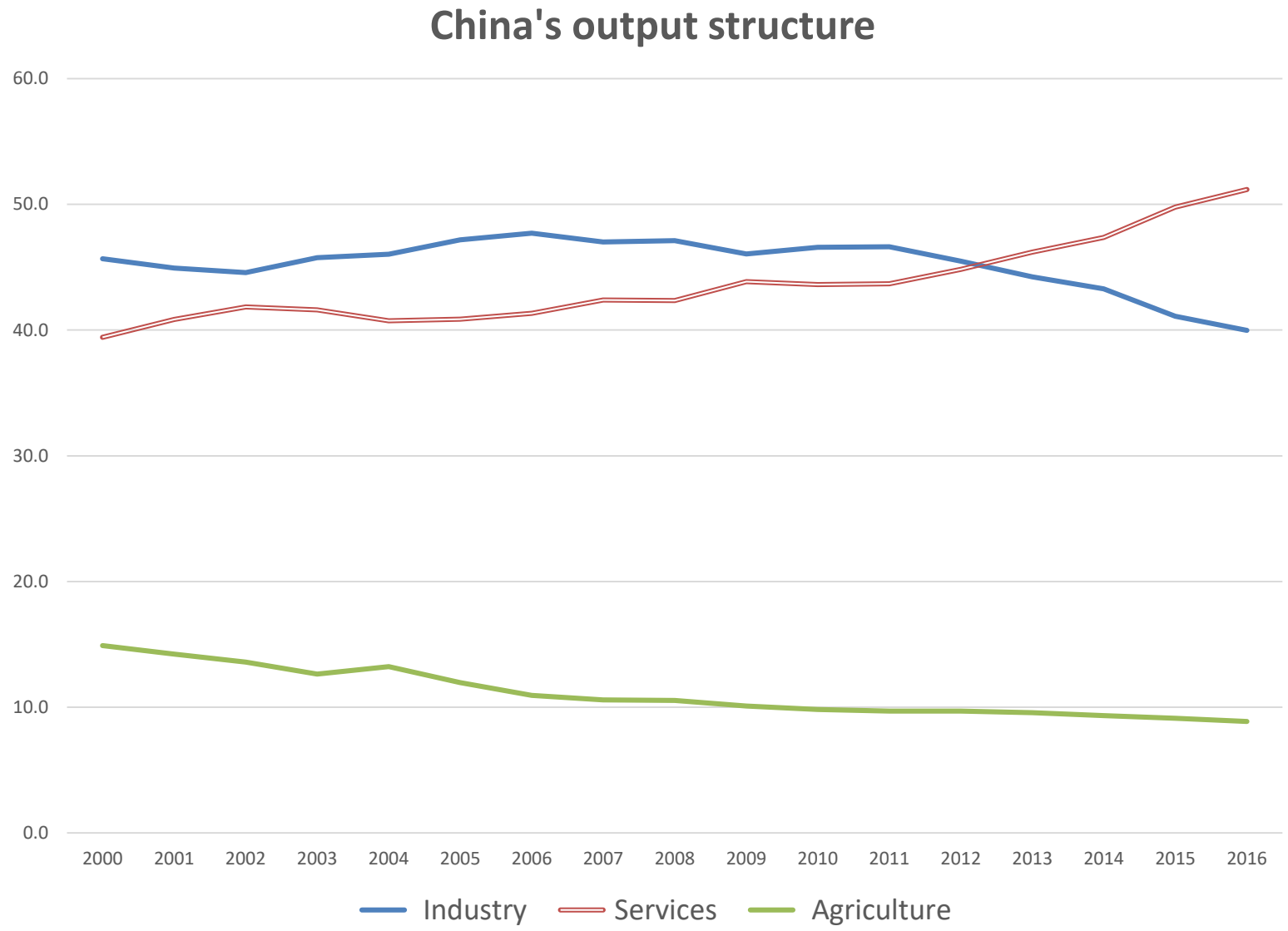
The cross-over point was experienced earlier in the four Asian Tigers

South Korea

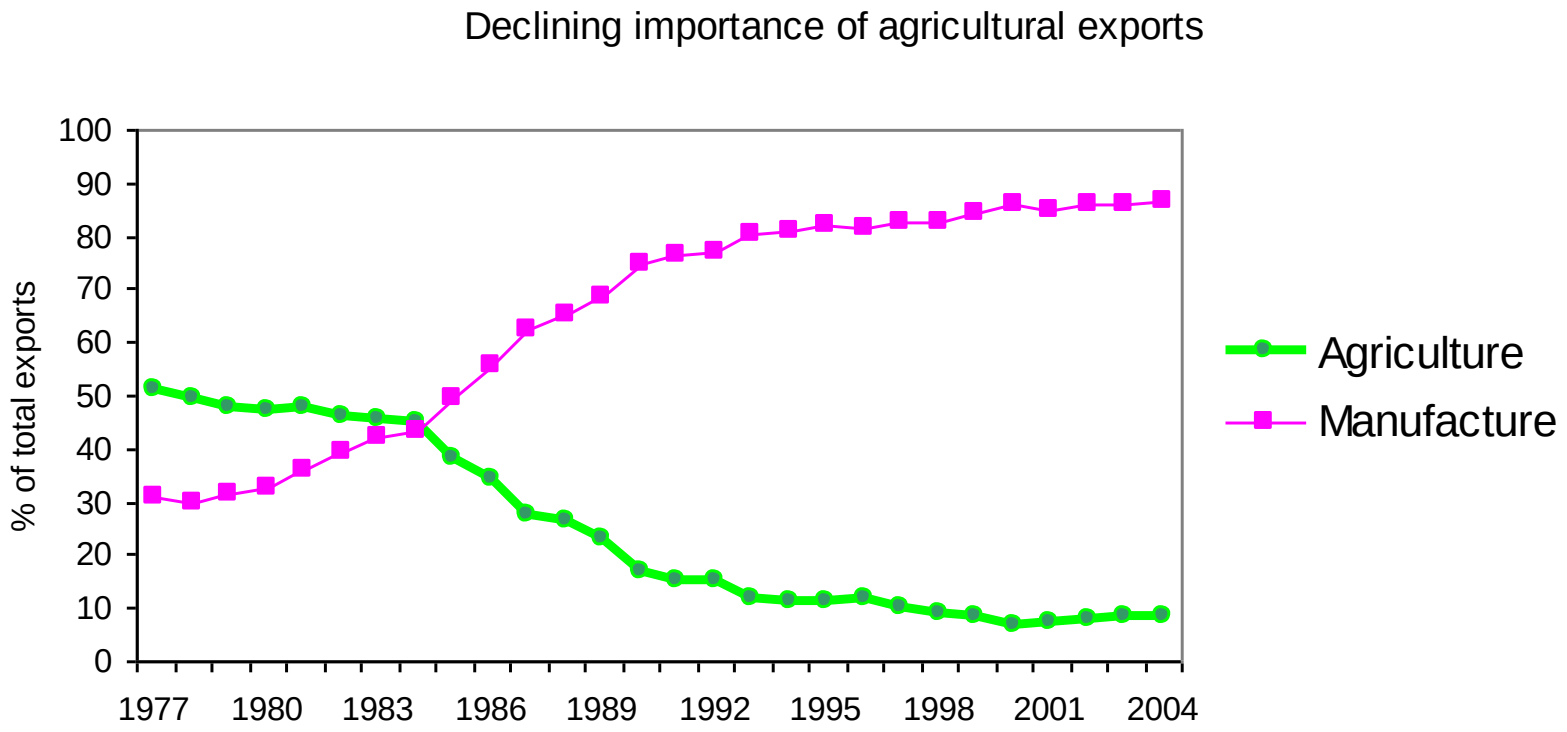

Percentage share
35
30
25
20
15
10
5
0
1970
1974
1978
1982
1986
1990
1994
1998
2002
2006
Share of Agricultural Product (%)
Share of Manufacturing Product (%)


Vietnam's Output Structure
(%GDP)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Industry
Services
Agriculture


Lao PDR's production Structure
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Percent GDP
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Industry
Services
Agriculture

