

Global Food Policy and Food Security Symposium Series

China's Agricultural Development and Policies: Are There Lessons for Africa and Other Developing Countries?

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Stanford University

China's Agricultural Development and Policies:

**Are There Lessons for Africa
and Other Developing Countries?**

Scott Rozelle, Stanford University

Jikun Huang, Chinese Academy of Sciences

What is the ultimate goal of
Development / Growth?

What is the ultimate goal of
Development / Growth?

Become a modern, rich,
industrialized nation

But, it starts with agriculture

Schultz / Mellor and Johnston / Others

- Agriculture provides income for farm households:
 - To build housing
 - To invest in education for kids
 - To finance move off the farm (and move into the city)
 - For starting self-employed enterprises
 - It is a source of demand ... in the early stages of industrialization

What has African agriculture (until recently)
looked like over the past three decades?

Almost no agricultural growth

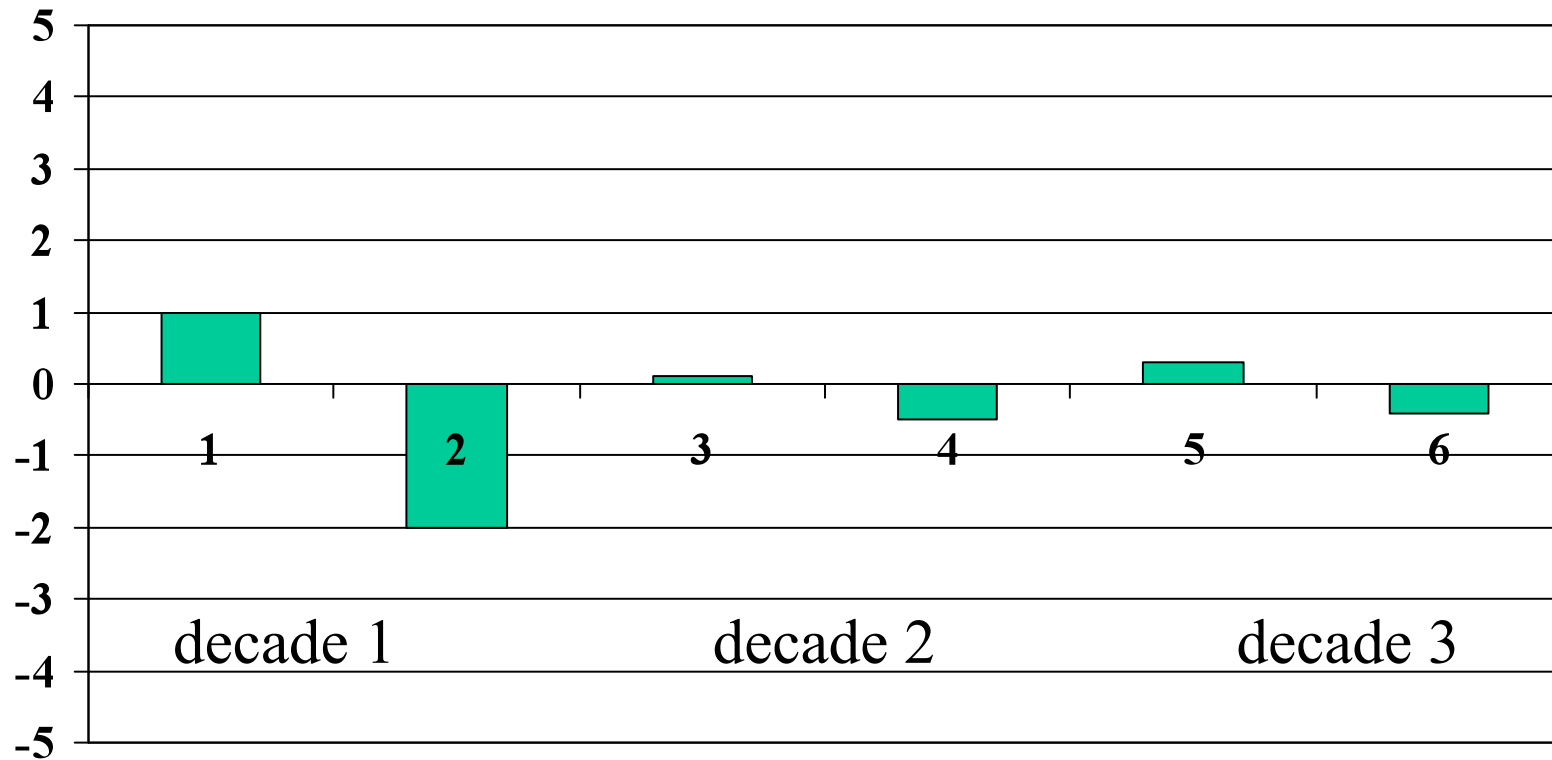
Almost no off-farm employment
growth

Almost no income growth

(let's look at some pictures of some lost
decades)

Agricultural TFP

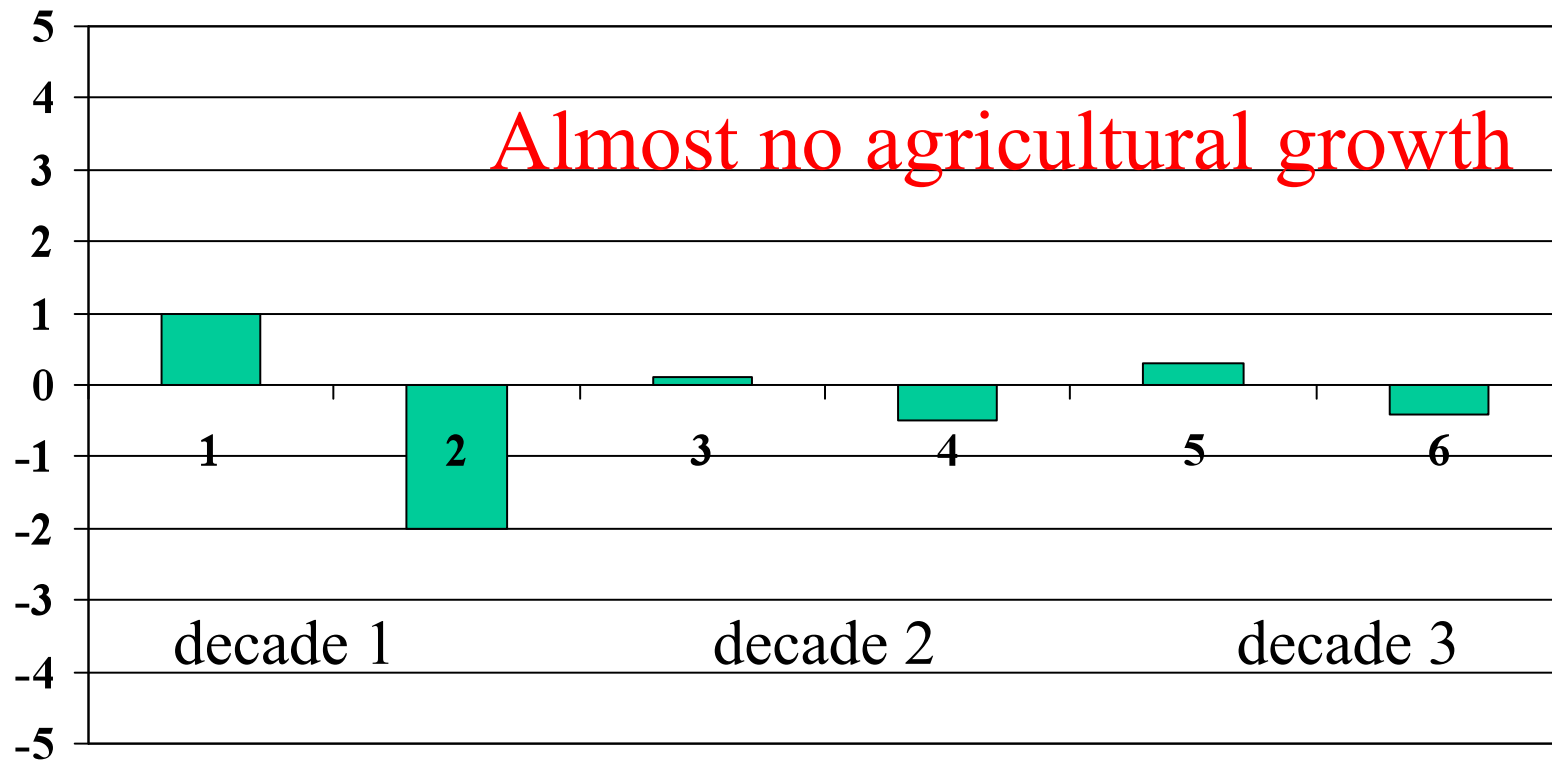
Accumulated Five-Year Growth Rates



6 Five Year Periods during the Dark Decades

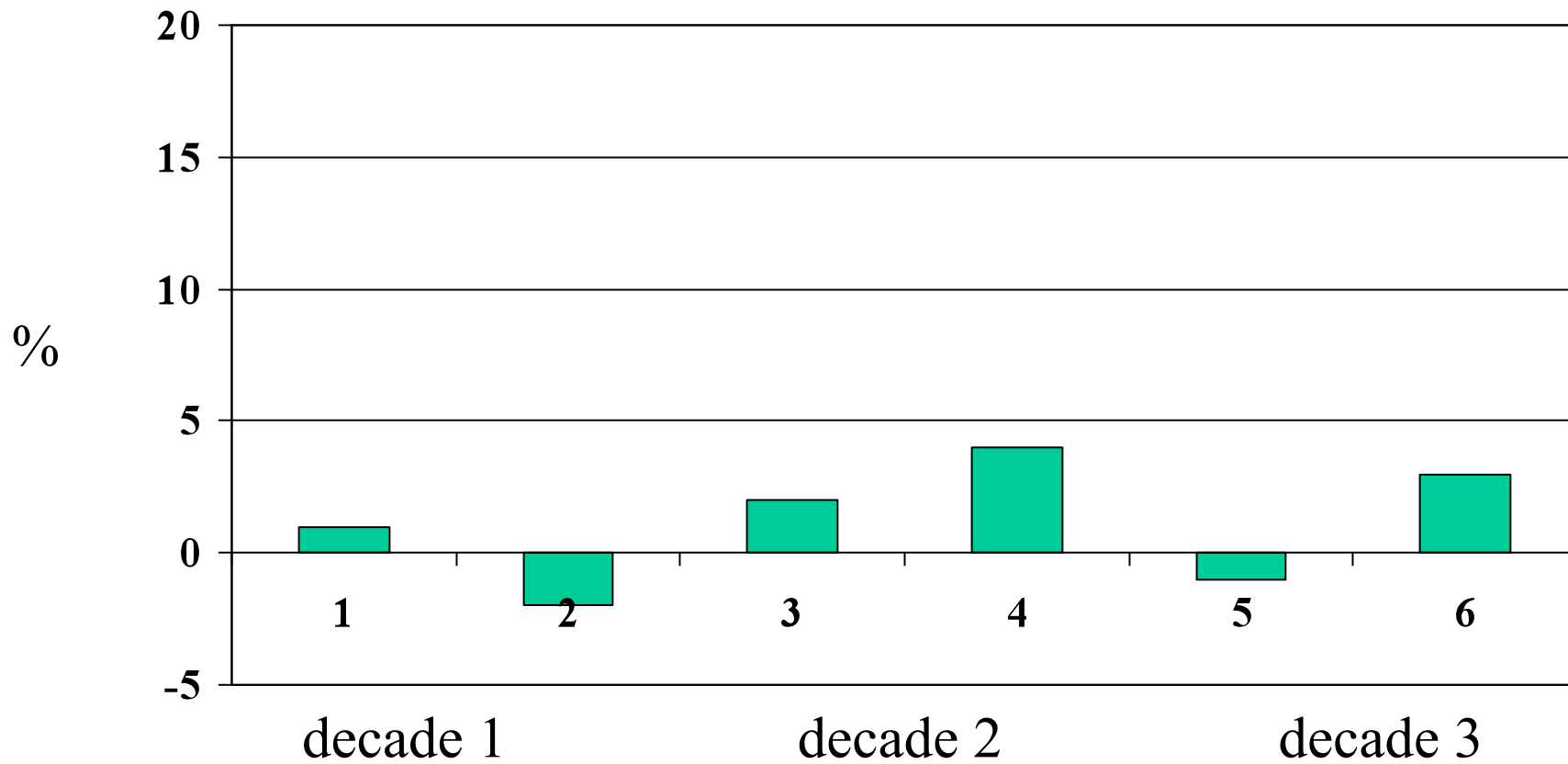
Agricultural TFP

Accumulated Five-Year Growth Rates



6 Five Year Periods during the Dark Decades

New off farm employment (share of rural population)



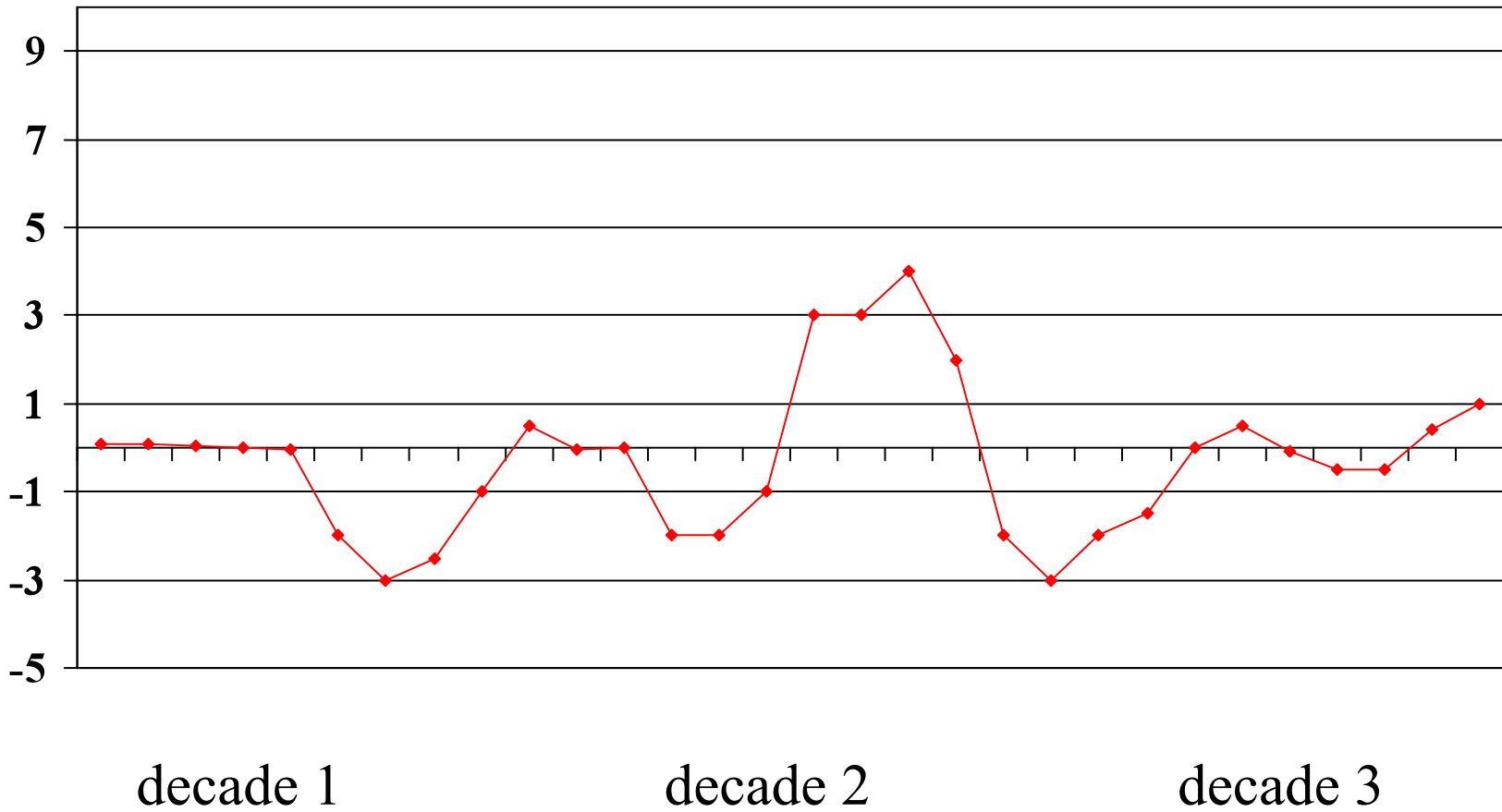
6 Five Year Periods during the Dark Decades

New off farm employment (share of rural population)