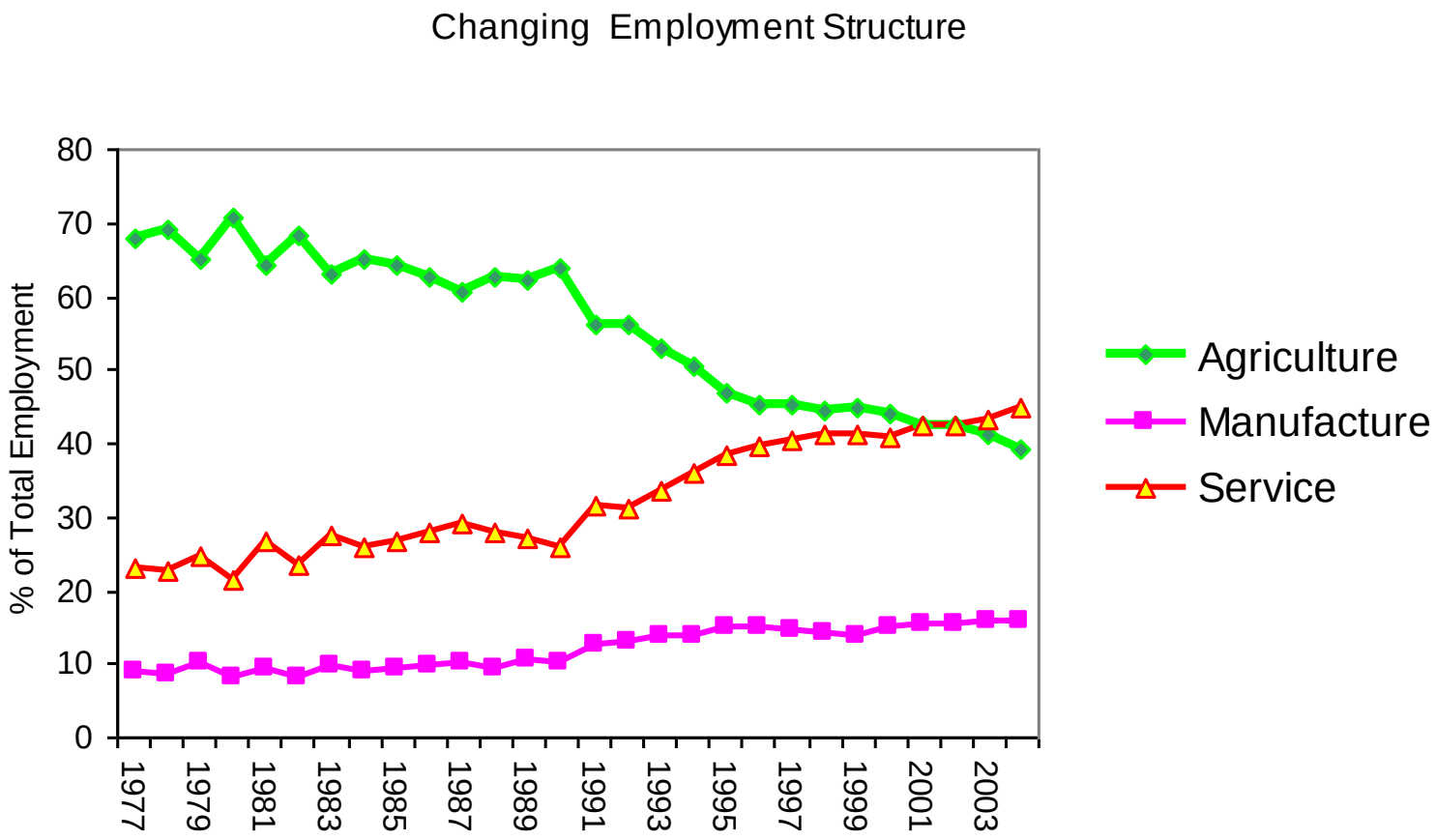

China's output structure
60.0
50.0
40.0
30.0
20.0
10.0
0.0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Industry
Services
Agriculture

2. Structure of Thailand's exports



Source: Bank of Thailand

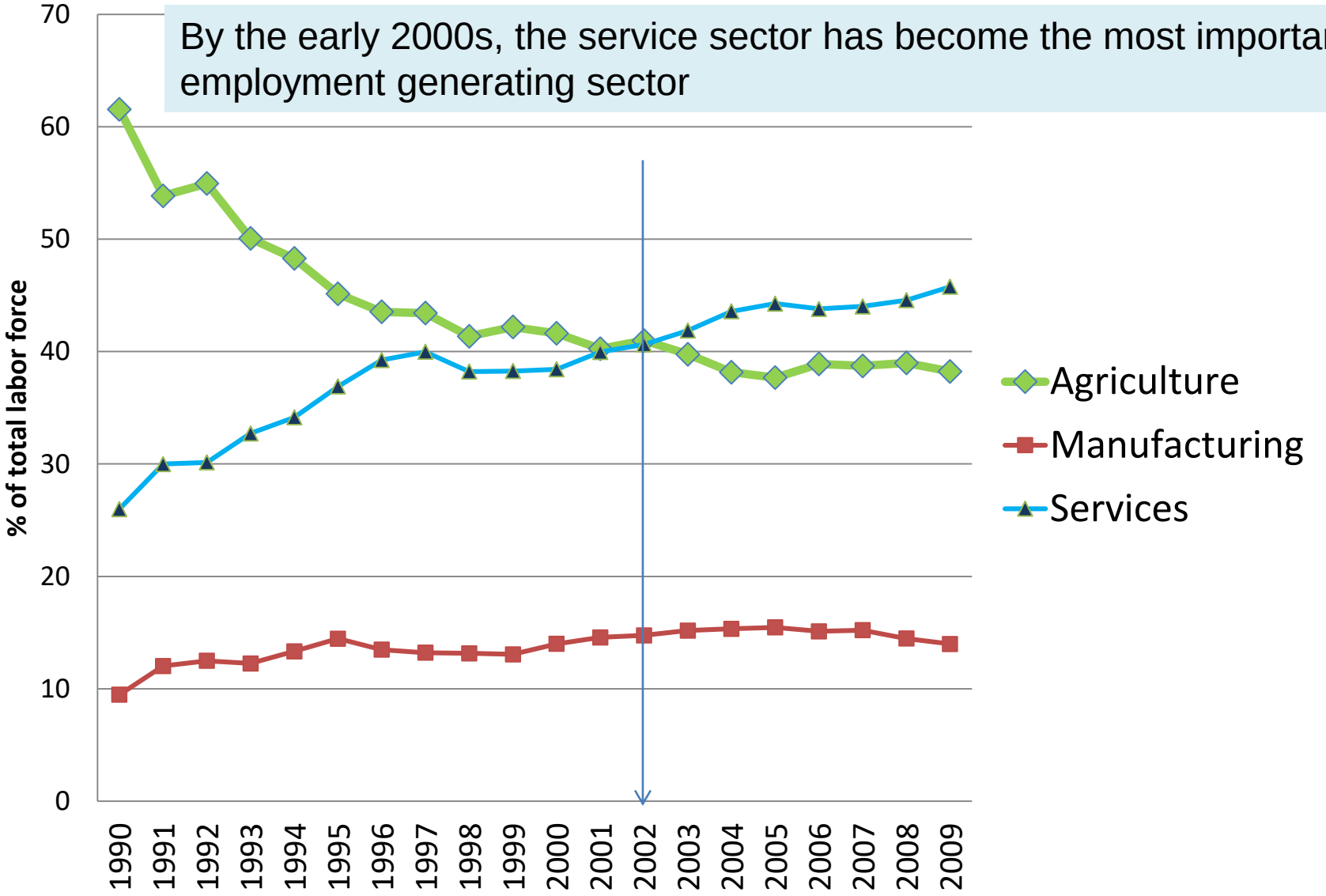
3. Employment Structure



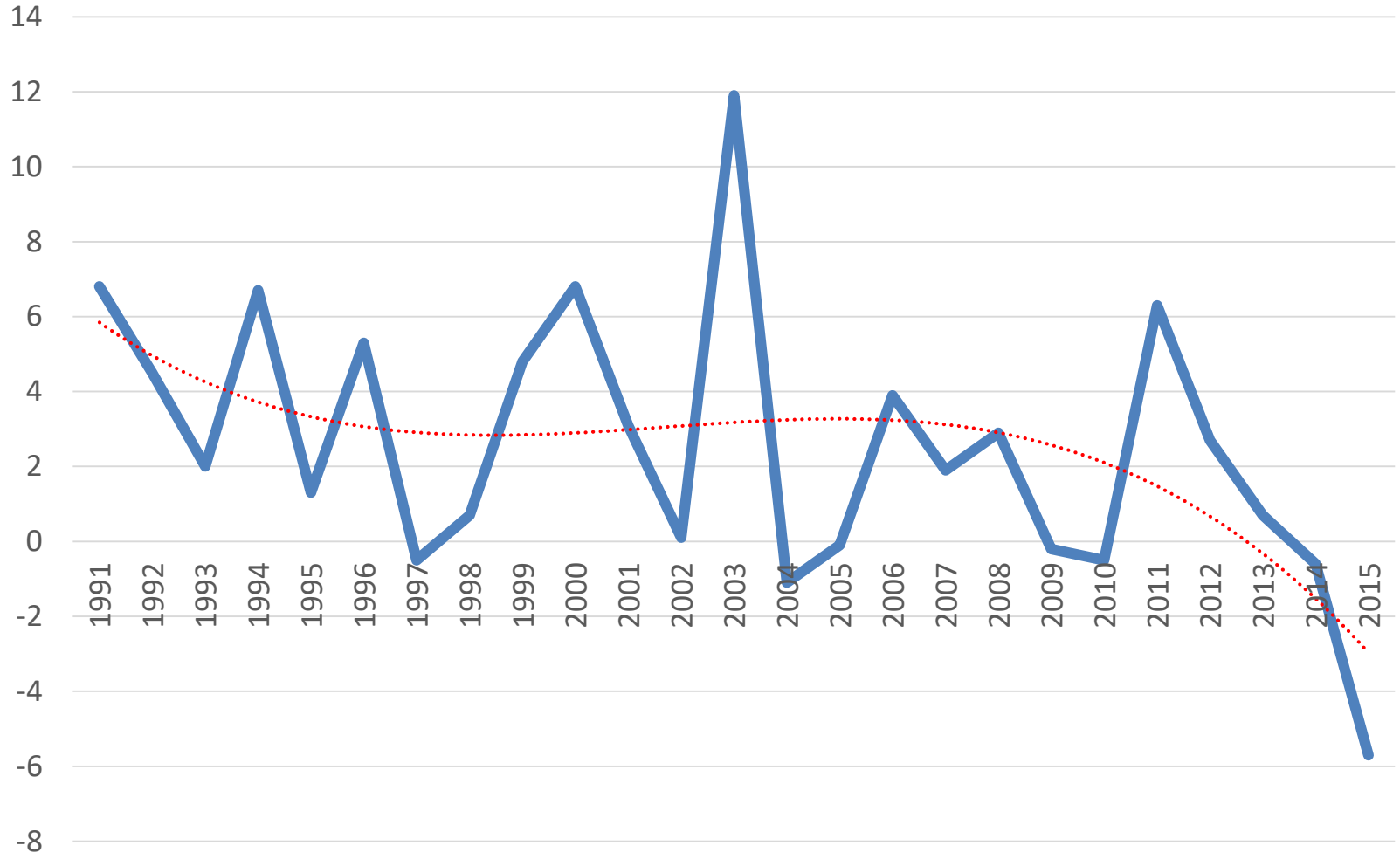
Source: Bank of Thailand

Thailand's Employment structure: 1990-2009

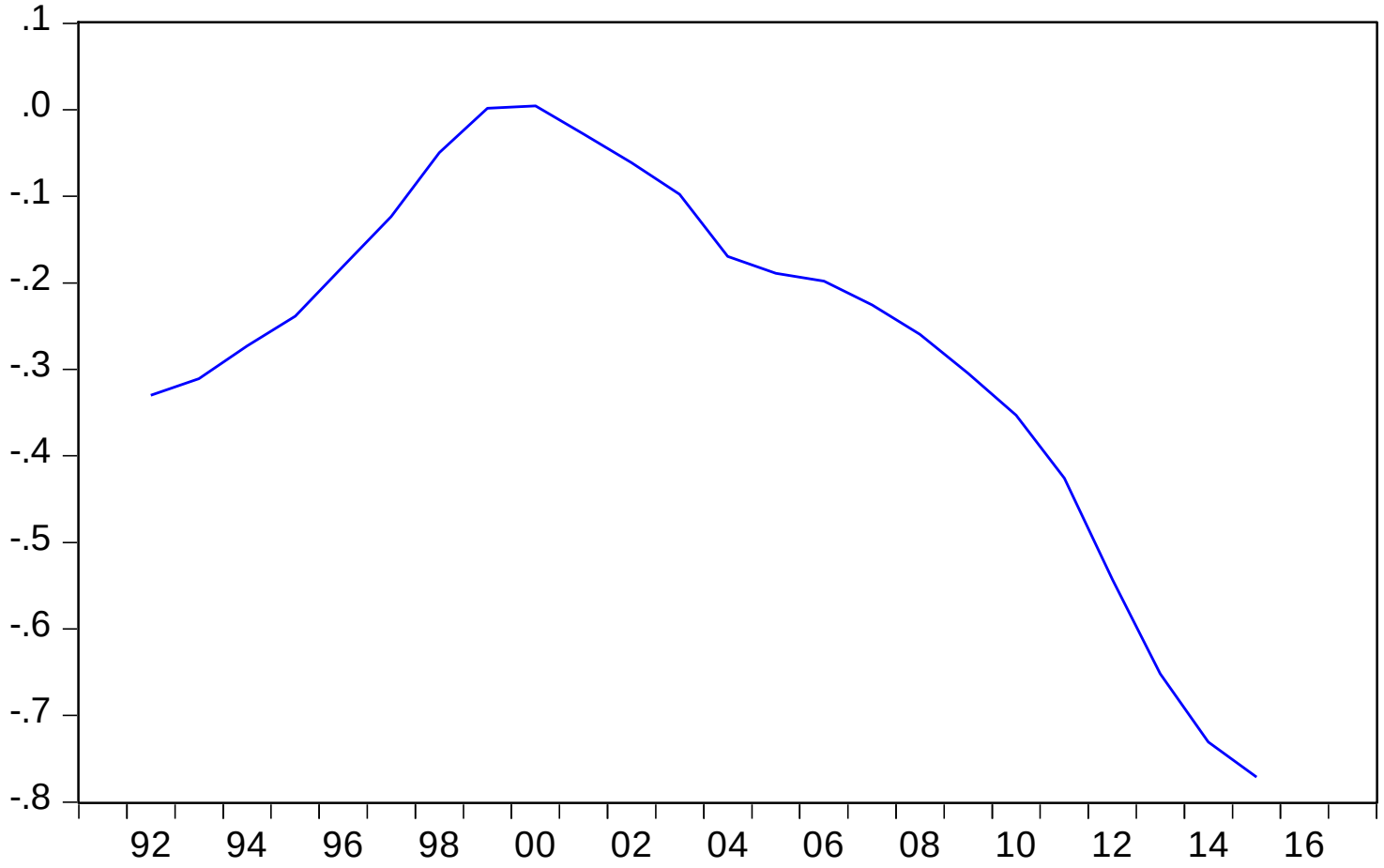
By the early 2000s, the service sector has become the most important employment generating sector



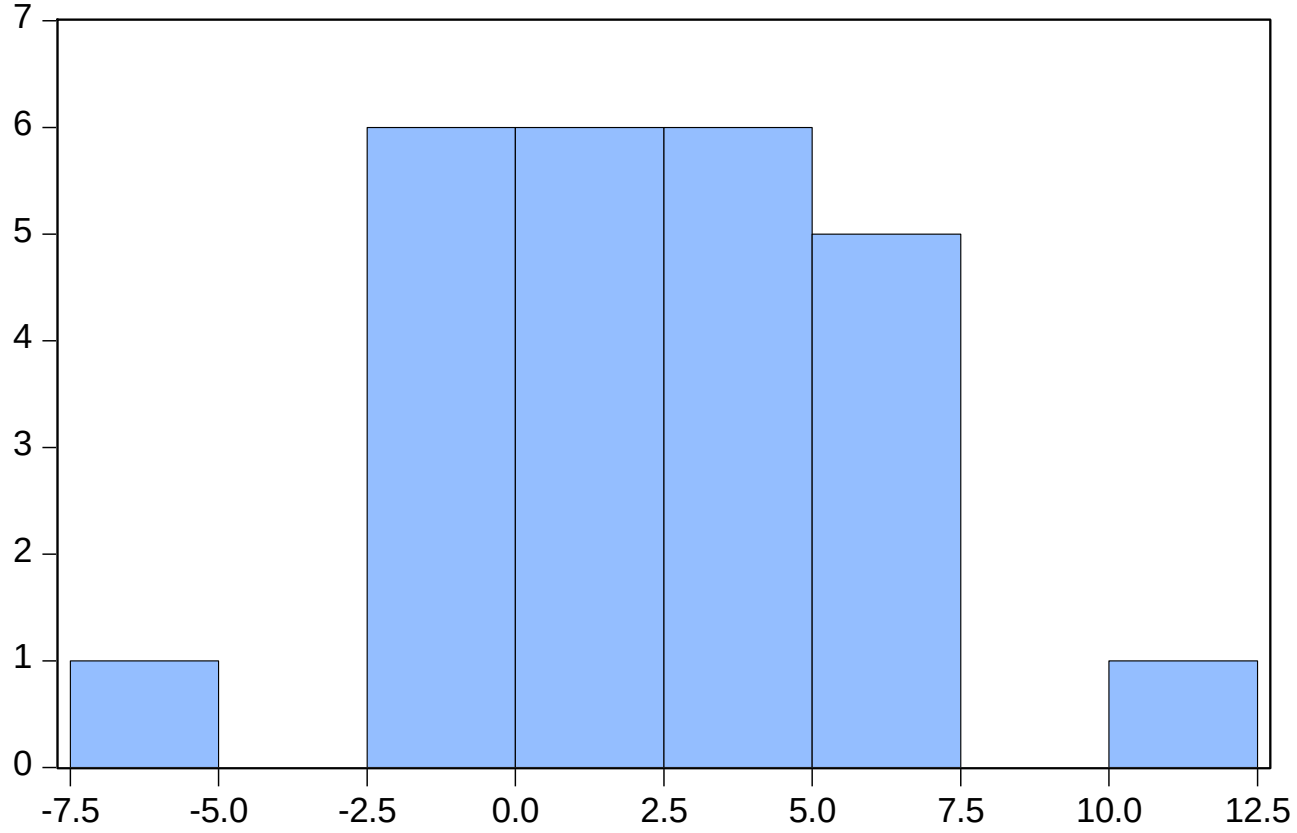
Agricultural Output: Annual Growth Rate



Changes in trend of agricultural output growth



Histogram and stats: Agricultural output growth rate



Series: GA	
Sample 1991 2017	
Observations 25	
Mean	2.548000
Median	2.000000
Maximum	11.90000
Minimum	-5.700000
Std. Dev.	3.612262
Skewness	0.335610
Kurtosis	3.605421
Jarque-Bera	0.851115
Probability	0.653405

A dismal view

- **“Thailand would lose comparative advantage in agriculture as manufacturing has increasingly become more important than agriculture”.**
- **“Due to the shortage of labor and water during the dry season, with the disappearance of land in the 1980s, the future of Thai agriculture would look bleak”.**
- **Ammar Siamwalla (1996) “Thai Agriculture: From engine of growth to sunset status”**

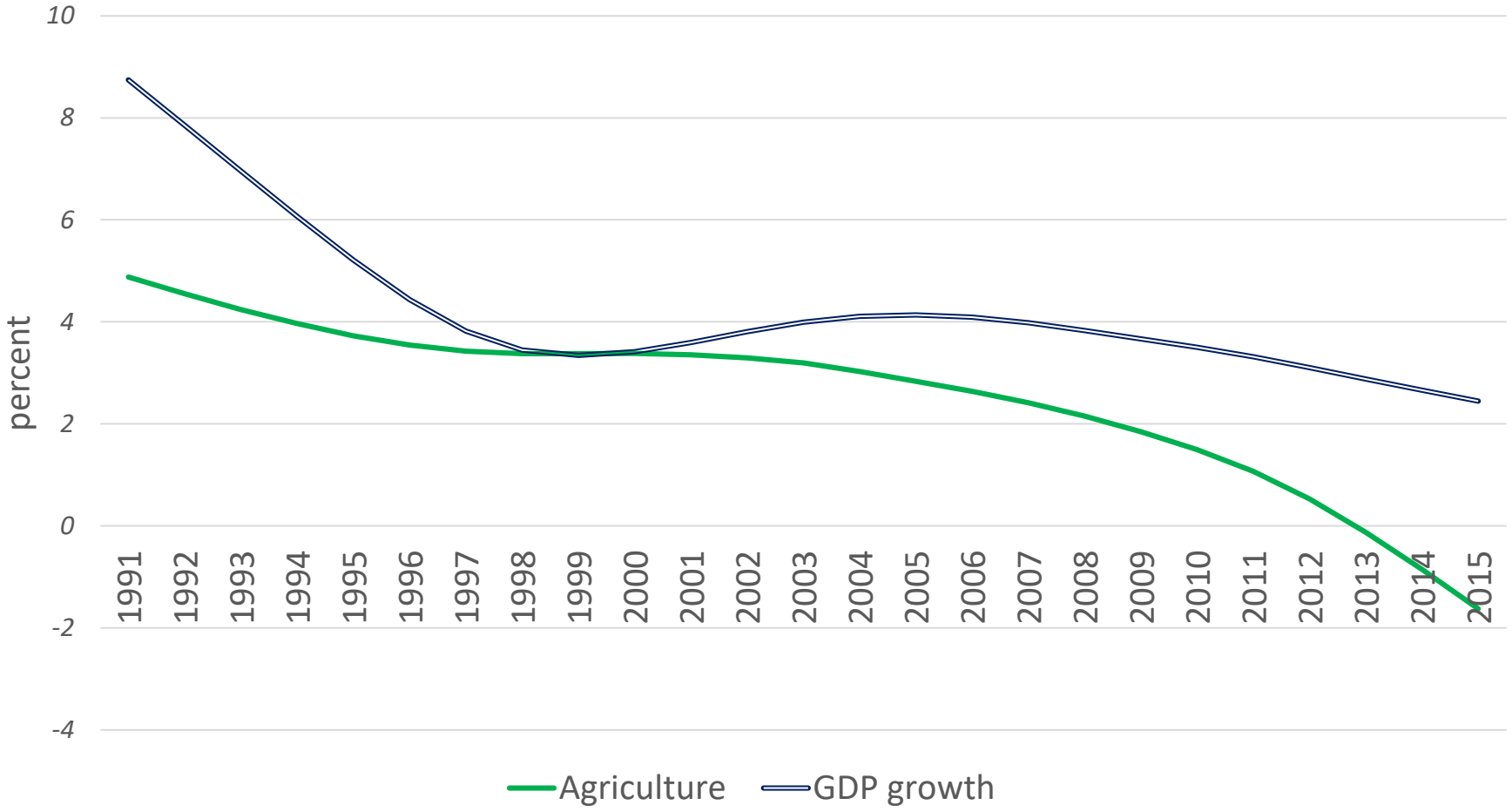
  Source: TDRI Quarterly Review Vol. 11, no.4