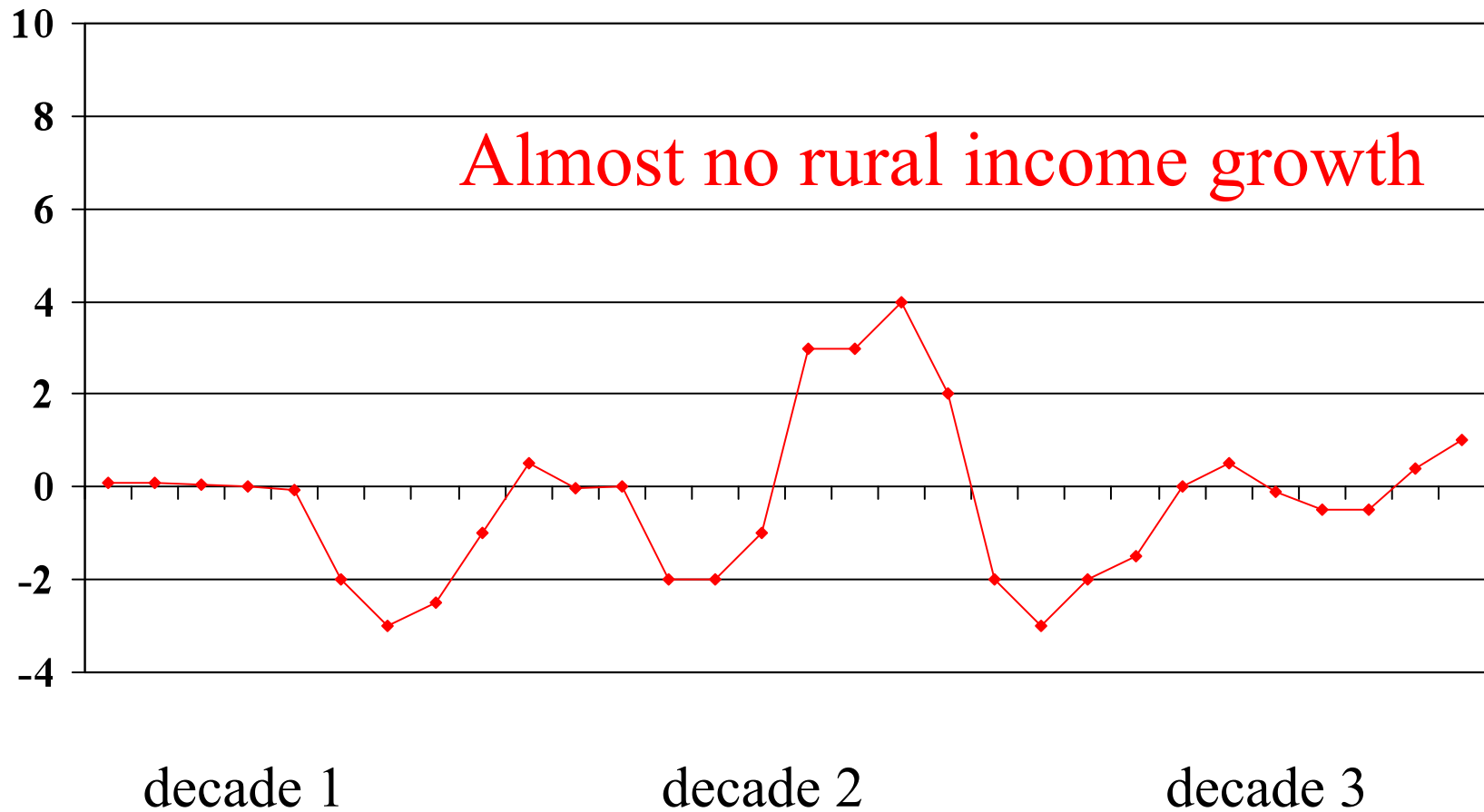


6 Five Year Periods during the Dark Decades

Annual Growth Rates Rural Income



Annual Growth Rates Rural Income

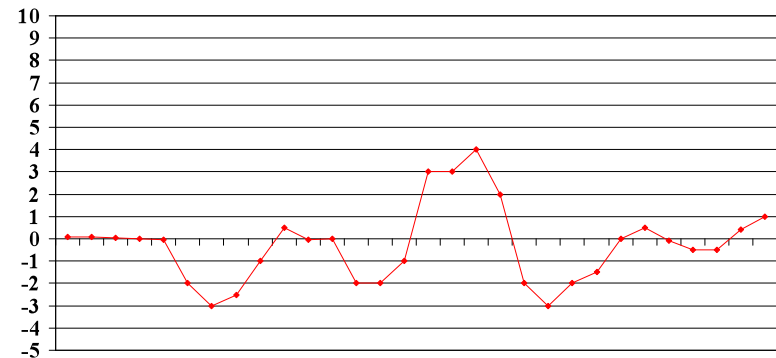
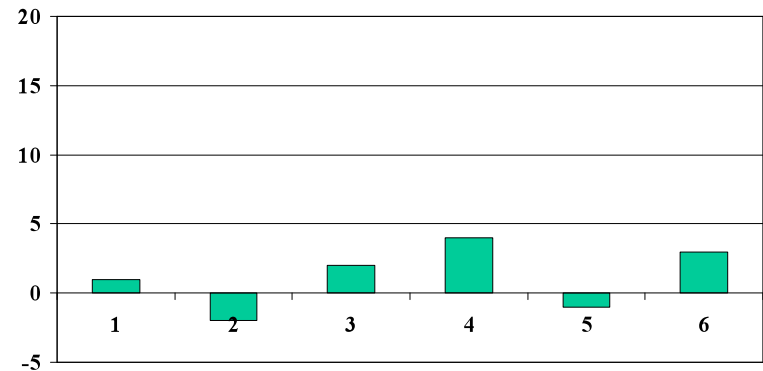
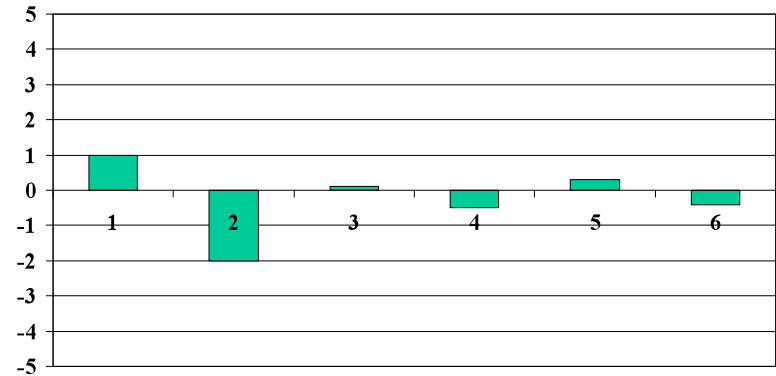


The summary of the record of these lost decades

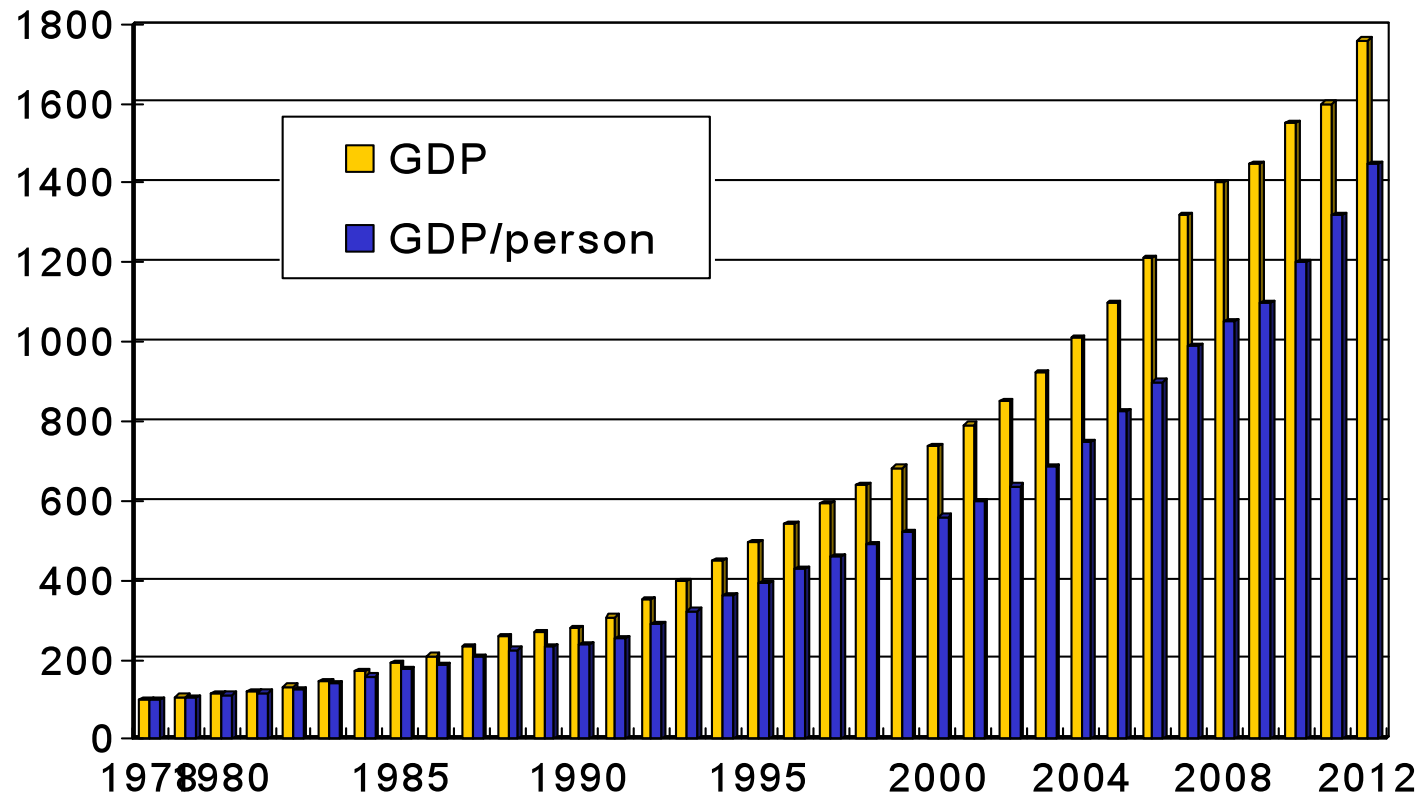
- Almost no agricultural growth
- Almost no off-farm employment growth
- Almost no income growth

So: This is the problem that “we” (the world, the USAID’s and DFID’s, the Gates Foundations, the African Governments themselves, academics in the US, Africa, elsewhere) are working on:

we want to take these anemic results and turn them into ...



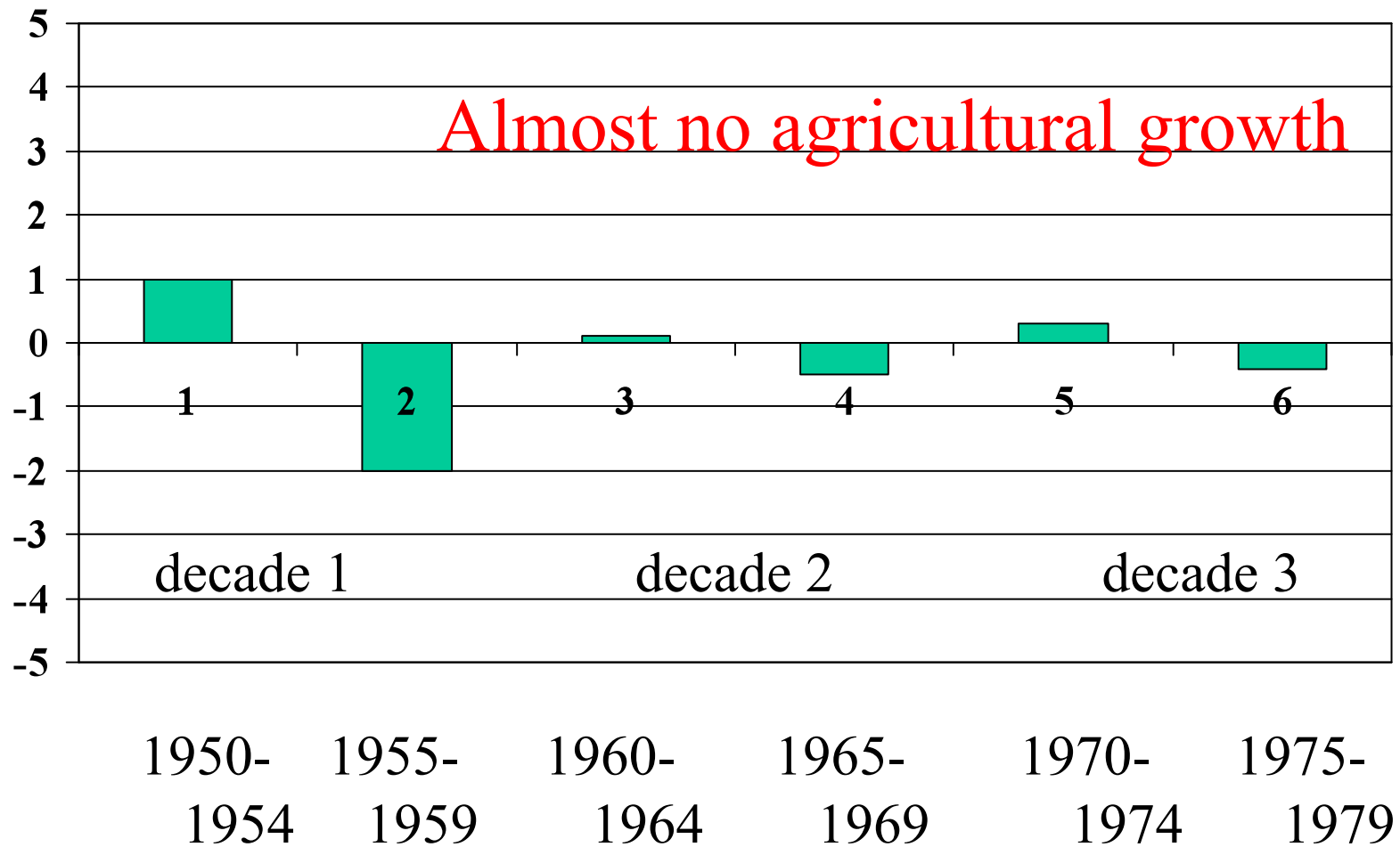
... 30 years of 10% growth



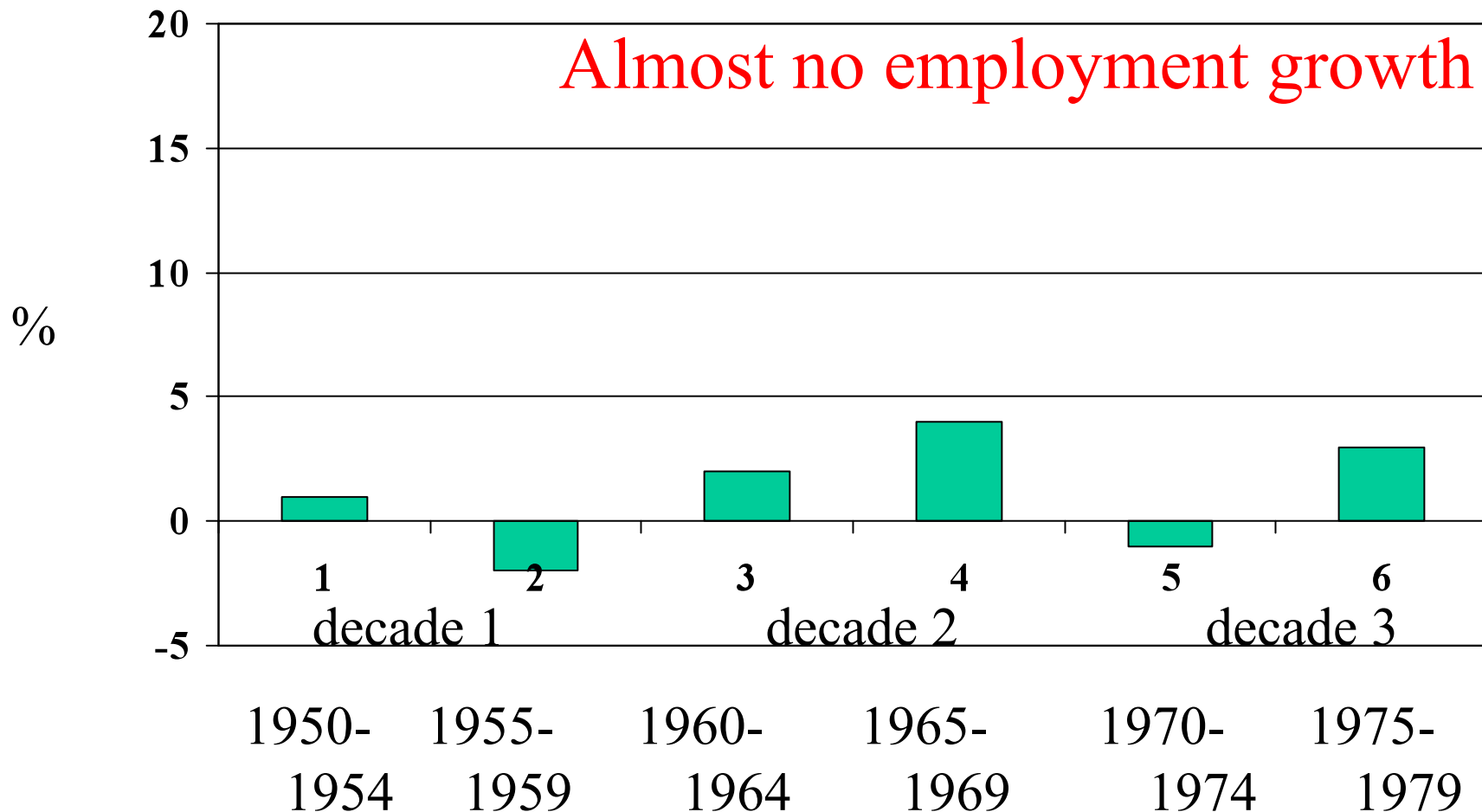
Is it possible?