- *(Really? Does land matter that much?)*

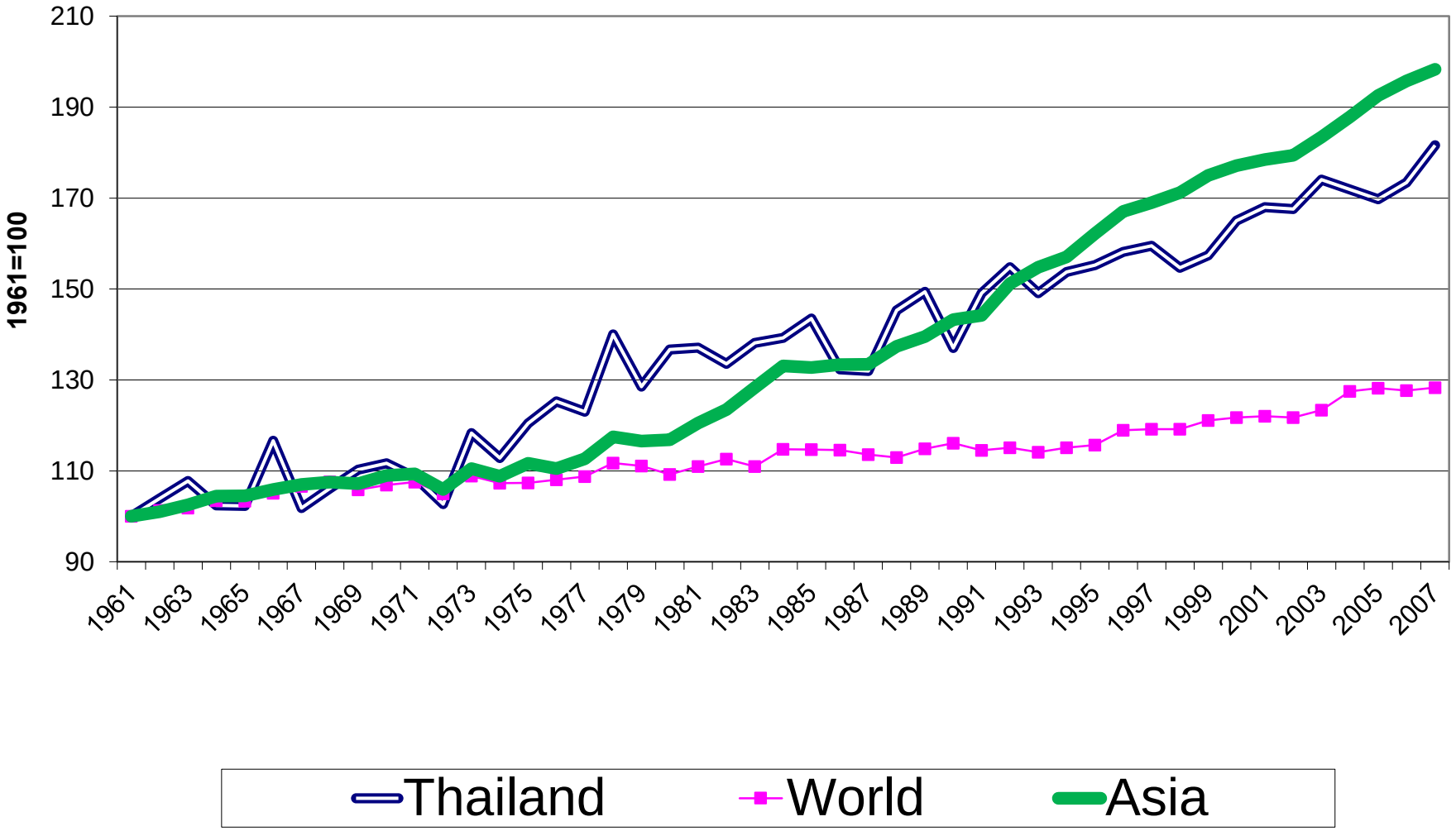
Blame the Dutch disease

- The boom in the non-agricultural sector led to higher wage rates in urban areas.
- Because of labor migration, the lack of labor ***intensified*** farm mechanization, which in turn diminished employment opportunities in agriculture.
- Wage pressure and declining agricultural prices squeezed farm profits, discouraging investment and further reducing agricultural growth.

Trend Growth Path
(excluding cyclical movement)



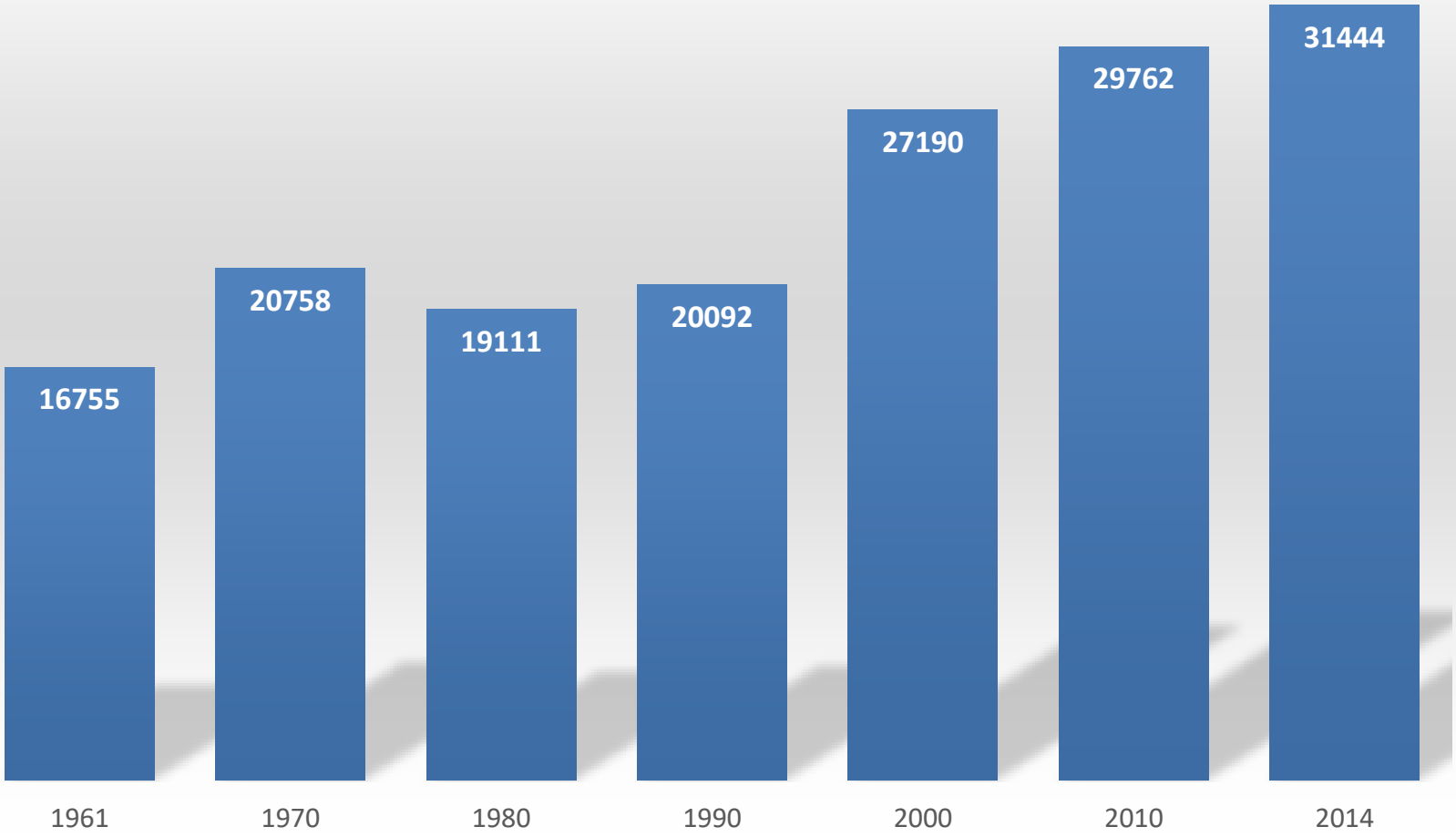
Agricultural Production per Capita Index



Thai agriculture over the last 50 years

- Per capita agricultural output in Thailand increased ***faster*** than the world average and industrialized countries.
- *The rapid **improvement** has become more pronounced since 2000s*.
- But Thailand still lags behind other countries in Asia, possibly due to the explosive growth of Chinese agriculture since 1970.
- There are still very large productivity gaps, though declining, between Thailand and developed countries.
- Given limited land for cultivation, the focus is on improving land productivity, which can be measured by average product of land (output in kg over hectare).

Cereals Yield (hg/ha)
Source: FAOSTAT



Why did rice farm productivity increase?

- Farm mechanization, fertilizer, and irrigation are responsible for such improvement.
- Large declines in imports of agricultural machinery can be attributed to large currency depreciations and expansion of domestic production of farm machinery.
- *How would the strong baht help or hurt Thai farmers?*

Factor Intensities

- Continued increases in factor intensities of farm input factors, which are complement to improvement in irrigation (e.g., water pumps, threshing machine, two-wheeled and four-wheeled tractors).
- The irrigated area as a percentage of arable land increased from 15 percent in 1960 to more than 30 percent in 2000.
- Improved High-Yielding Varieties (HYV) of rice also resulted in yield improvement.
- Irrigation made it possible for these input factors become complement to each other.

Martin, Will, and Devashish Mitra. "Productivity growth and convergence in agriculture versus manufacturing." Economic Development and Cultural Change 49.2 (2001): 403-422.

- **Employing panel data from** 50 countries **over the period 1967-92, Martin and Mitra found that productivity growth has been *higher for agriculture* than manufacturing sector in both industrial and developing countries.**
- **The shift *away* from agriculture in developing countries has been driven by higher productivity growth in agriculture.**
- Rapid accumulation of human capital contributed to a strong shift out of agricultural activities and into export-oriented manufacturing industry in East Asian economies."

We neglected agriculture at our peril

- **In Thailand, human and physical capital accumulation increased at a much faster pace in manufacture and urban areas than in agricultural rural areas.**
- **Foreign direct investment and capital inflows concentrated in the manufacturing and services sectors; thereby substantially raising capital-labor ratios in both sectors.**
- **Alas, FDI in agricultural sector has been insignificant, if any.**

Thus productivity increase in manufacture was *higher* than the increase in the agricultural sector--in particular prior to the financial crisis.

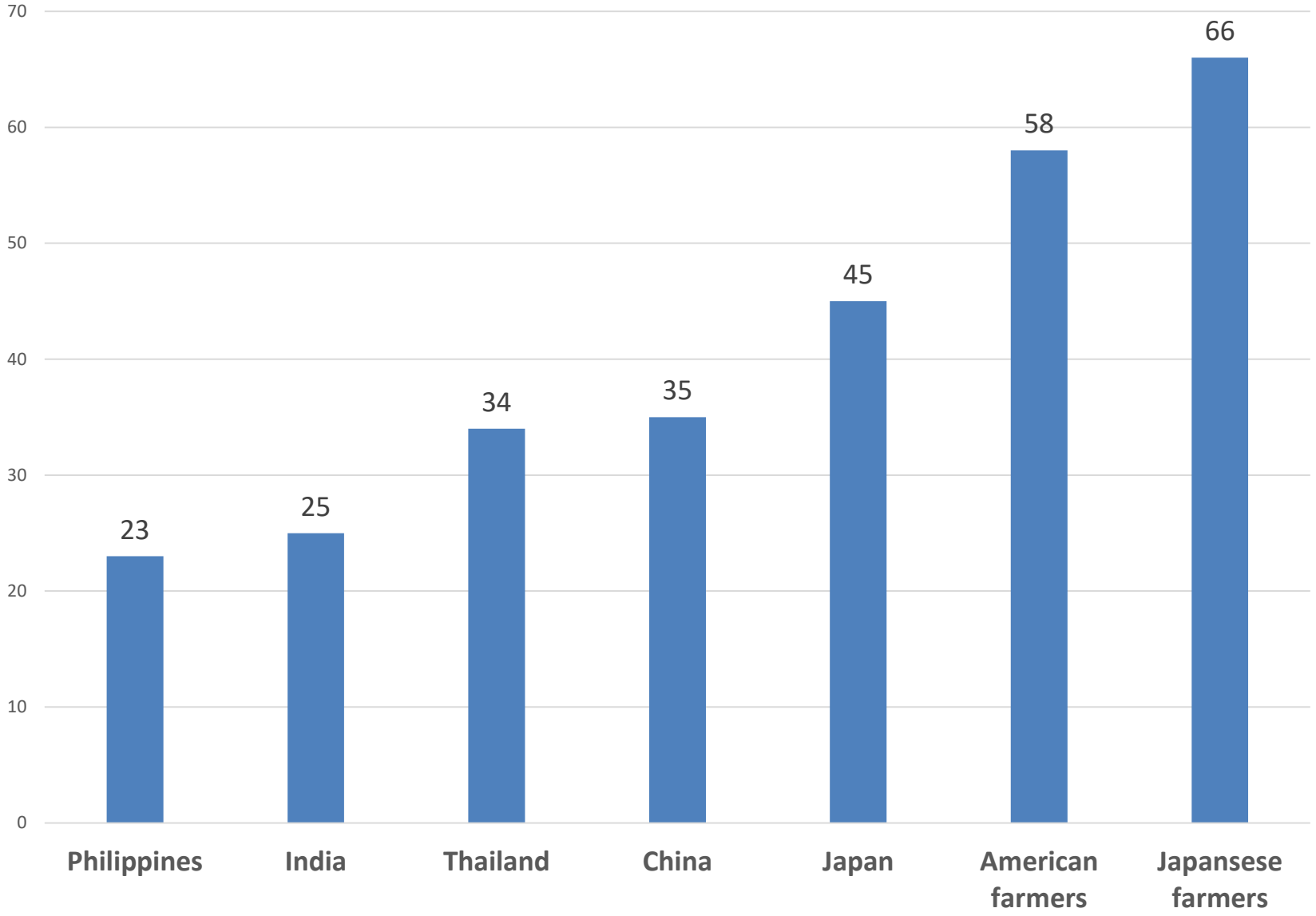
In general for both LDCs and developed countries

$$\left(MP_L\right)^a > \left(MP_L\right)^m$$

But in the case of Thailand

$$\left(MP_L\right)^a < \left(MP_L\right)^m$$

Comparative Median Age of Population



Why has the majority of Thailand's labor force remained in agriculture?

- From 1985 to 2003, the ratio of output per worker in manufacturing sector increased by eightfold, while the same ratio in the agricultural sector increased less than twofold.
- Productivity gap between the two sectors remains as large as before if not widening.
- High capital-labor ratio in the manufacturing sector implies limited capacity to generate employment.
- The shift out of the agricultural sector has been *painfully slow*.

Harvesting Time

- Harvesting was the critical labor period for small grains such as wheat, barley, or rice.
- For centuries it was extremely labor-intensive and needed to be done in a relatively brief period of time in order to save the crop from weather damage.
- Labor-saving techniques for harvesting came very late in history.
- There seems to have been ***no decrease in labor*** use during harvesting from at least the 14th century until early in the last century

Harvesting tools: The sickle and the scythe

- The reason was quite simple: the sickle remained the tool used to harvest grain.
- It was used in the United States well into the past century. The sickle coexisted with the scythe for some time, then was rapidly replaced by various forms of reapers, then by the binder, and in the current century by the combine.

Harvesting tools in modern time

- Prior to the binder, which became common only after the mid-19th century, the stalks of grain were collected into bundles by a time-consuming hand operation.
- The binder performed this function mechanically with a great saving in time.
- With the sickle, one man could harvest a third to a half an acre per day;
- The binder permitted a man with 2-4 horses to harvest 8-18 acres per day, a reduction in labor requirements of 90 percent.

Thailand's Agricultural Sector vs Manufacturing: Capital-Labor Ratio

$$\left(\frac{K}{L}\right)^{a} < \left(\frac{K}{L}\right)^{m}$$

John Deere Combine 9870 STS with 625D

A John Deere Titan series unloading corn

Smart Farming

binder Products for Agriculture

The Agricultural Industry has changed. We focus on designing the most robust connector to withstand some of the harshest environments for agricultural applications. Today farming has become "smart" farming, allocating sensory information to computers making sure every measurement is accurate. Our M9, M16, and M12 connectors are designed and built to withstand rugged environments and ensure reliable weather-proof connections.

Capital-Labor ratio in Agriculture in Developed Countries is higher than manufacturing's

$$\left(\frac{K}{L}\right)^{a} > \left(\frac{K}{L}\right)^{m}$$

Johnson, D. Gale. World agriculture in disarray, 2nd Ed. London: Macmillan, 1991.

- According to Dale Johnson (1991), American agriculture has a capital-labor ratio that is six times the ratio in manufacturing.

$$\left(\frac{K}{L}\right)^{a} > \left(\frac{K}{L}\right)^{m}$$

- Agriculture in developed countries are *more* capital intensive than developing countries.

- Thai agricultural labors are deprived of vital inputs: water, fertilizer, machinery, and irrigation
- Output per land and output per farmer is very low.
- Productivity also differs due to high yielding varieties of rice strains.