China's Agricultural TFP 1950 to 1979

Accumulated Five-Year Growth Rates

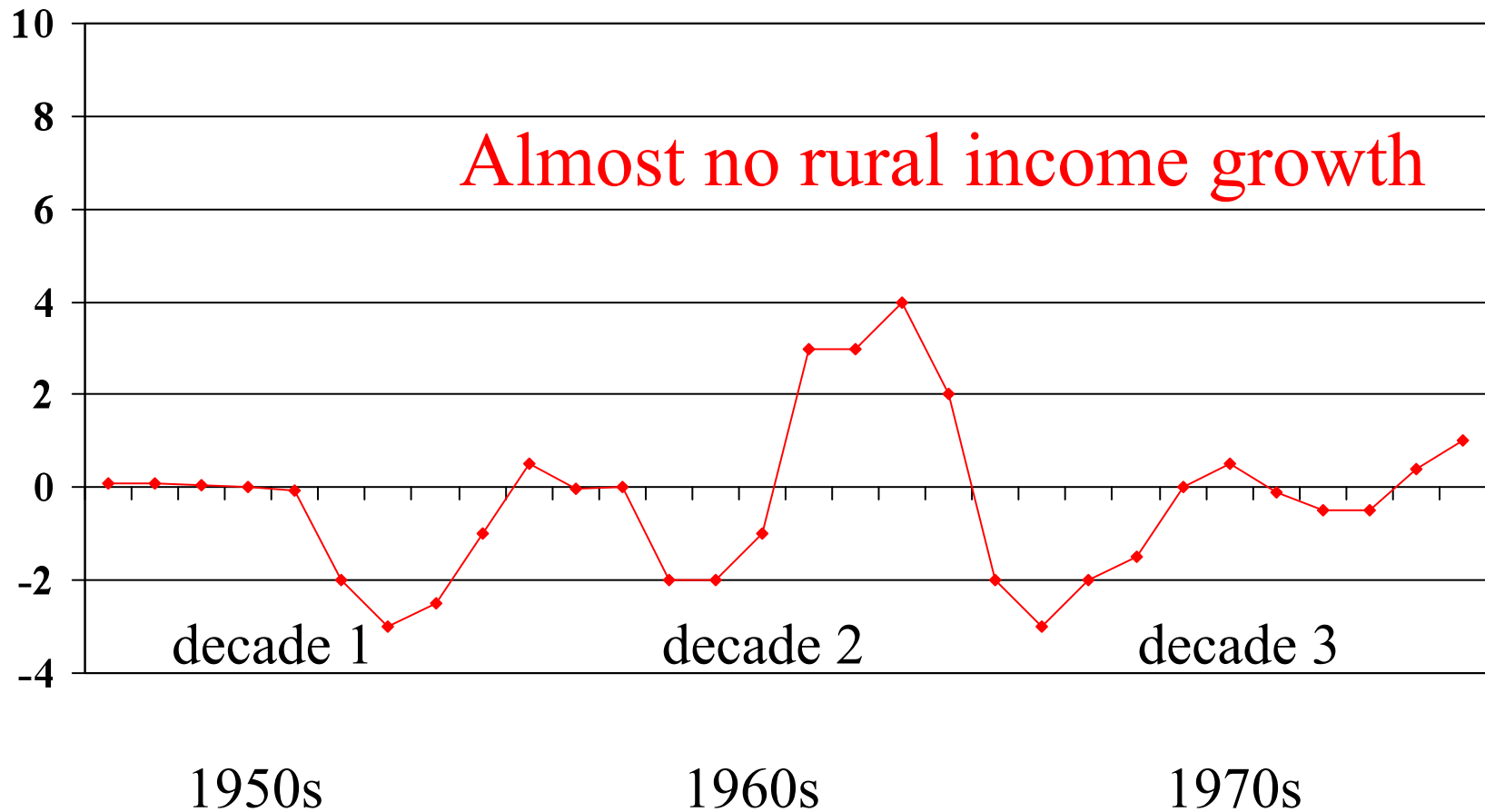


China's new off farm employment (share of rural population) 1950 to 1979



China's Rural Income Growth 1950 to 1979

Annual Growth Rates Rural Income



The summary of the record of China during the 1950s, 1960s and 1970s

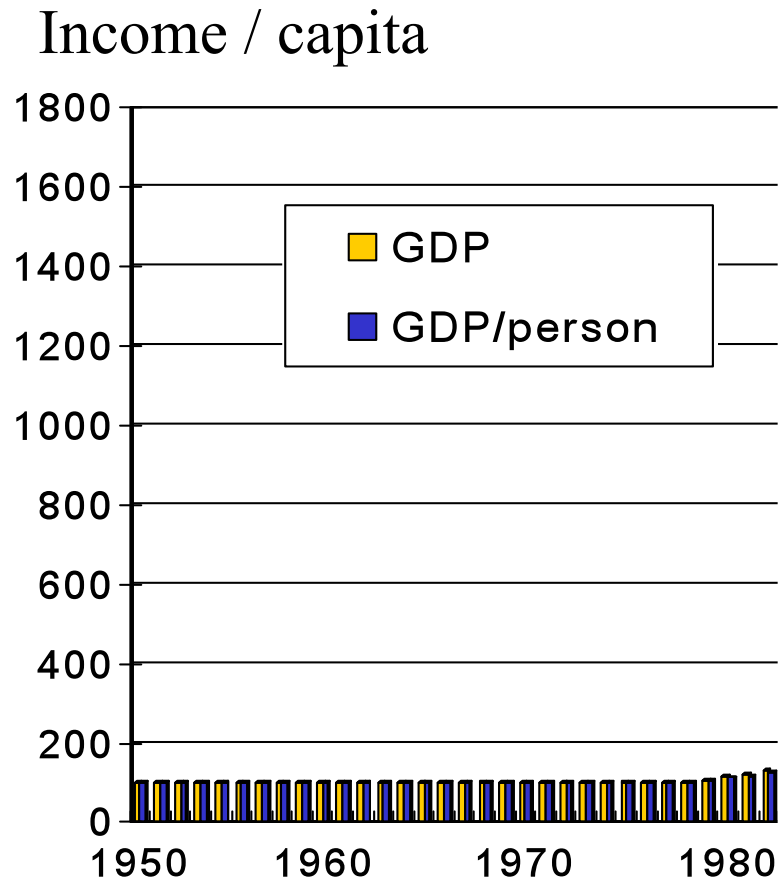
- Almost no agricultural growth
- Almost no off-farm employment growth
- Almost no income growth

These were China's Lost Decades

Is it possible after three decades of
NO GROWTH to launch a miracle?

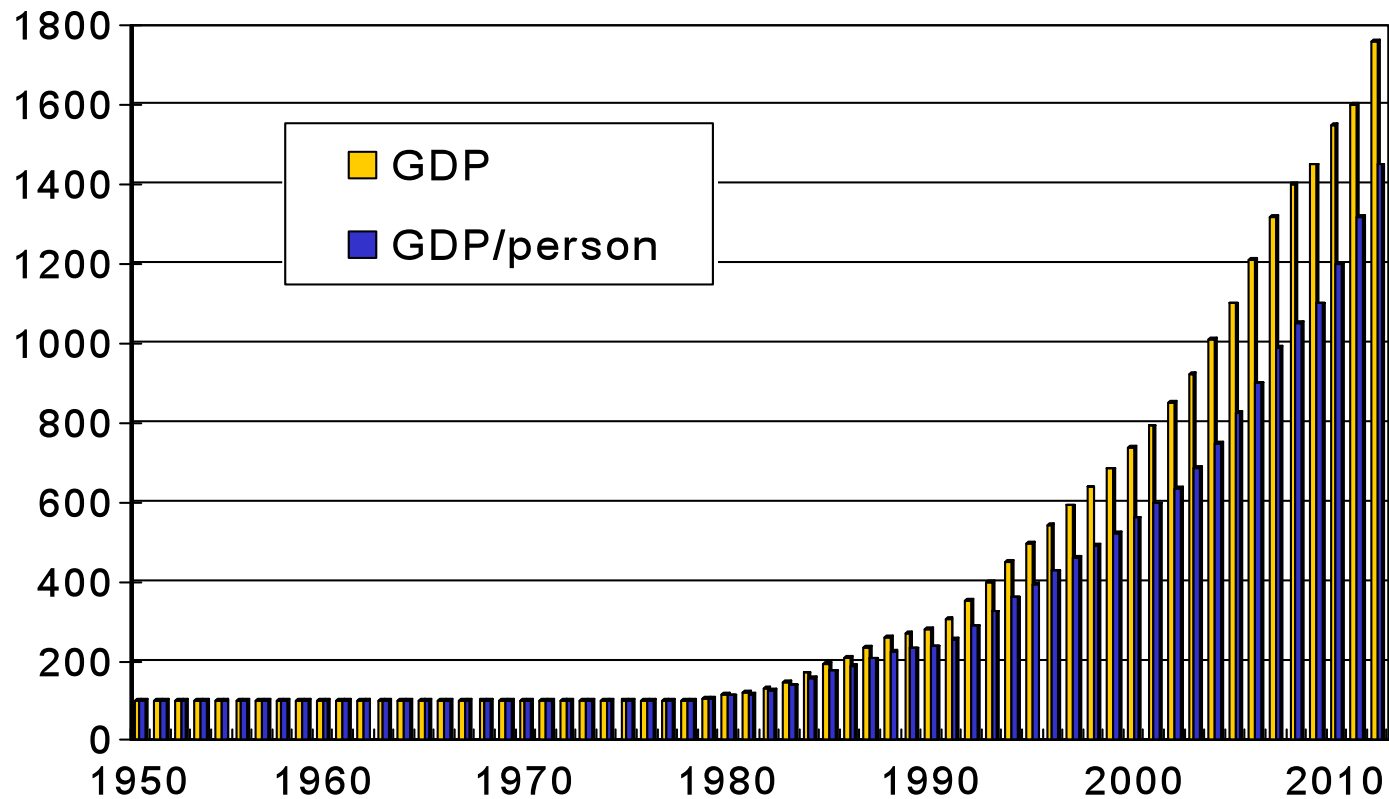
*Of course, this is what we are hoping for in the case of
Africa and other places in the developing world!*

30 years of stagnation → 30 years of 10% growth



30 years of stagnation → 30 years of 10% growth

Income / capita

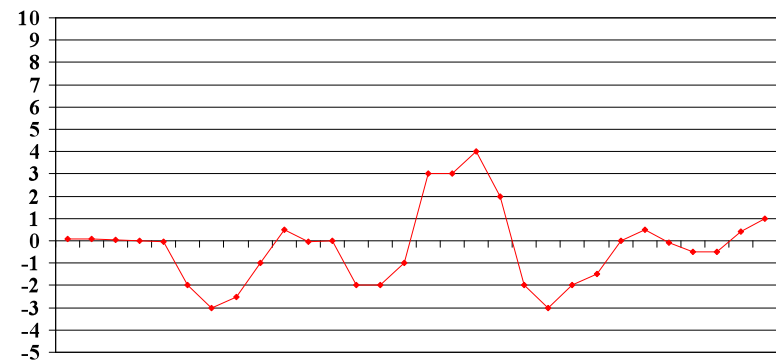
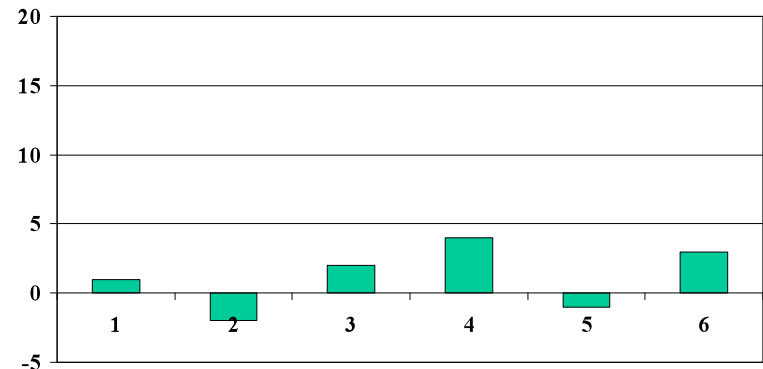
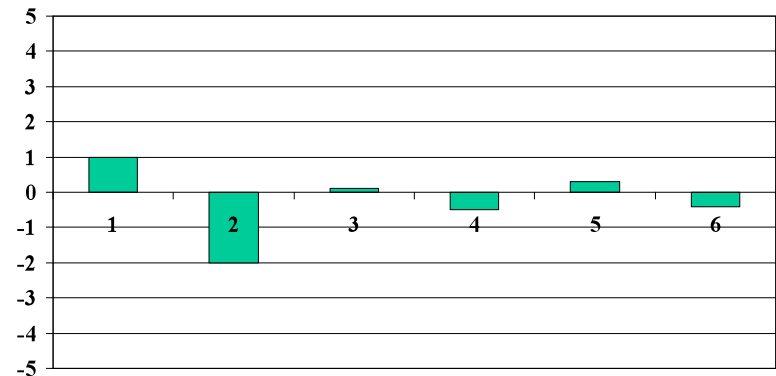


Today's presentation is about how China took:

zero growth in TFP ...
zero transformation &
zero growth in income

... and made it into
what China is today ...

And think about some of the lessons ... if there are any ... for Africa

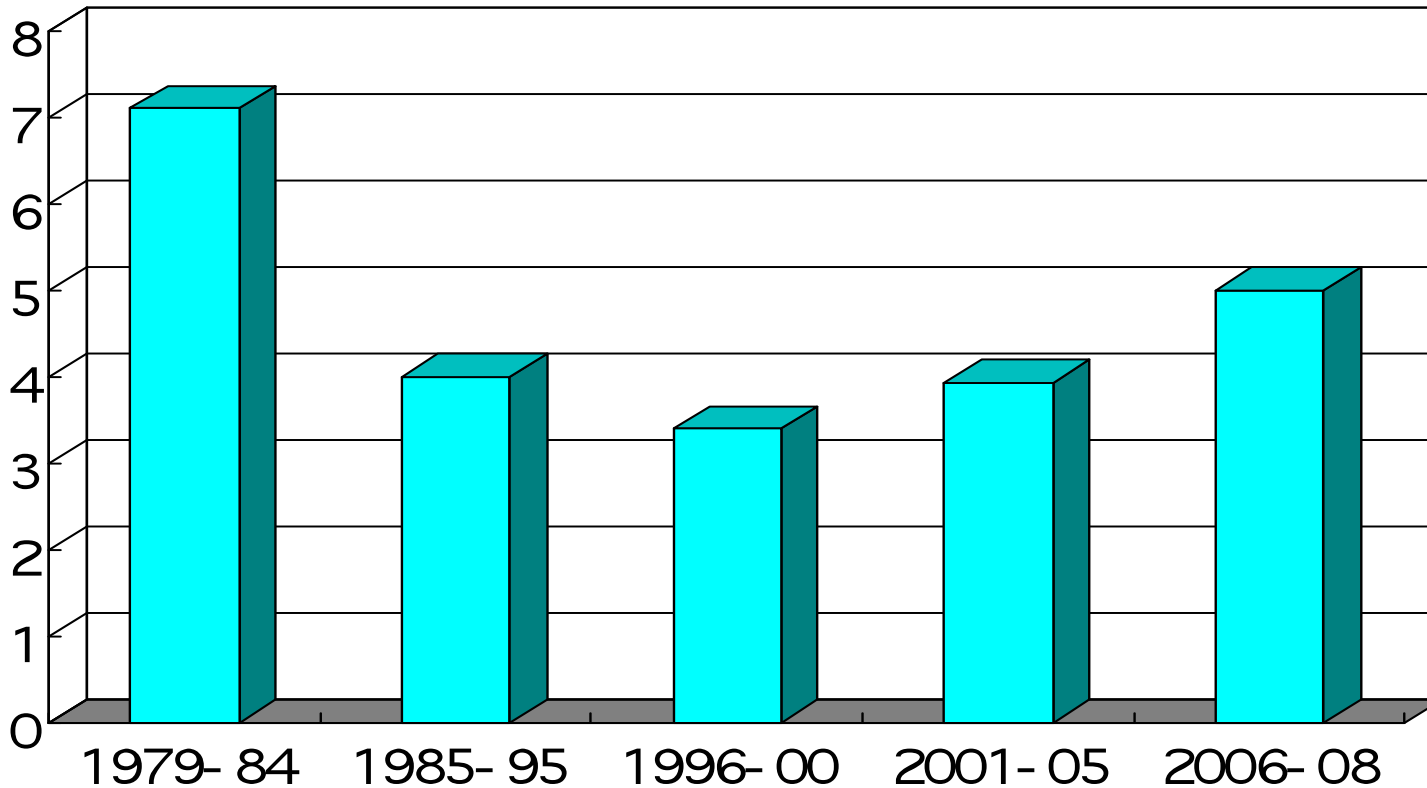


Strategy of the Presentation

1. The Record of China's Past
2. Driving Forces: China's Policy Menu & Impacts
3. What China Did NOT Do
 - Some lessons to learn to follow
 - Some lessons to learn to avoid
4. Policy Lessons for Africa?