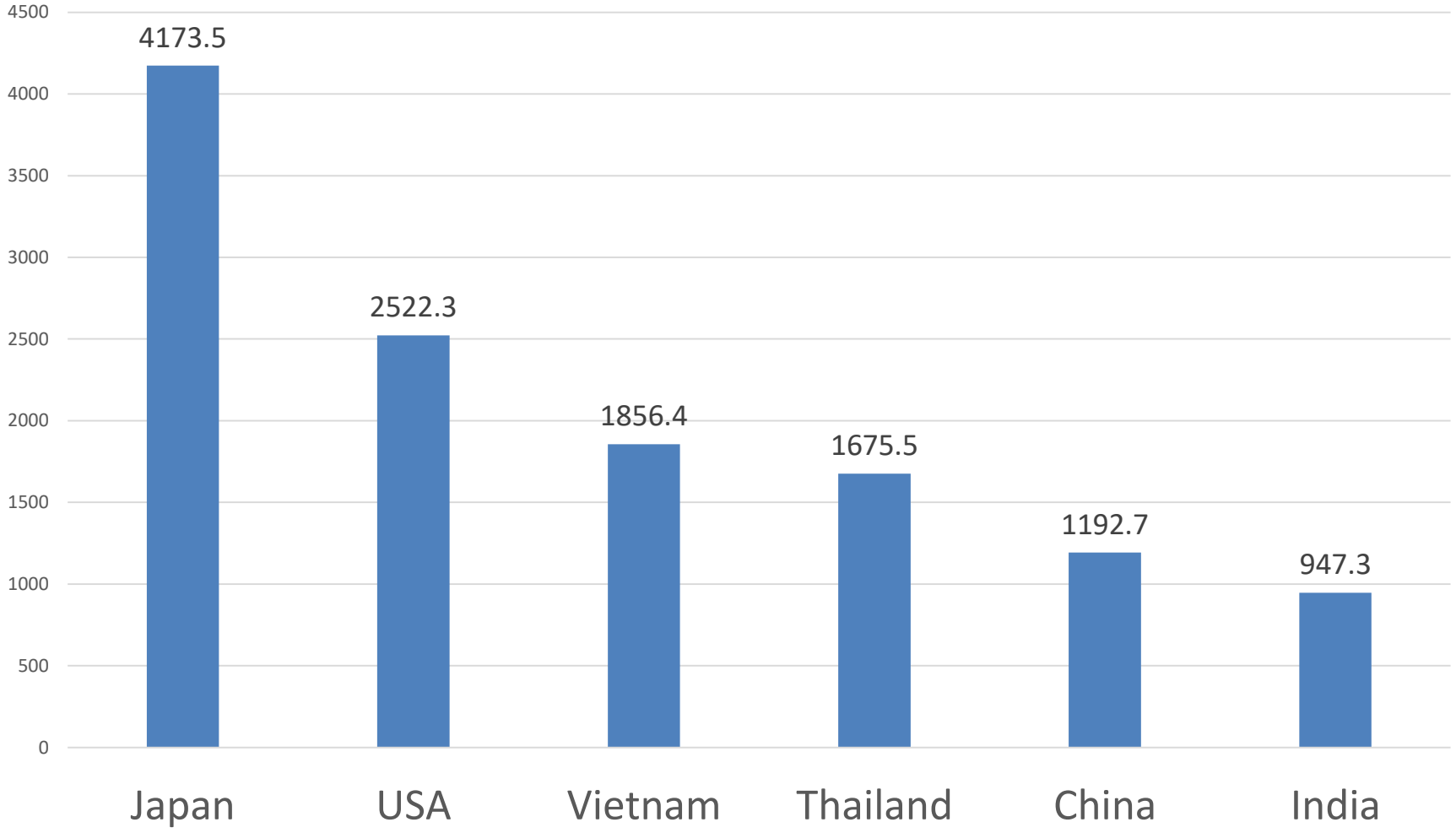
Johnson, D. Gale. "Agriculture and the Wealth of Nations." *The American economic review* 87.2 (1997): 1-12

- Evidence of agriculture's role in contributing to the wealth of nations is found in data on productivity change.
- Labor productivity growth in agriculture has been greater than in the other sectors of the economies in the industrial countries.
- This was especially true during the postwar period up to 1980. From 1967-1968 to 1983-1984, for 17 of 18 industrial countries for which there were data on changes in GDP in constant prices, labor productivity growth in agriculture exceeded that in other sectors.

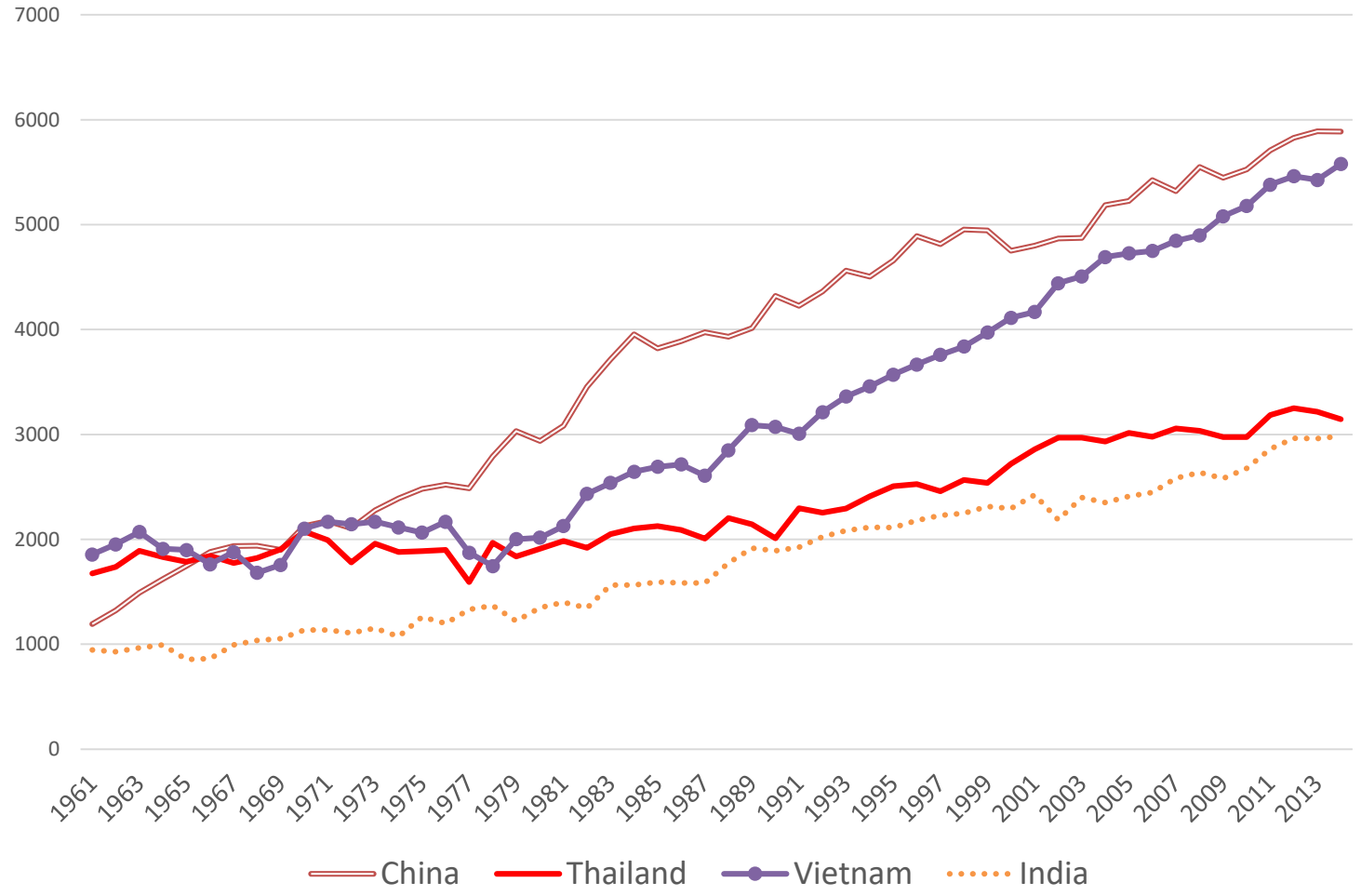
Johnson, D. Gale. "Agriculture and the Wealth of Nations." *The American economic review* 87.2 (1997): 1-12.

- Much of the concern over future world food supplies is based on the assumption that land is the limiting resource.
- This is putting the emphasis in the wrong place.
- The major factors that may limit the growth of food production in developing countries are:
- Knowledge and research, the availability of nonfarm inputs at reasonable prices, and the governmental policies that affect incentives.
- If policies provide for the first two and do not discriminate against agriculture in trade and macroeconomic policies, farmers will do the rest.

Cereal yield (kg per hectare): 1961



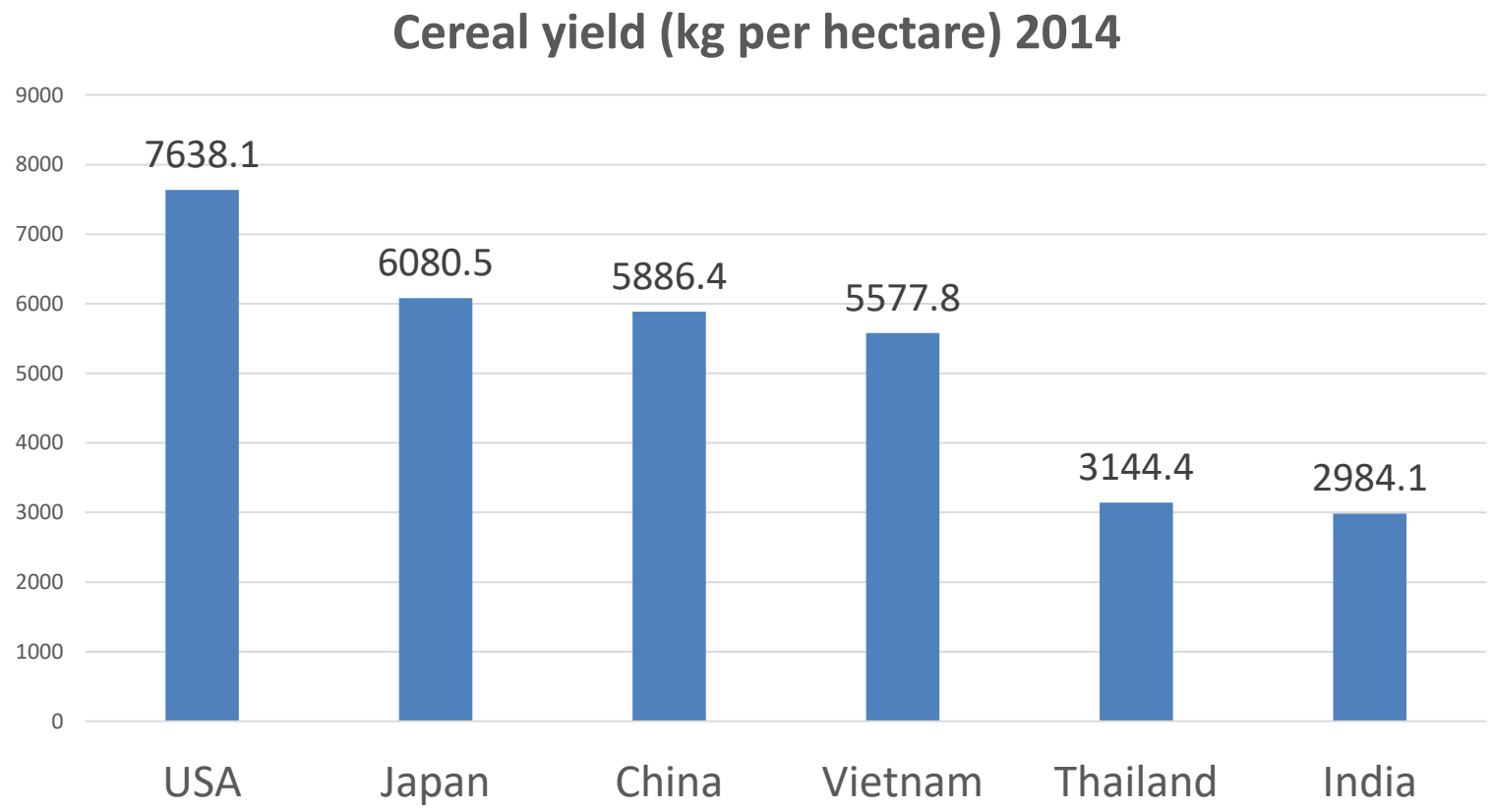
Cereal yield (kg per hectare)
Source: World Bank



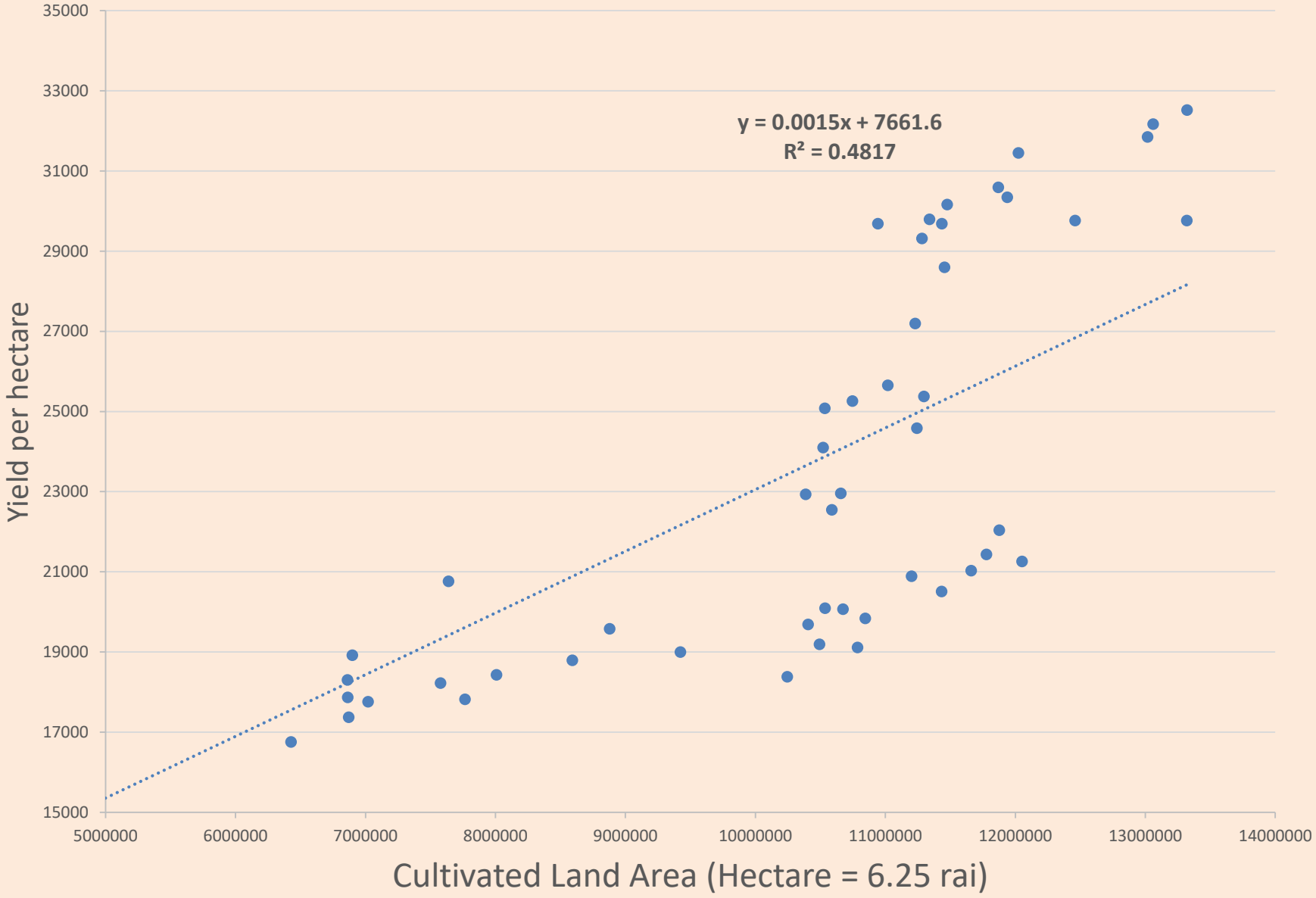
China's super rice: Knowledge and Research

- The new Chinese rice breed yields 1,000 kg per rai (0.16 hectare).
- China's *super rice* breed yields 2,000 kg per rai.
- Thai farmers harvest only 400kg per rai.
- "*Pathum Thani* 1" one of the best cross-breeds yields only 500kg per rai.
- Since investment in new breeds leads to falling price, which might spark protests, the government was reluctant to invest in rice growing (What an excuse!)

Thailand's Farm productivity has remained comparatively low on international standard



Thailand's Productivity of Cereals (1961-2016)



History of Irrigation in Thailand

- By the mid-1800s, a number of canals had been constructed in the central plain to carry floodwaters from the Chao Phraya, and in the latter half of the century other canals were dug.
- The canals did not form a controlled irrigation system, however, but simply a distribution net, and whether additional water could be made available depended on the level of the rivers.
- Records covering almost a hundred years to 1930 showed that in about one-third of the years water from the rivers was insufficient, resulting in considerable crop losses.
- In 1902 the government contracted with a Dutch expert to develop a controlled irrigation plan for the entire country but failed to take further action.
- Droughts in 1910 and 1911 led to renewed interest and the hiring of a British irrigation specialist. Nevertheless, the first irrigation project was not completed until 1922.

Learn from the past mistakes

- By 1938 about 440,000 hectares had been irrigated. Supply problems held up projects during World War II, but work resumed with renewed vigor in the late 1940s. By 1950 the irrigated area totaled nearly 650,000 hectares.
- In 1950 Thailand secured the first of *a series of loans from the World Bank* for the construction of the vital Chainant Diversion Dam on the Chao Phraya and a number of major canals.
- By 1960 over 1.5 million hectares had been irrigated, almost entirely in the Center and in the North.

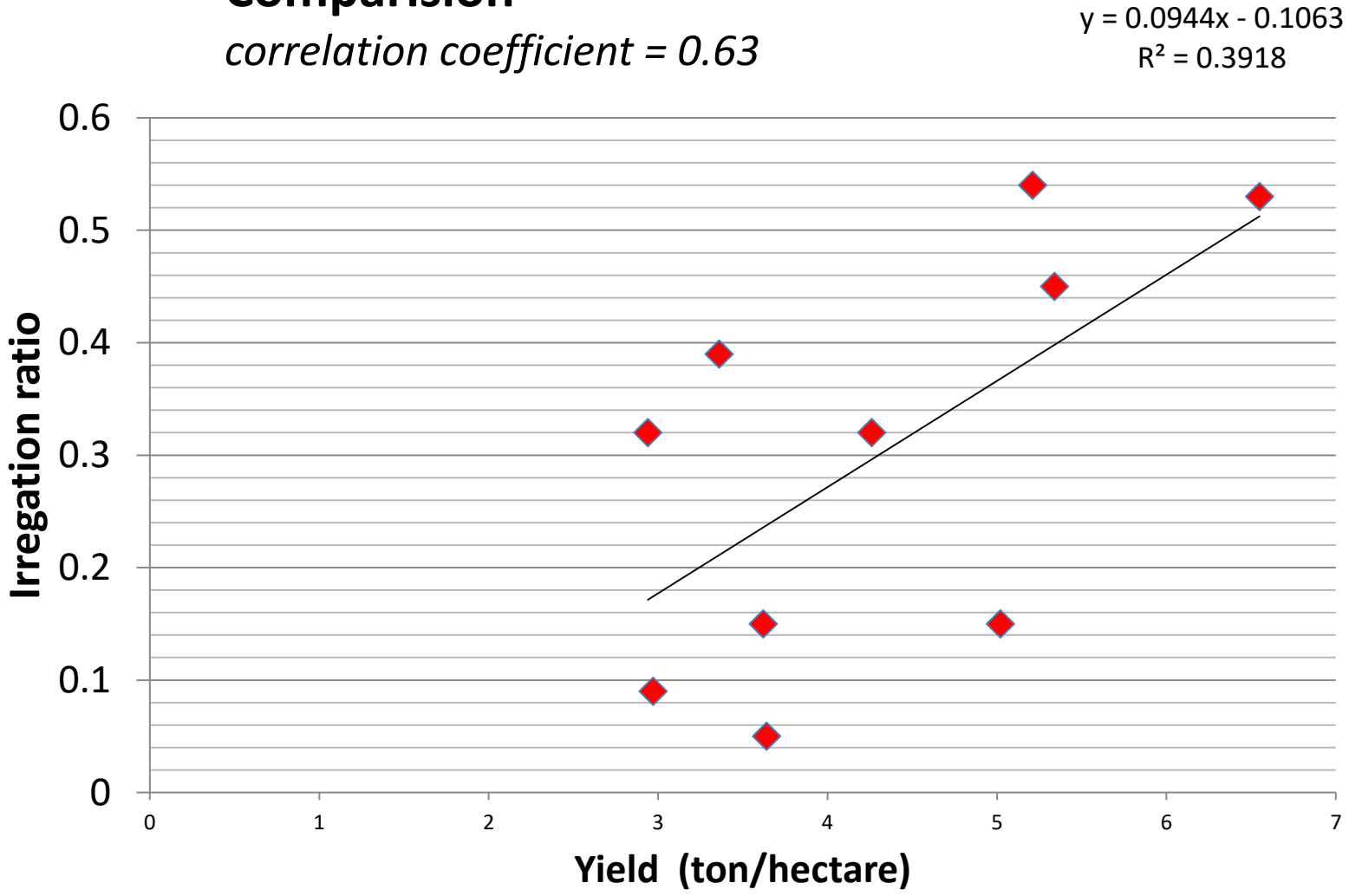
Hydroelectric power-generating dams

- Systematic development of the irrigation system began with the First Economic Development Plan (1961-66) and was continued in later plans.
- New assistance from the World Bank included financing of the important multipurpose Phumiphon (Bhumibol) Dam (completed in 1964) on the Mae Nam Ping and the Sirikit Dam (completed in 1973) on the Mae Nam Nan.
- These dams, both of which have associated hydroelectric power-generating facilities, impound water at two large reservoir locations in the Chao Phraya Basin.
- Other World Bank-financed projects were also carried out in this basin during the 1970s, and by the end of the decade nearly 1.3 million hectares had controlled water flow in the rainy season, and about 450,000 hectares had it in the dry season.