Part 1. The Record of China's Past

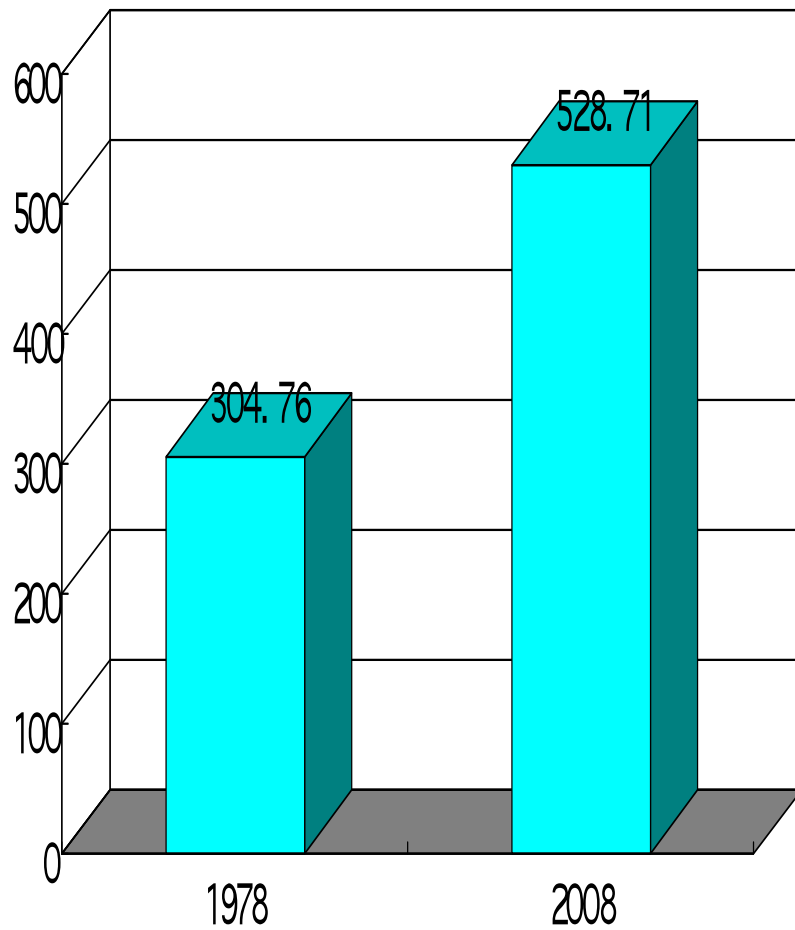
Average annual growth rate (%) of agricultural GDP



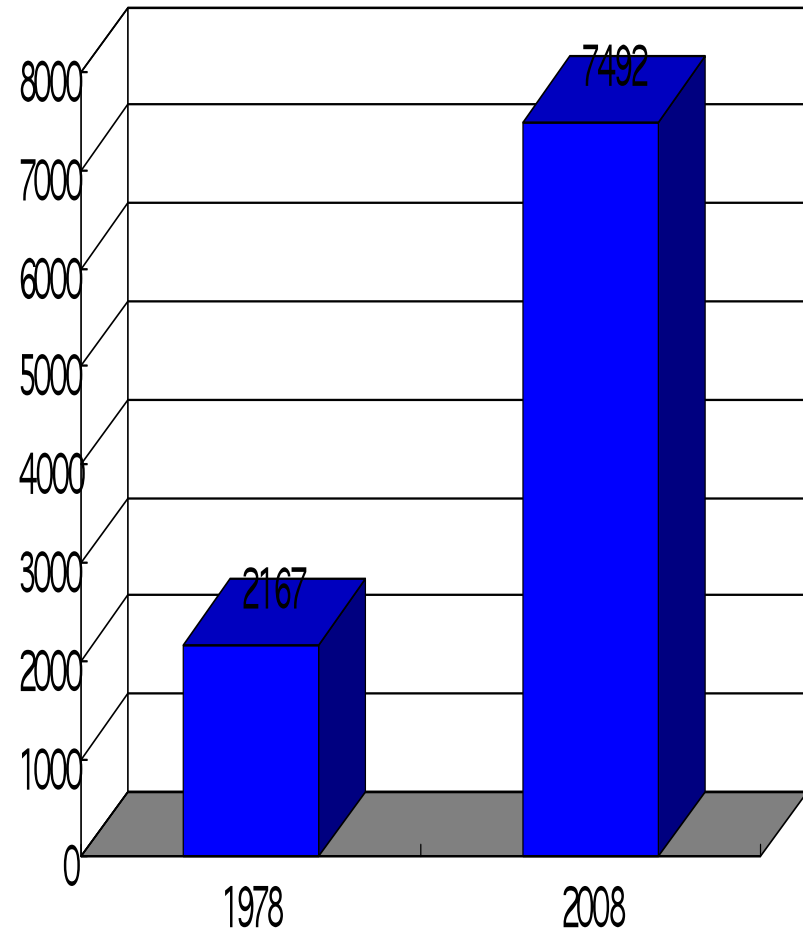
Average annual growth rate in agricultural GDP was about 4 times of population growth rates.

Grain and cotton production in 1978-2008

Grain (million tons)

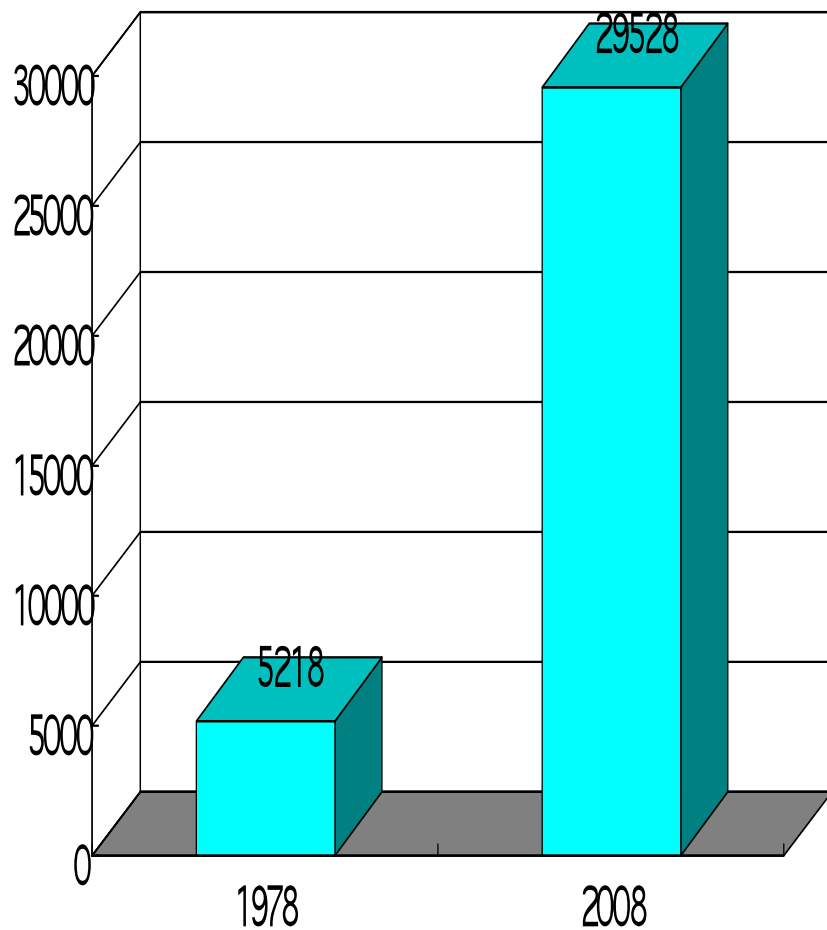


Cotton (1000 tons)

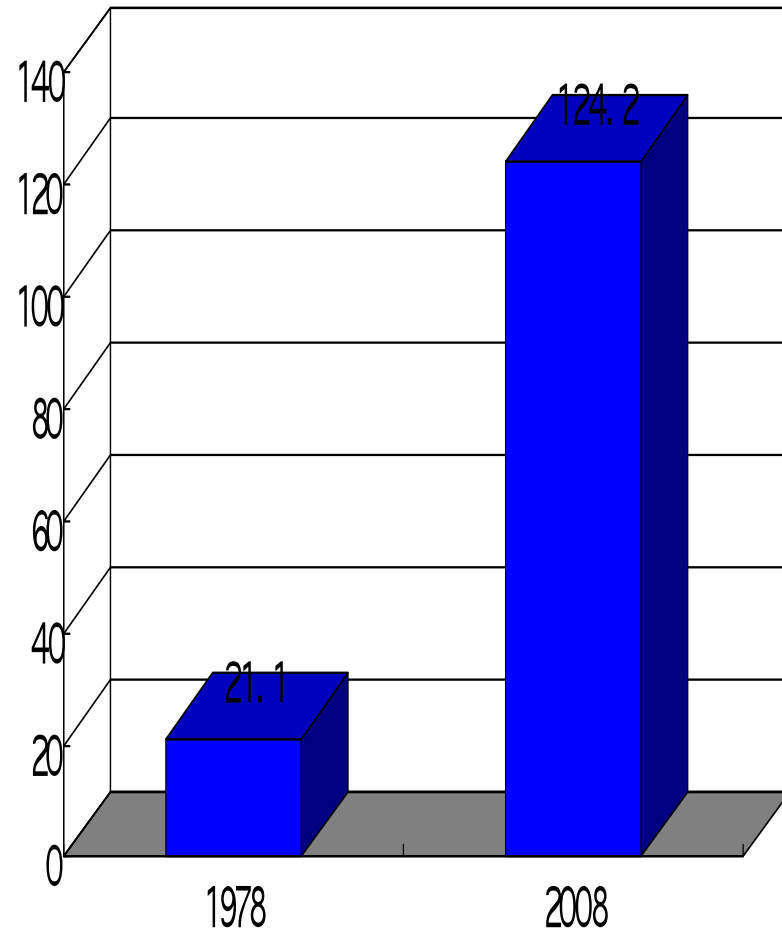


Production of oil and sugar crops

Oil crops (1000 tons)

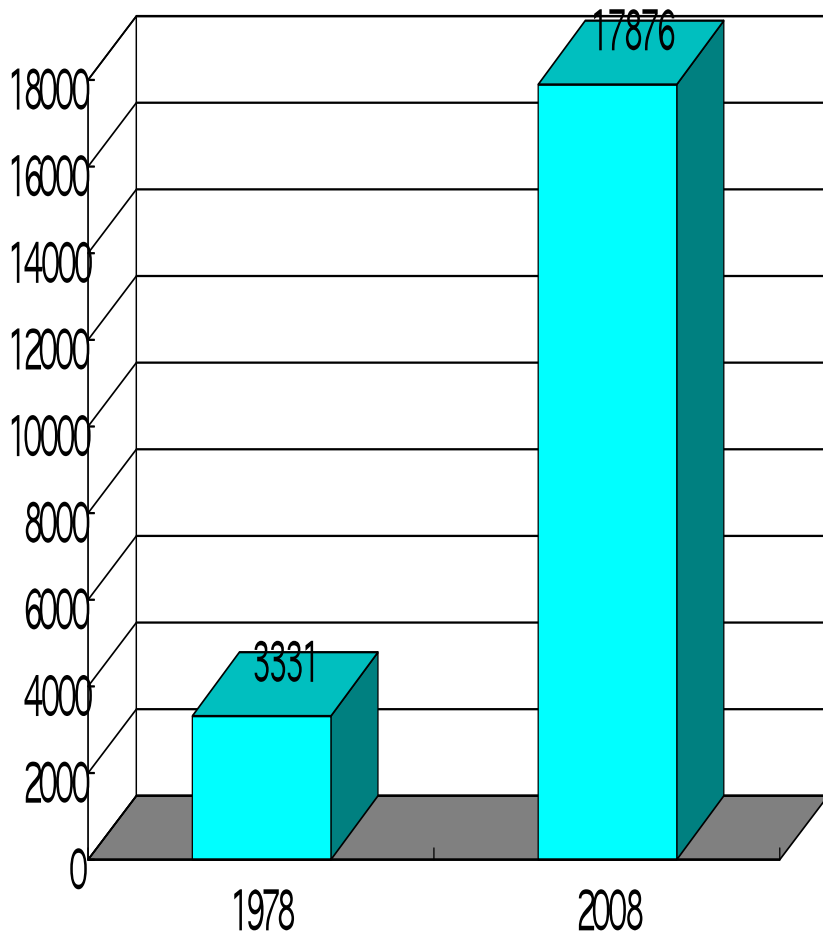


Sugar crops (million tons)

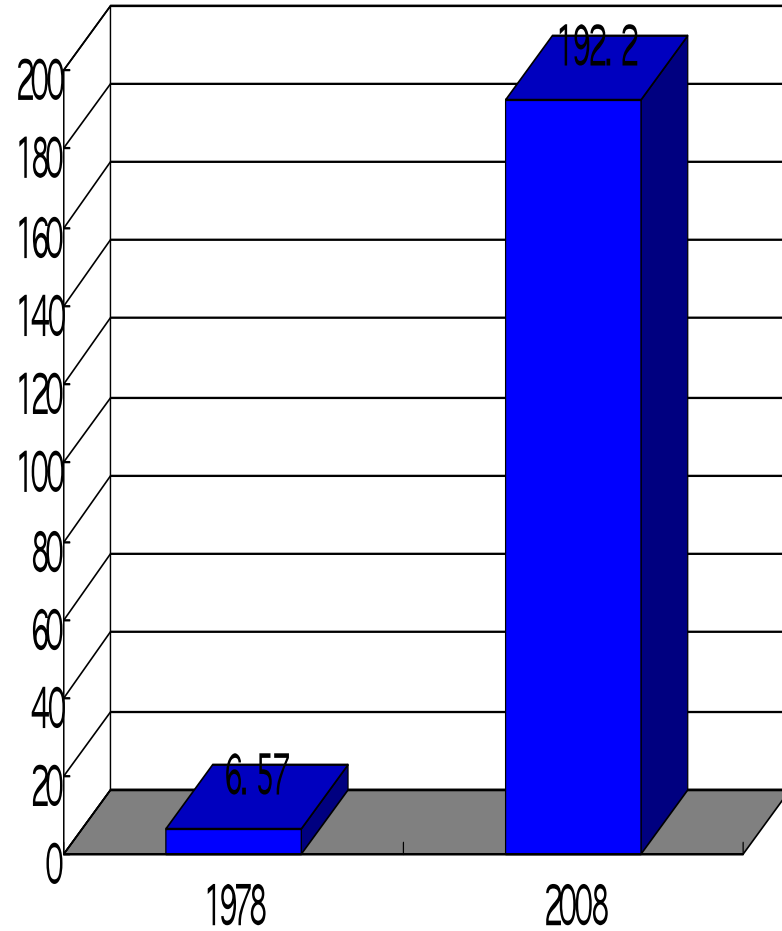


Vegetables and fruit

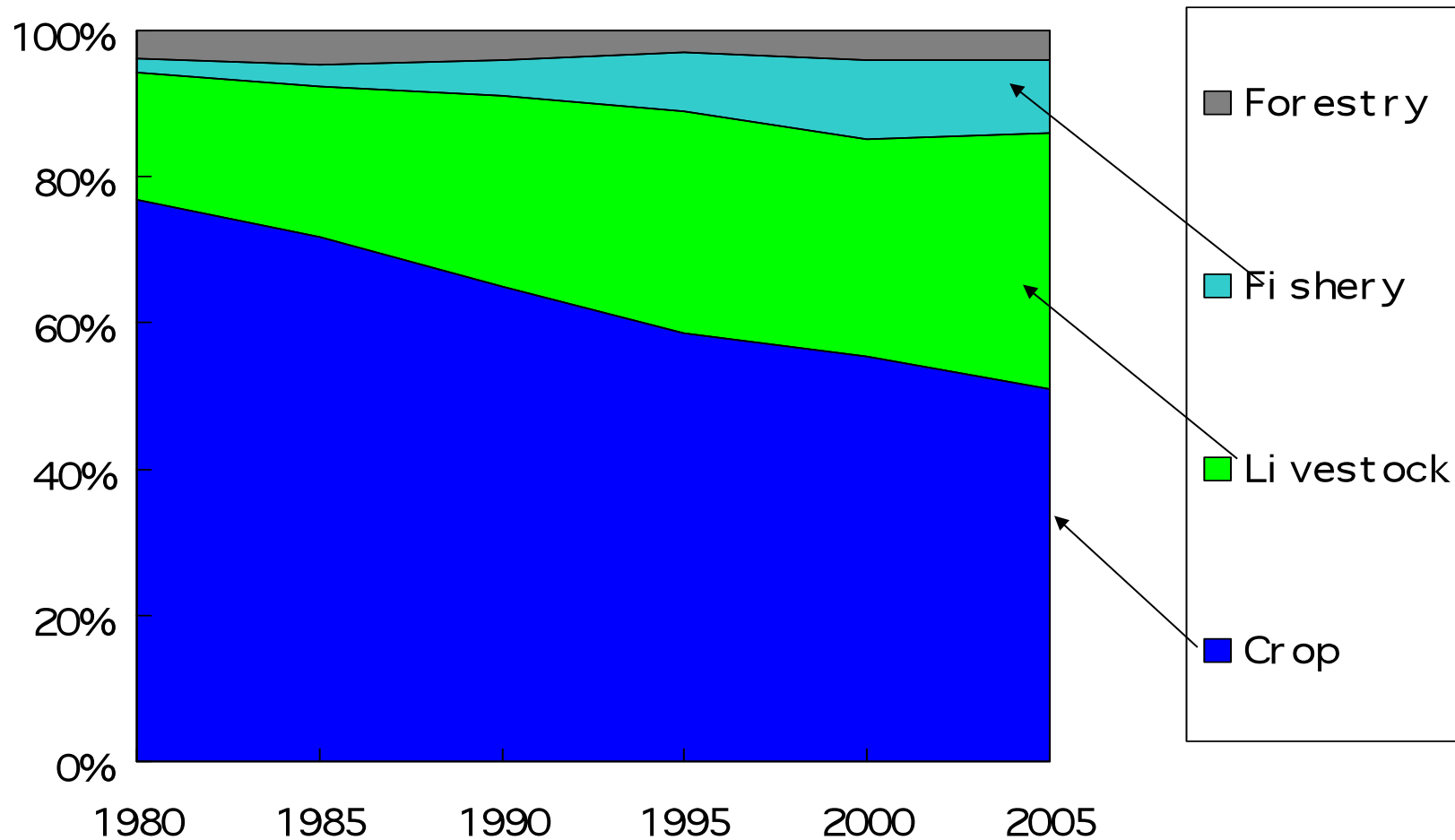
Vegetable area (1000 ha)



Fruit outputs (million tons)

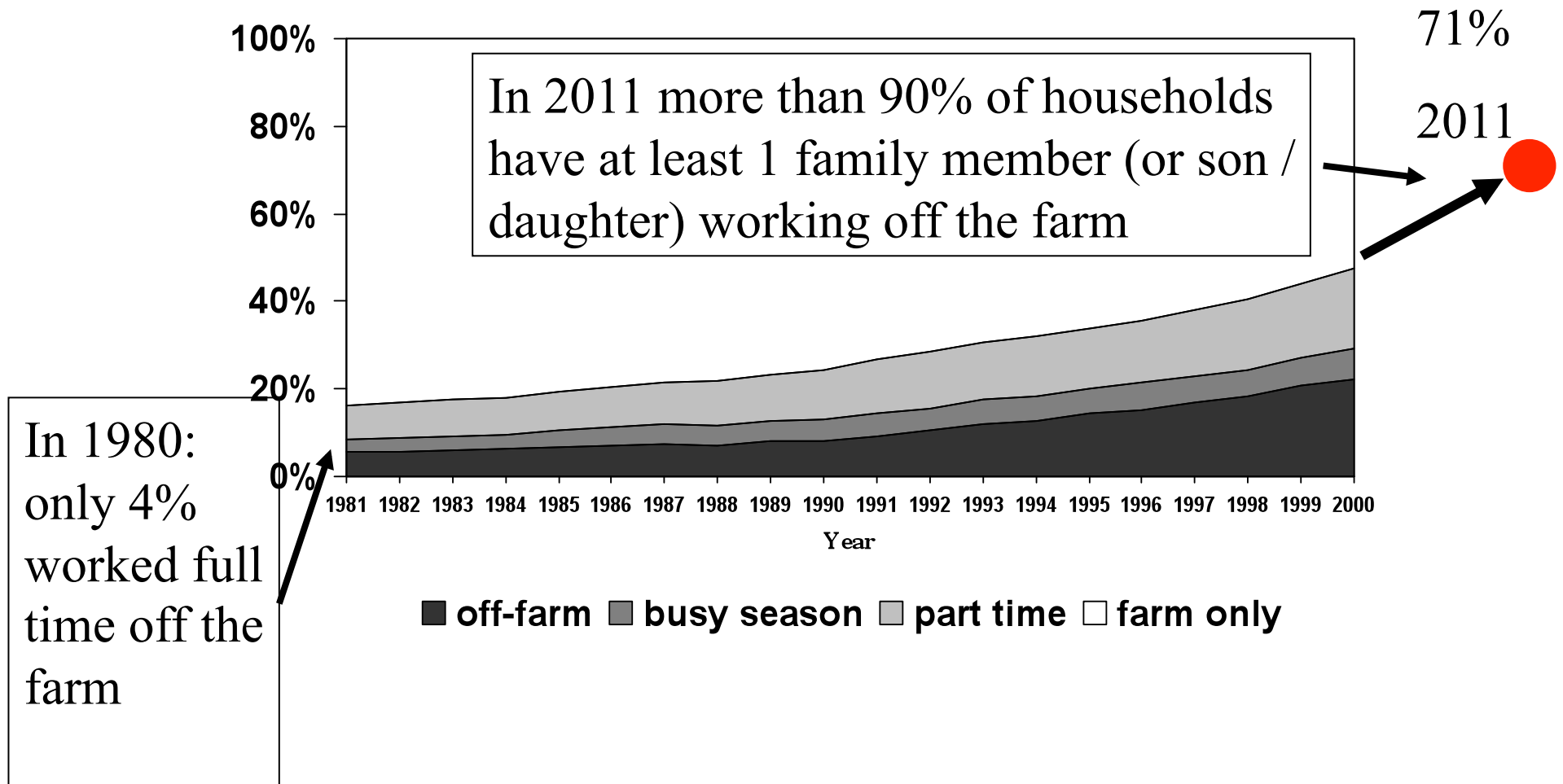


Shares of output values within agricultural sector, 1980-2005, (%)

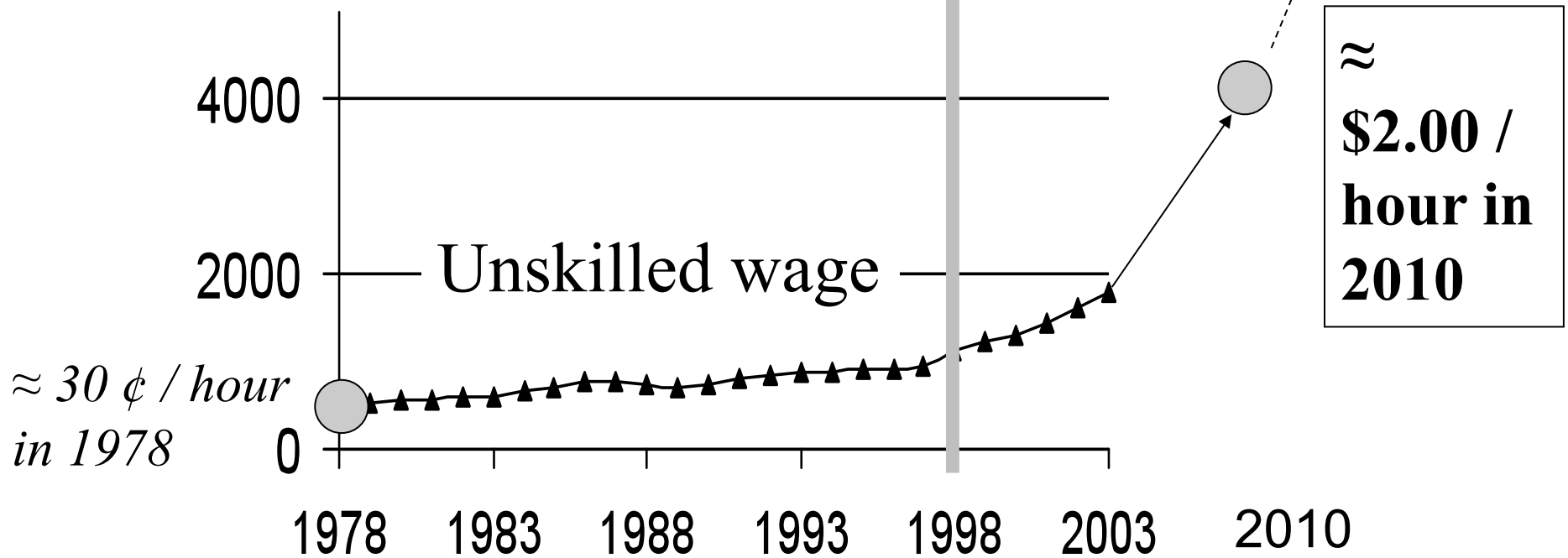


Livestock and fishery have grown even faster...

Overall Increase in Off-farm Work



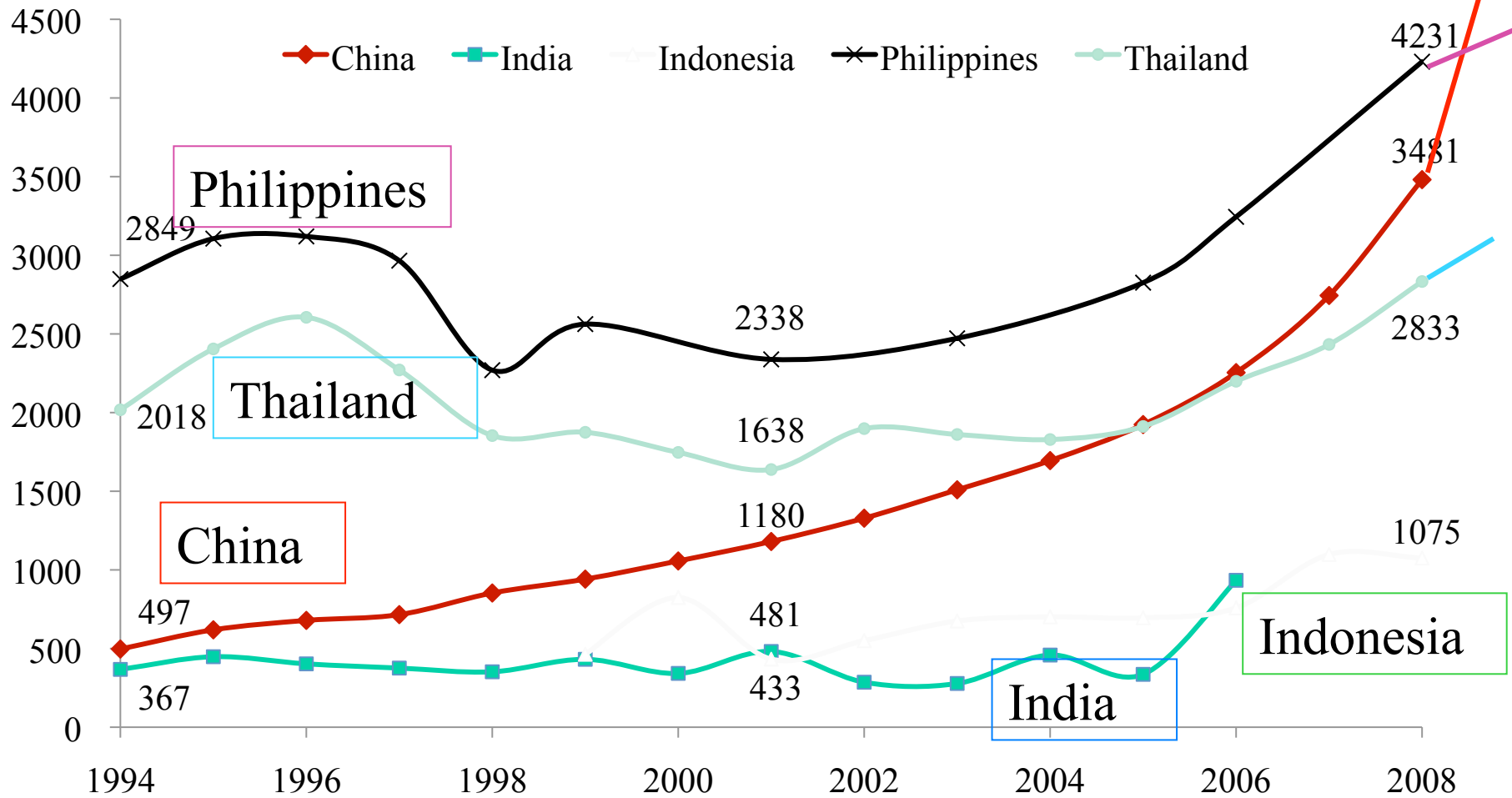
Annual Real Hourly Wage (1978 dollars)



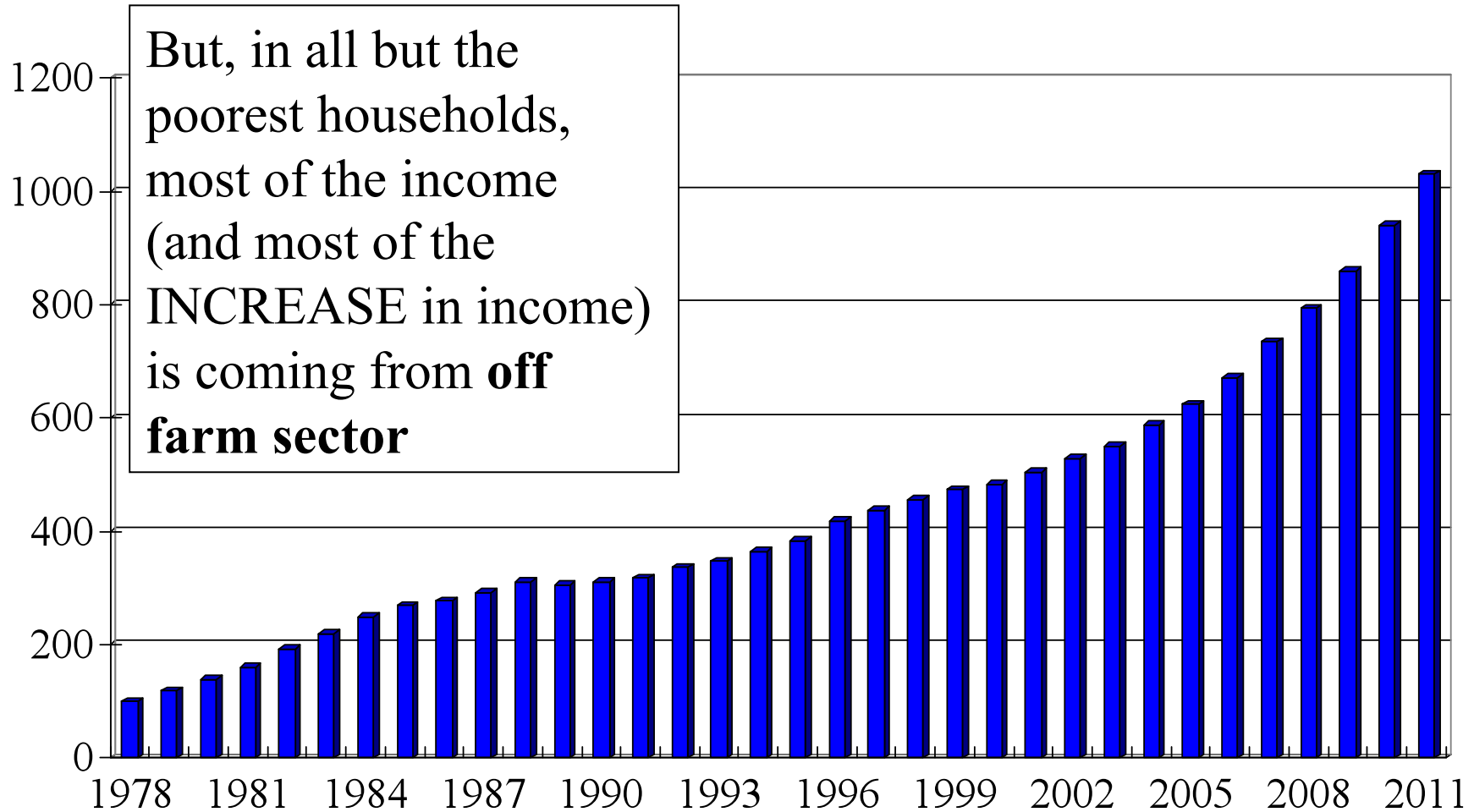
How Expensive are Chinese Workers?

Manufacturing Wages 1994-2008 (USD/year)

China



Per capita income in real term (1978=100)



Part 2: Driving Forces: China's Policy Menu & Impacts

- What are major driving forces of success of China's agriculture in the past?
- What role did policy play?