	Yield(ton/hectare)	Irrigation ratio
Myanmar	3.64	0.05
Cambodia	2.97	0.09
Indonesia	5.02	0.15
Philippines	3.62	0.15
South Korea	4.26	0.32
Thailand	2.94	0.32
India	3.36	0.39
Vietnam	5.34	0.45
China	6.55	0.53
Japan	5.21	0.54

Rice yeild and irregation: International Comparision

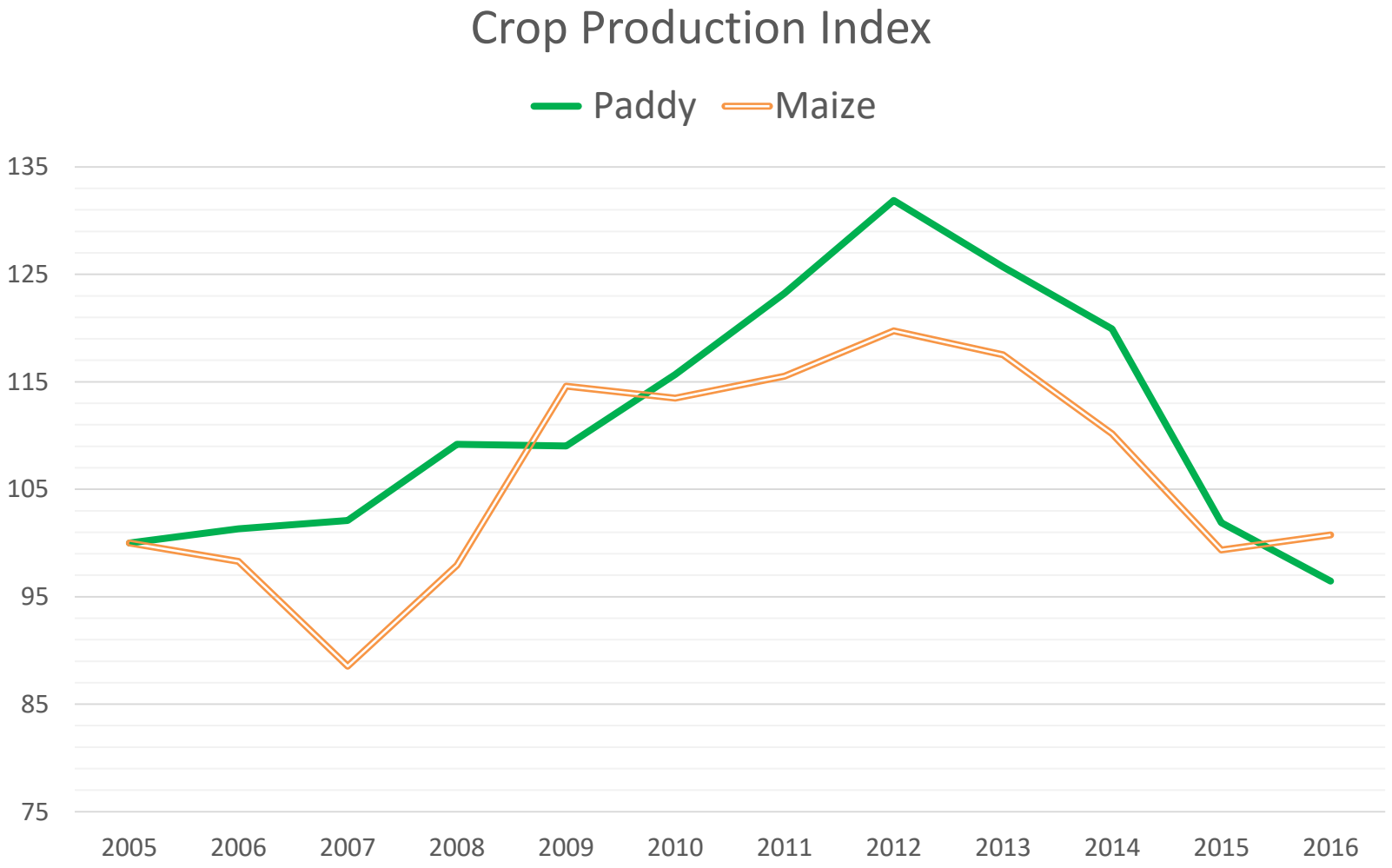
correlation coefficient = 0.63



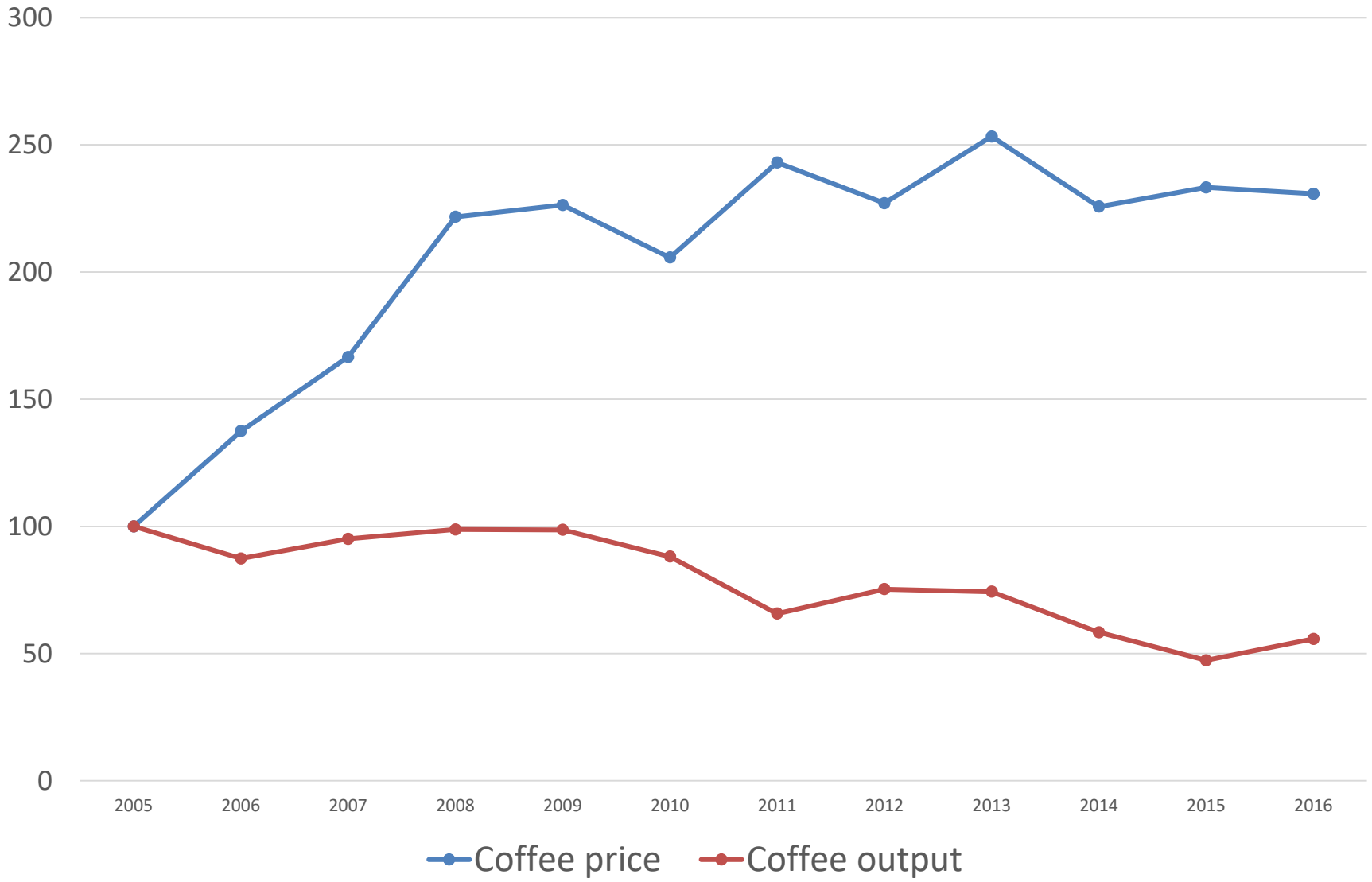
Heterogenous Production Functions

- Public investment in irrigation is required to reduce the number of rain-fed farming.
- Productivity of irrigated farm is higher by water supply which is required by new high yielding varieties.
- Different rice farming technology implies different production function and capital-labor ratio, which is rising as farmers are ageing.

Changing Crop Production



Missed Opportunity?: Coffee



Conclusion: changing crop patterns

- Agricultural output changes in response to price incentives, which can be affected by government subsidies and external factors.
- The force of competition ensures that only cost effective commodities can survive.
- Rising cost of production and changing demand pattern can be detrimental to the export commodities.
- Market intervention by the government is costly, inefficient, and disruptive due to distorted incentives.

Schultz: Transforming Traditional Agriculture

- Schultz warned numerous governments that accepted the conventional wisdom that there was surplus labor in agriculture that could be withdrawn at little or no cost to provide labor for the development of industry, which was claimed to be the real engine of economic growth.
- Governments throughout the developing world continued to exploit agriculture through export taxes, price controls, and protection of the agricultural input sectors.
- This exploitation generally persisted until well into the 1980's. (Thailand abolished rice premium export tax in the 1970s)
- The history of that exploitation fully justifies the position taken by Smith, namely, that agriculture should not be discriminated against.