Major driving forces (in past three decades—1980 to today)

- Institutional reform
- Market liberalization
- Investment into agricultural sector
 - Irrigation
 - Technology
 - Other

2a. Institutional reform (incentives)

Nature of Reforms (1)

1950s / 1960s / 1970s → China's Farmers in
Communes ... Land belongs to “others”

- 40,000 communes [before]
-

Decollectivization (1978 to 1984)

- 200,000,000+ million farms [after]

[Every rural resident (900,000,000 of them) has land]

- Almost all farms are “family farms”
- Farm size: “1 mu per person”

Performance from 1950s to 1970s

- More than 80% of population in rural sector
- Subsistence agriculture ... more than 80% of rural rely fully on farming
- Undiversified agriculture: grain / grain / grain
- Although yields rose (mostly due to increasing water control ... and increasing labor input into farming (more than 200 days per hectare of labor input) →

Ag growth; Off-farm employment; Income/capita growth = ZERO

Nature of Reforms (1)

1950s / 1960s / 1970s → China's Farmers in
Communes ... Land belongs to “others”

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Decollectivization or HRS (1978 to 1984)

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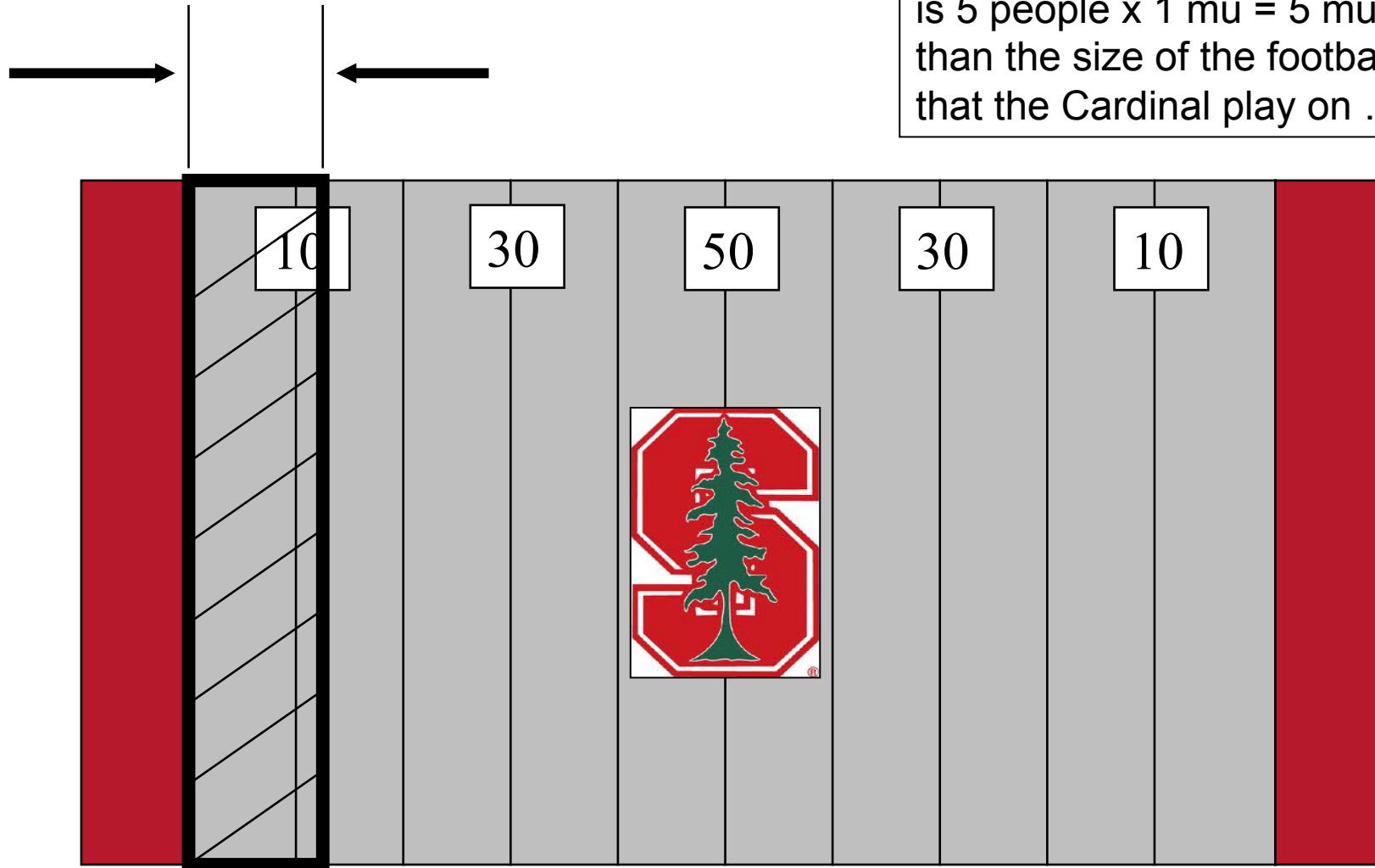
[Every rural resident (900,000,000 of them) has land]

- Almost all farms are “family farms”
- Although farm size was small: “1 mu per person”

How big is a mu?

1 mu =
area from
0 – 12
yard line

The average size of a farm in China
is 5 people x 1 mu = 5 mu or less
than the size of the football field
that the Cardinal play on ...



Nature of Reforms (1)

1950s / 1960s / 1970s → China's Farmers in
Communes ... Land belongs to “others”

- 40,000 communes [before]
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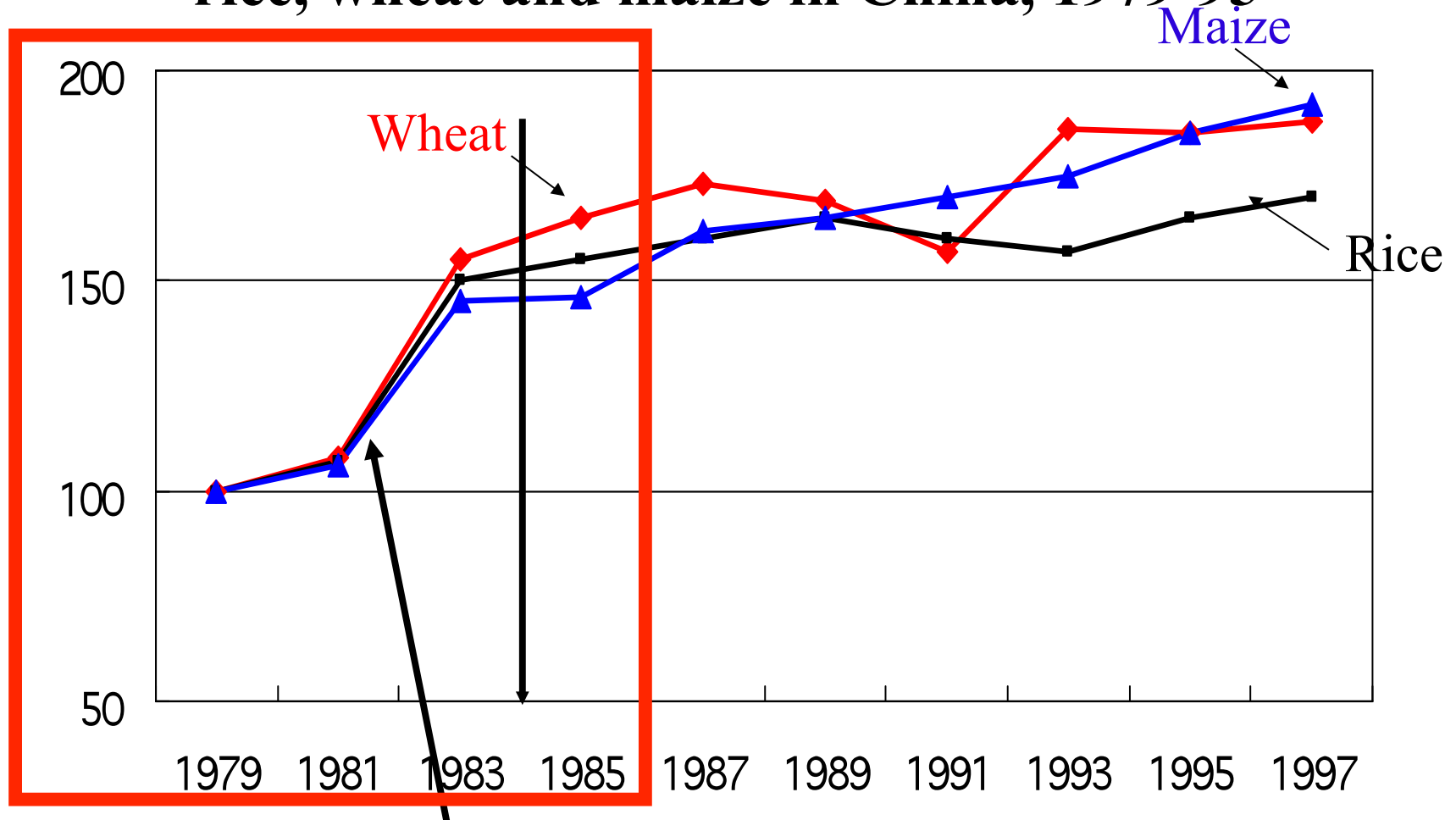
[Every rural resident (900,000,000 of them) has land]

- Almost all farms are “family farms”
- Although farm size was small: “1 mu per person”

“right to choose crop + inputs”

“right to income”

IMPACT of HRS on Total Factor Productivity for rice, wheat and maize in China, 1979-95



Institutional change (HRS) was major source of TFP growth in 1979-84

2b. Market liberalization

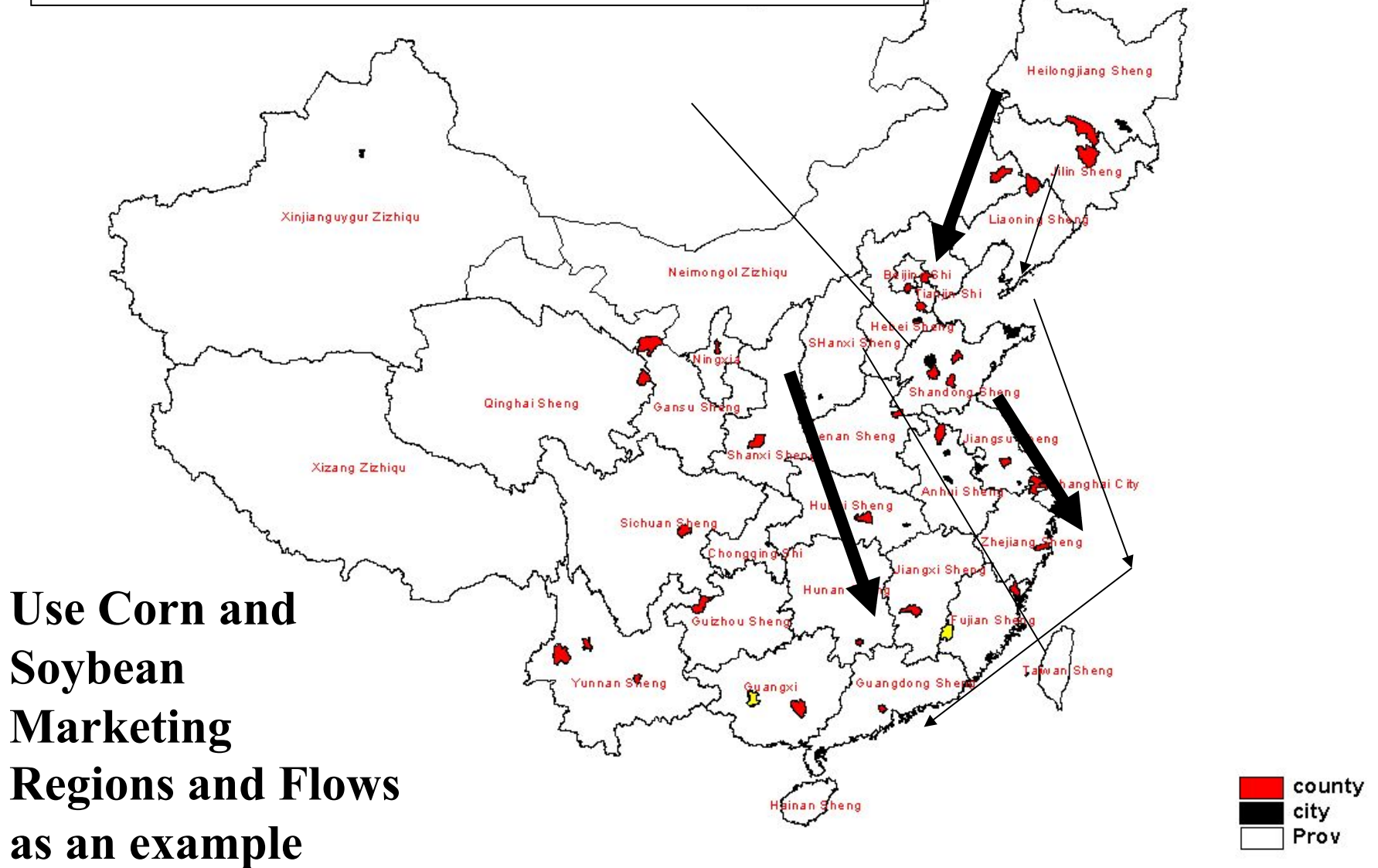
2b. Market liberalization

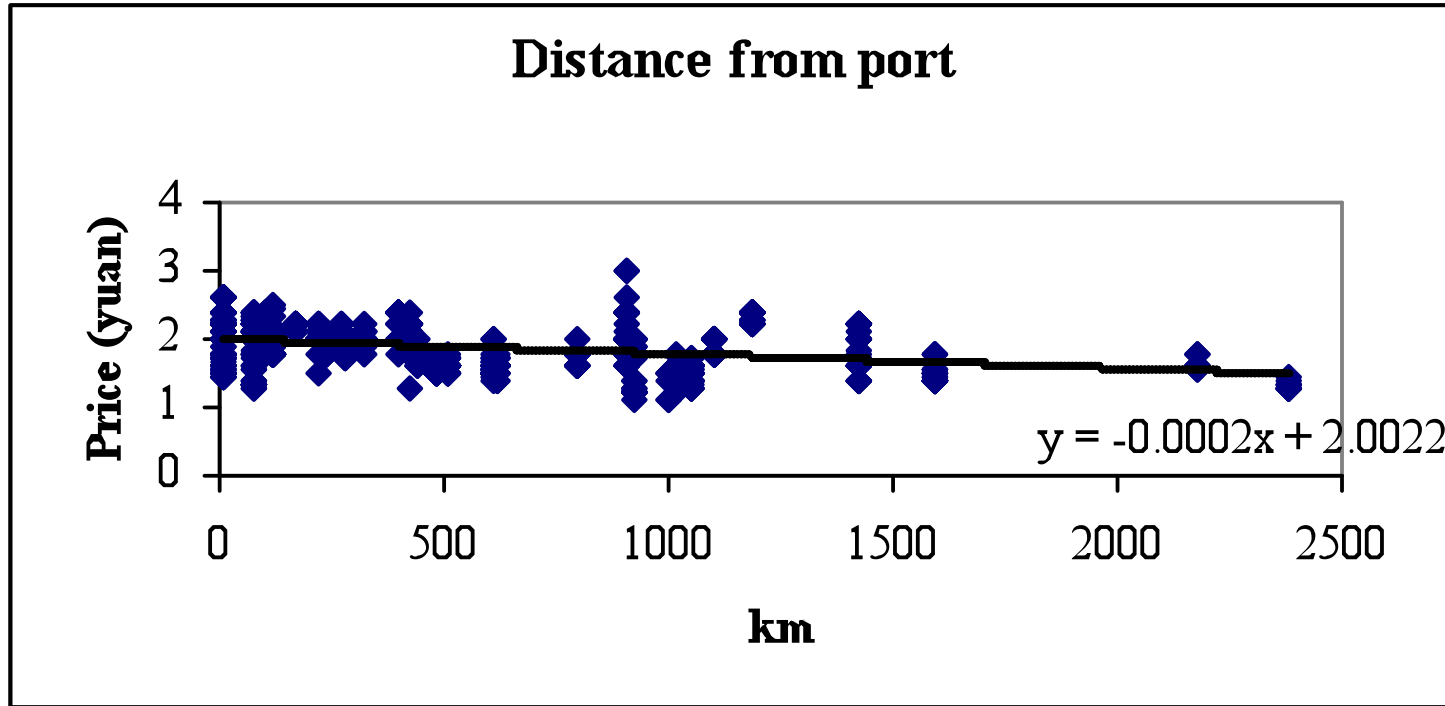
Market support policies

POLICY AGENDA:

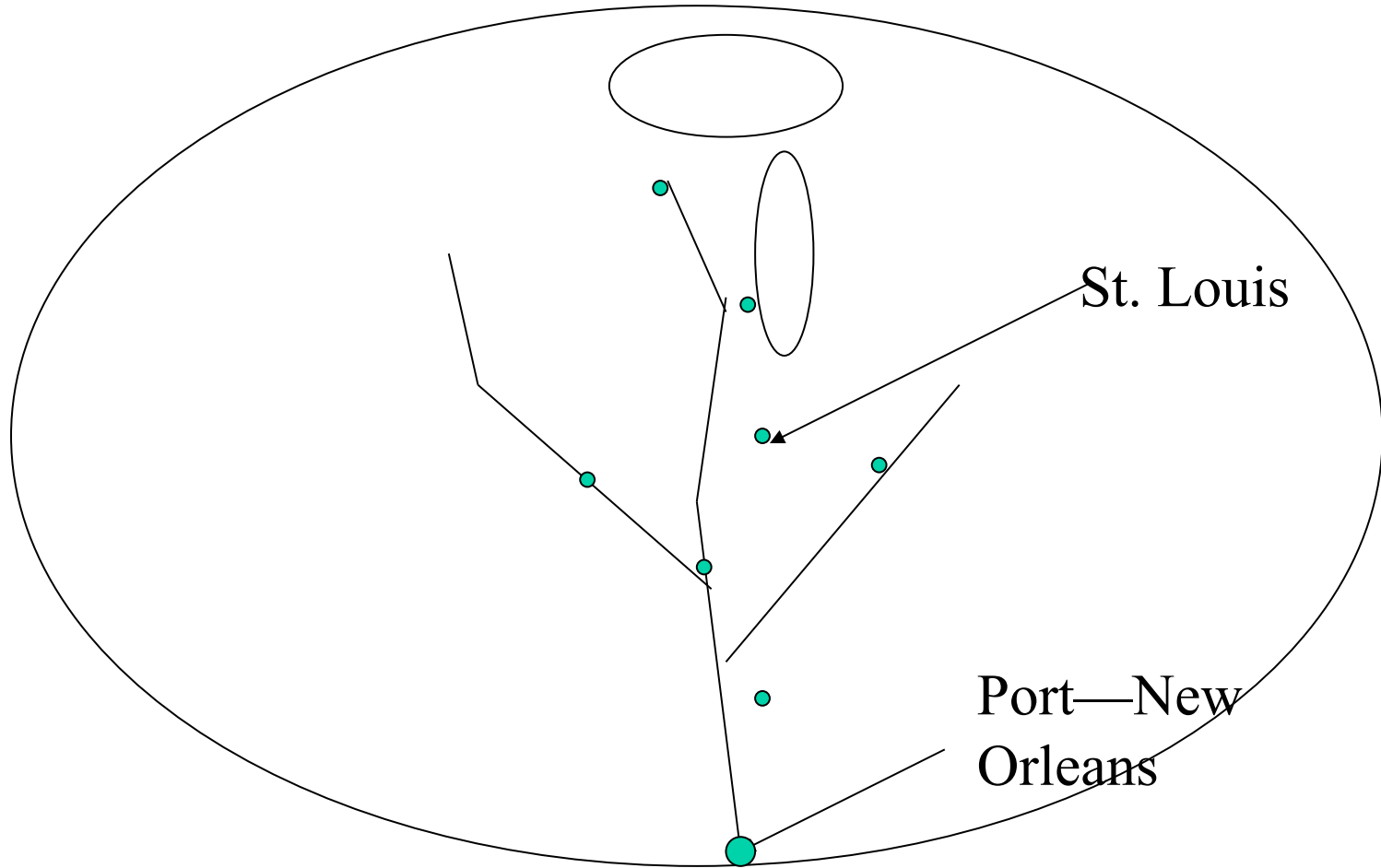
- Dismantled Parastatals (State-owned trading companies)
- Deregulated Trading Rules
- Invested in Roads
- Invested in Communications

Did China's Markets Integrate?

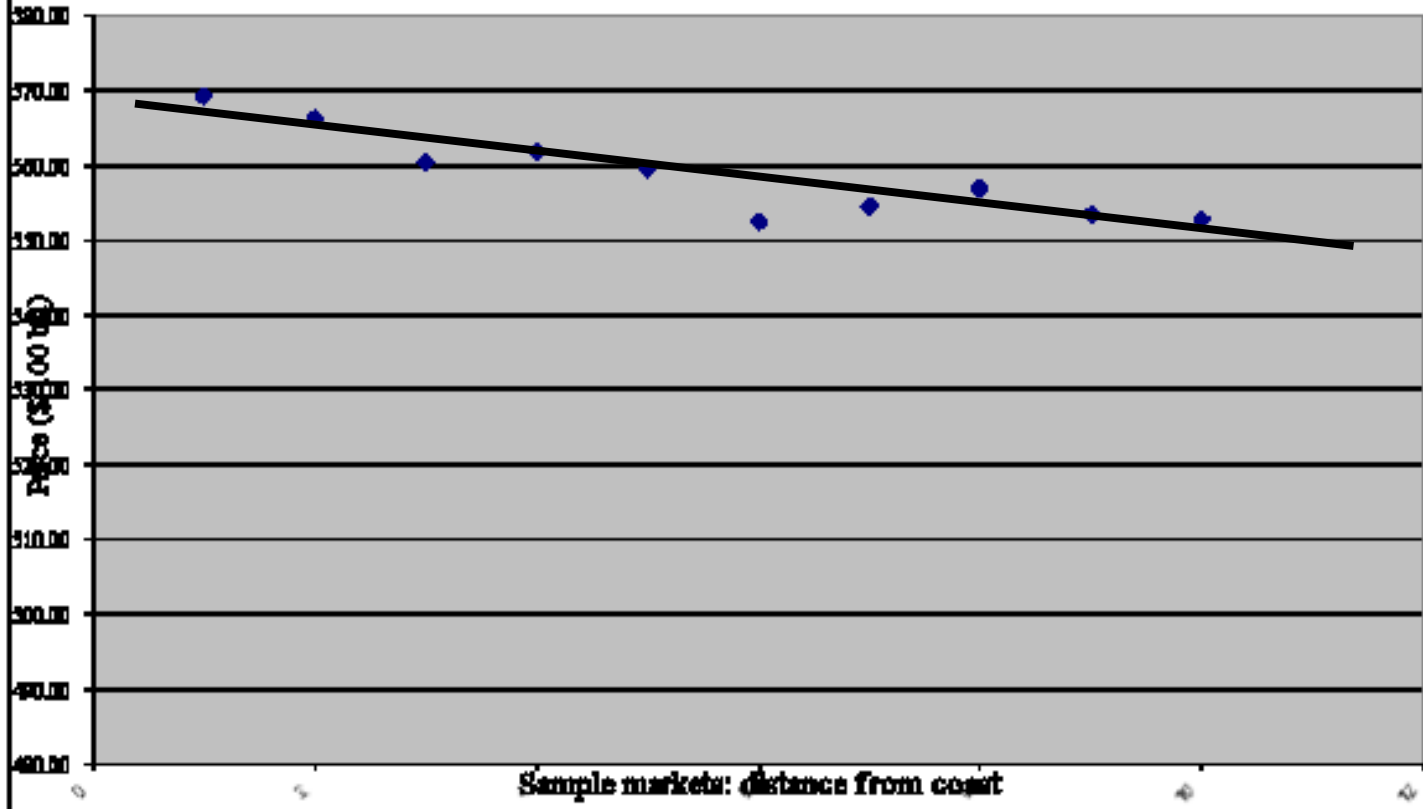




Location of Major Corn Markets in Greater Mississippi Valley



US Corn Prices

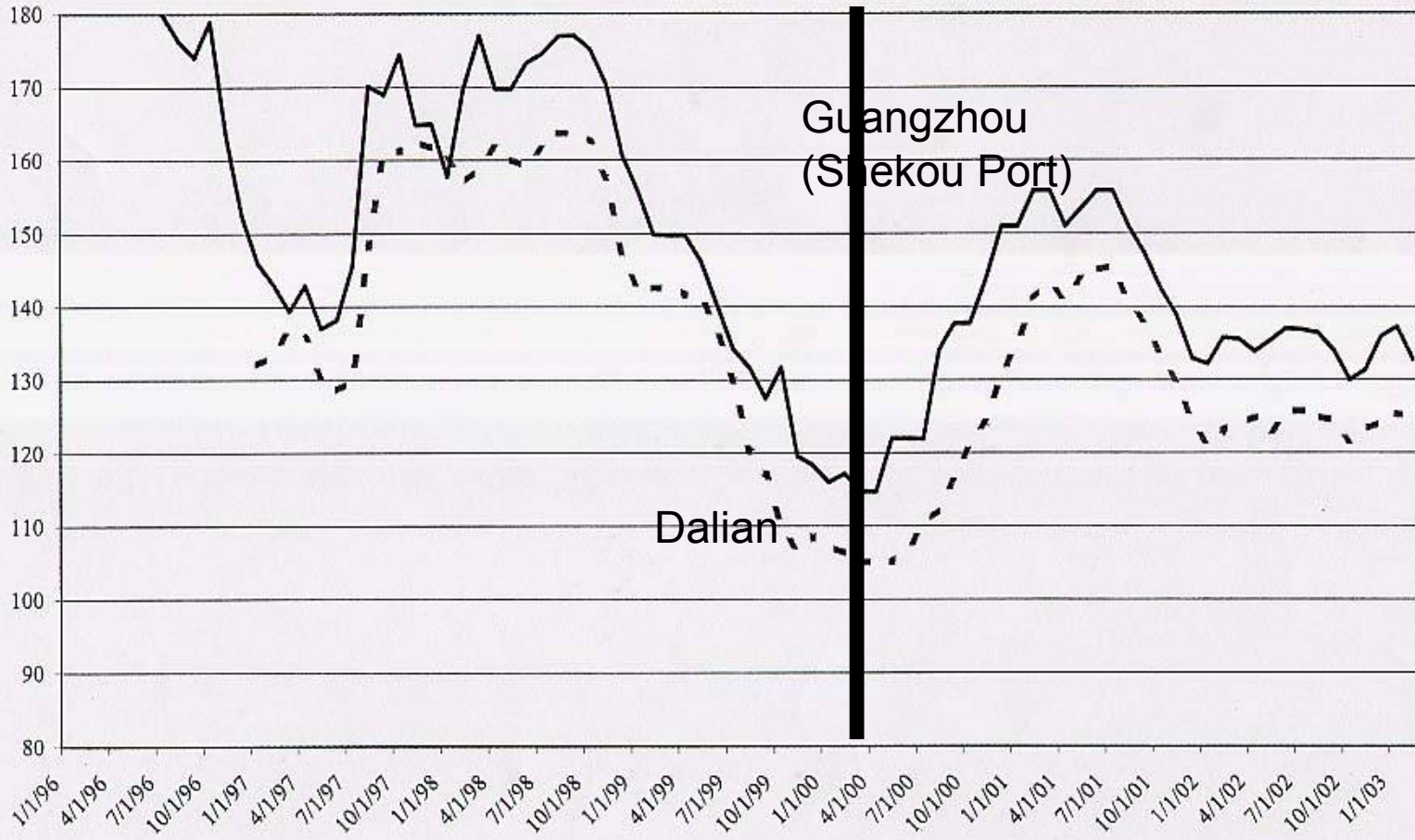


Percentage change in price for every 1000 kilometers of distance from port

	Corn	Soybean	Rice
China 1998	-4%	-10%	-10%
1999	-4%	-9%	-9%
2000	-3%	-4%	-7%
US – 1998	-5%	-3.5%	8%

Guangdon V.S. Dalian

- - - Dalian- at
storage(\$/mt)
— Guangdong(\$)



After 2000, prices of corn in Dalian and Guangzhou almost move perfectly together ...

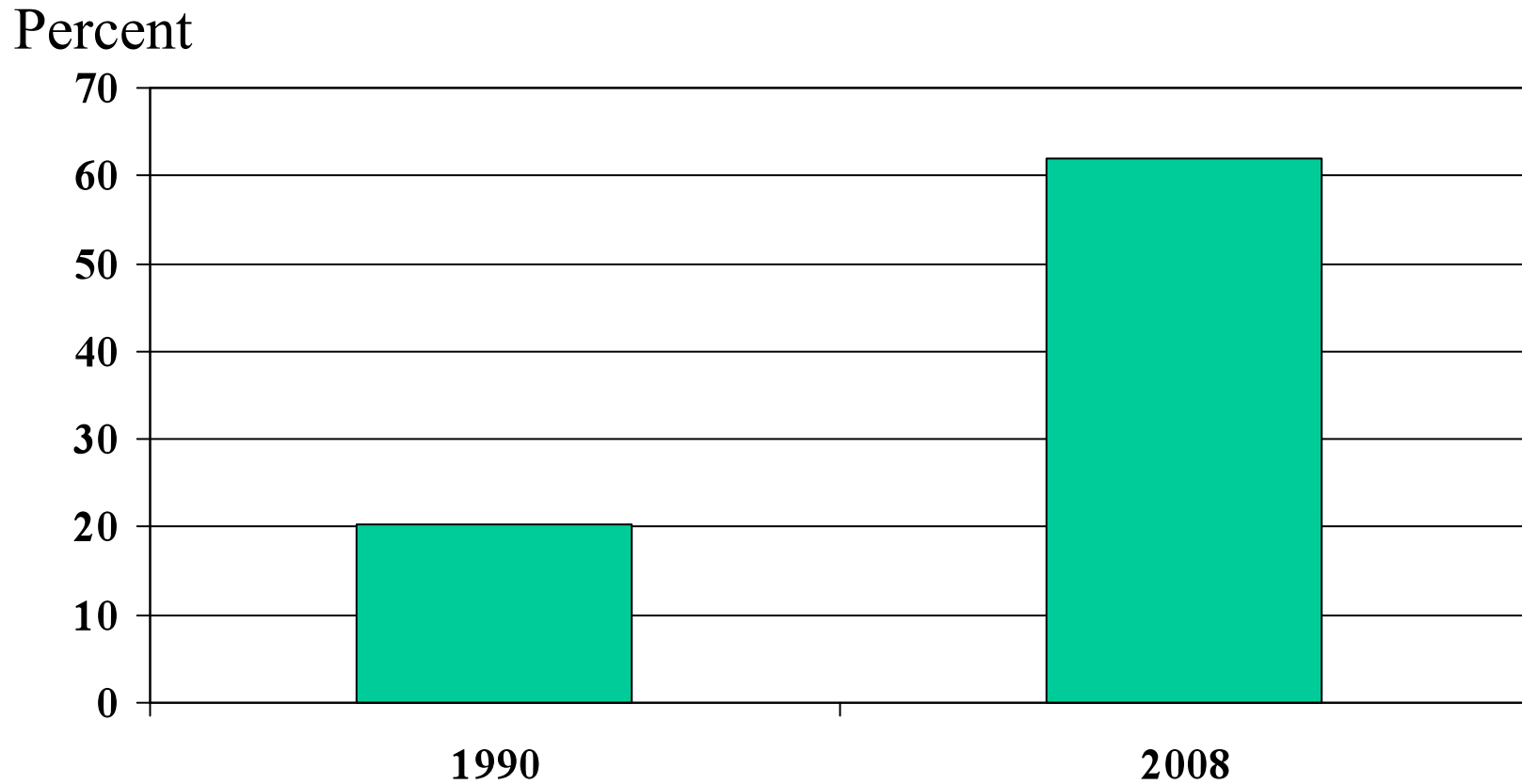
Integration in China's Markets (percent of market pairs that have integrated price series)

	1991-92	1997-00	2001-2003
Corn	46	93	100
Soybean	56	95	98

When using statistical tests (on more than 800 pairs of markets), almost all markets move together in an integrated way, up from less than $\frac{1}{2}$ in the early 1990s (when markets were NOT integrated)

What is the Impact of Rise of Markets

Rise of Specialization



Share of villages reporting they specialize in a crop/livestock

What is impact on the poor?

$$\text{Area_cash crops} = a_0 + a_1 * \text{Poor} + a_2 * Z + e$$

$$\text{Output_cash crops} = a_0 + a_1 * \text{Poor} + a_2 * Z + e$$

$$\text{Income_cash crops} = a_0 + a_1 * \text{Poor} + a_2 * Z + e$$

All things equal, do the poor benefit in this highly marketized world?

Is “a1” + or - ?

In four different studies (Hebei dairy; Shangdong apples; Shandong tomatoes; Shaanxi walnuts) →

$a_1 > 0$ → the poor have benefited in this super marketized world?

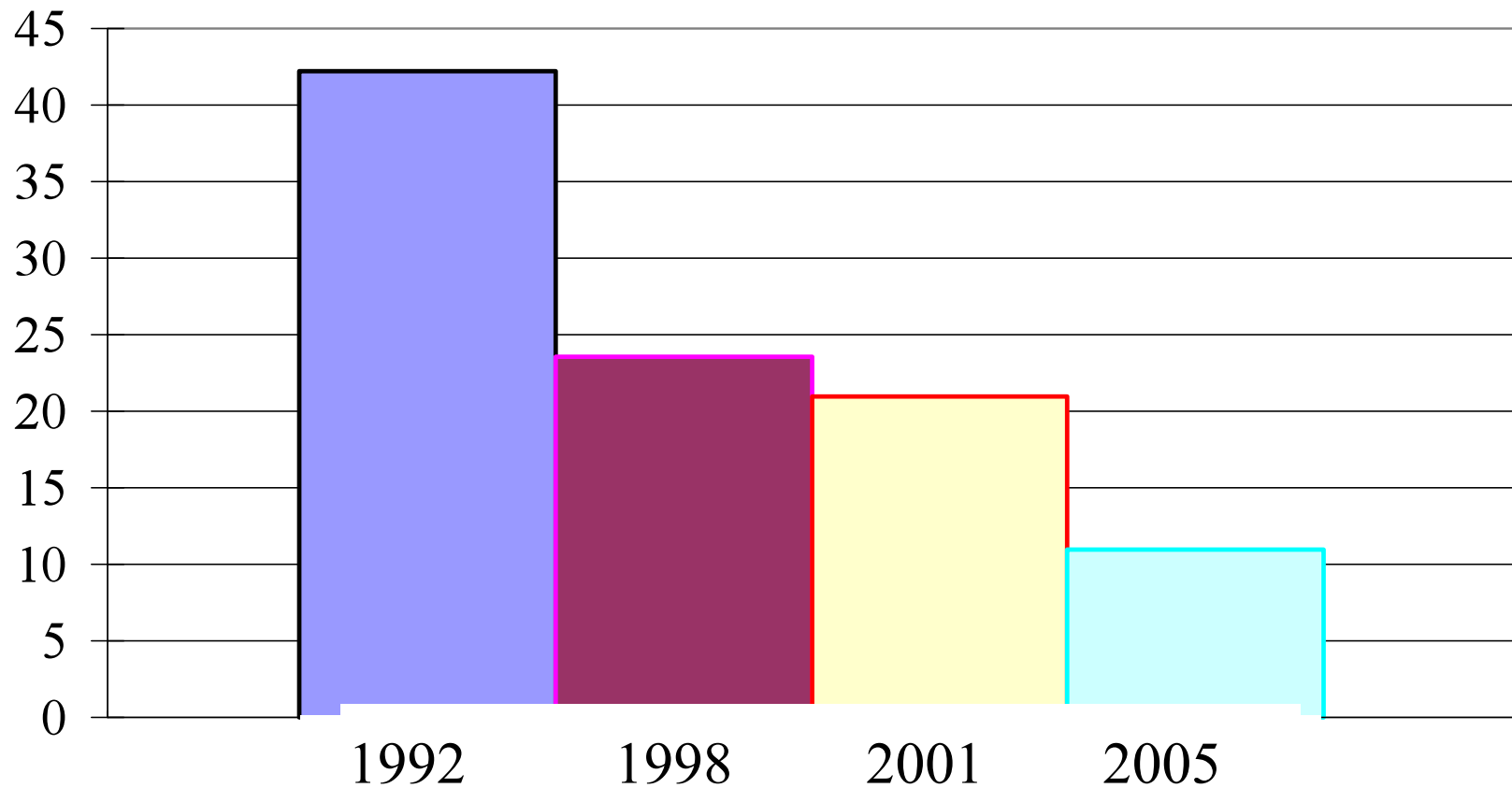
Why? Millions of traders willing to go to furthest most remote places to make a sale ...

Integration at the border

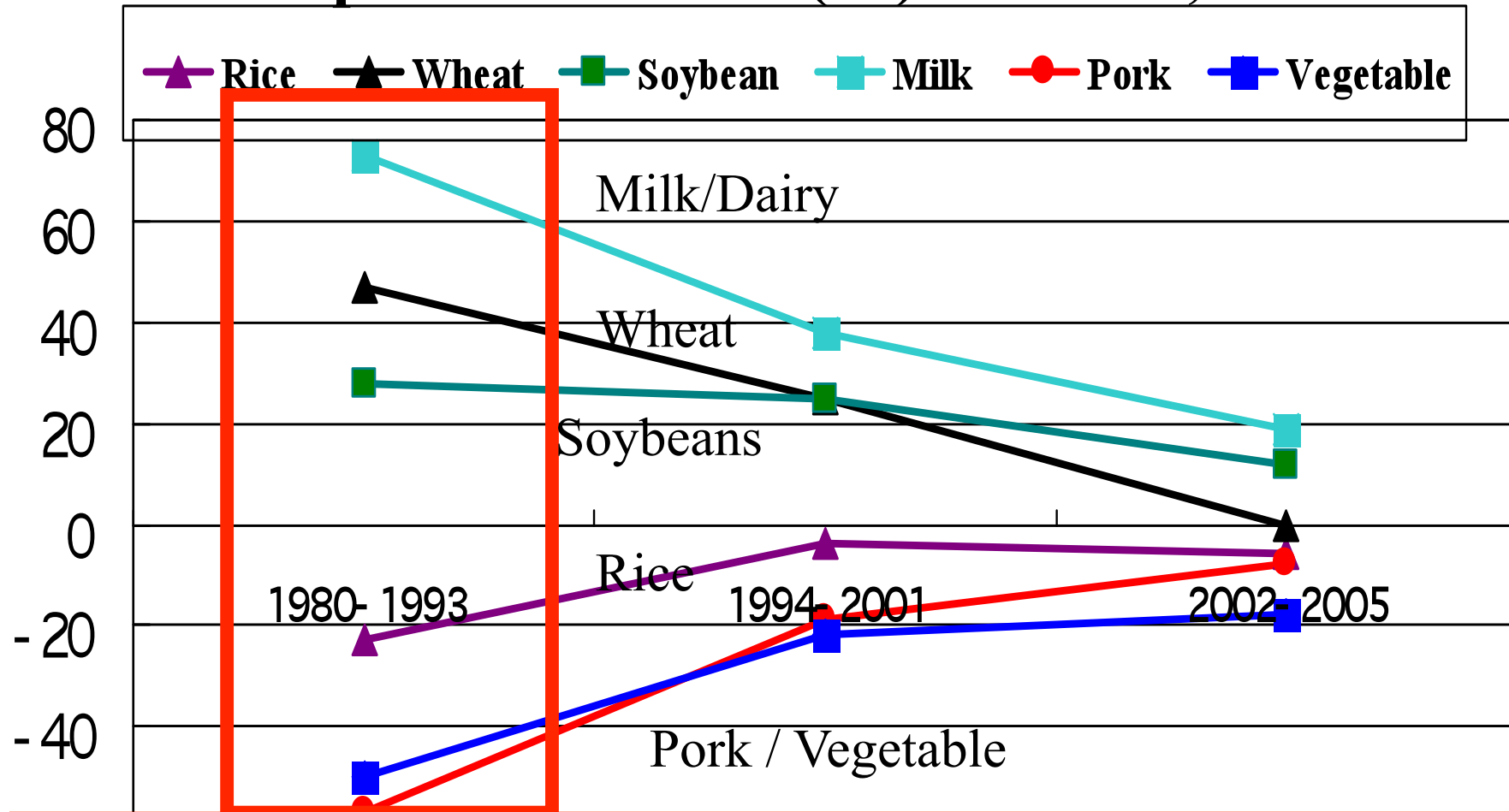
Agricultural tariff rates (%):

Prior to WTO accession (1992-2001) : 42% → 21%

China's WTO commitment (2001-2005): 21% → 11%

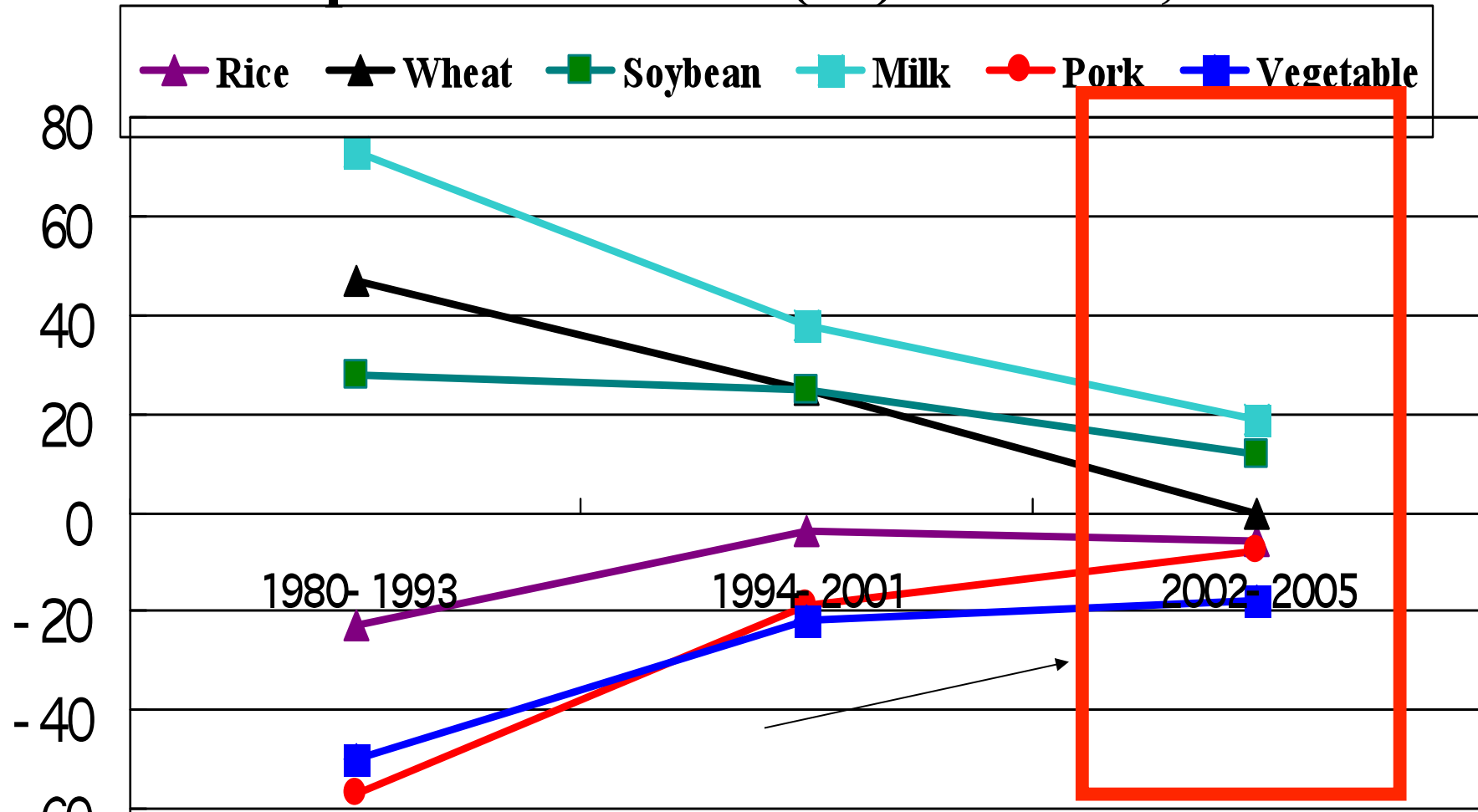


Nominal protection rates (%) in China, 1980-2005



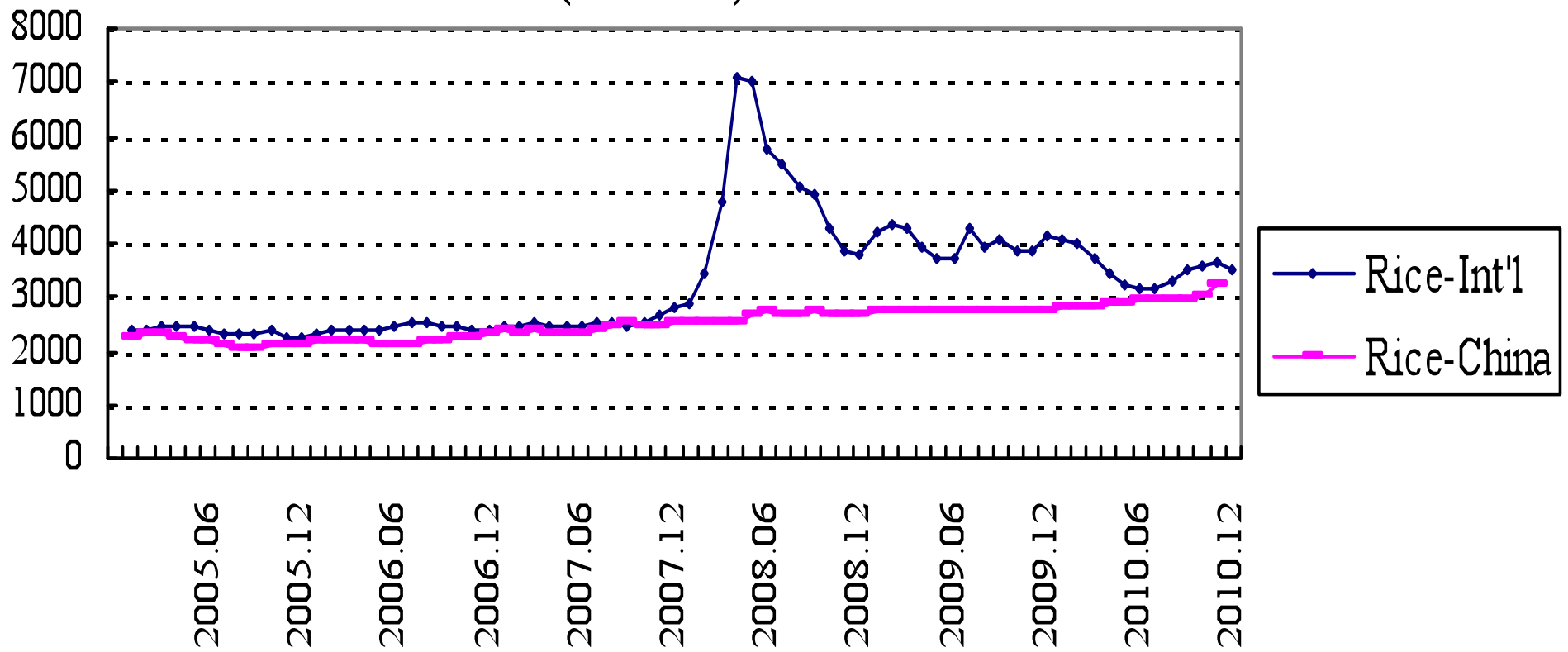
This slide shows that while the prices of some commodities were much higher than world market prices in the 1980s (those commodities > 0) and many were way under world market prices (those commodities < 0)

Nominal protection rates (%) in China, 1980-2005

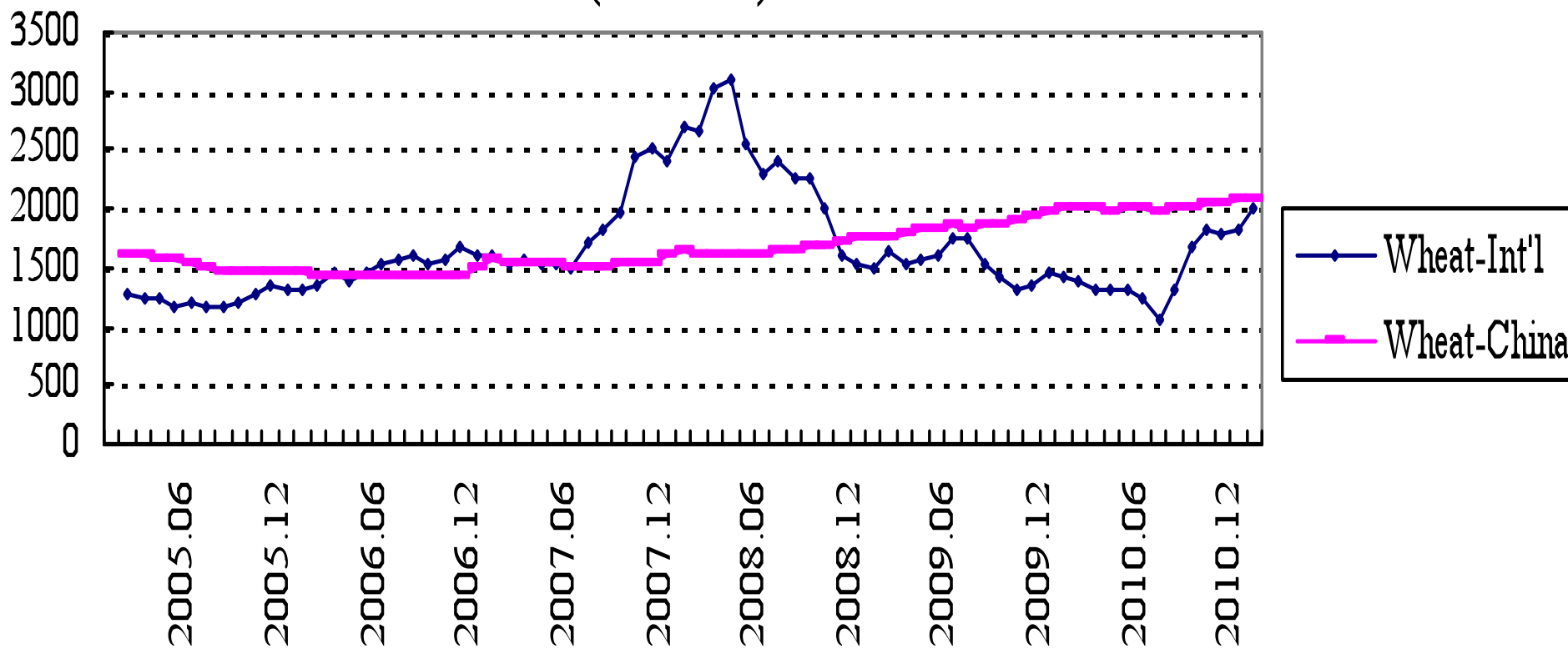


... by the 2000s, the prices of most of China's commodities were nearly equal to the prices of the same commodities on world markets ... this means that China is VERY OPEN ... these numbers are more close to those in Australia and New Zealand than Japan, Korea or Europe

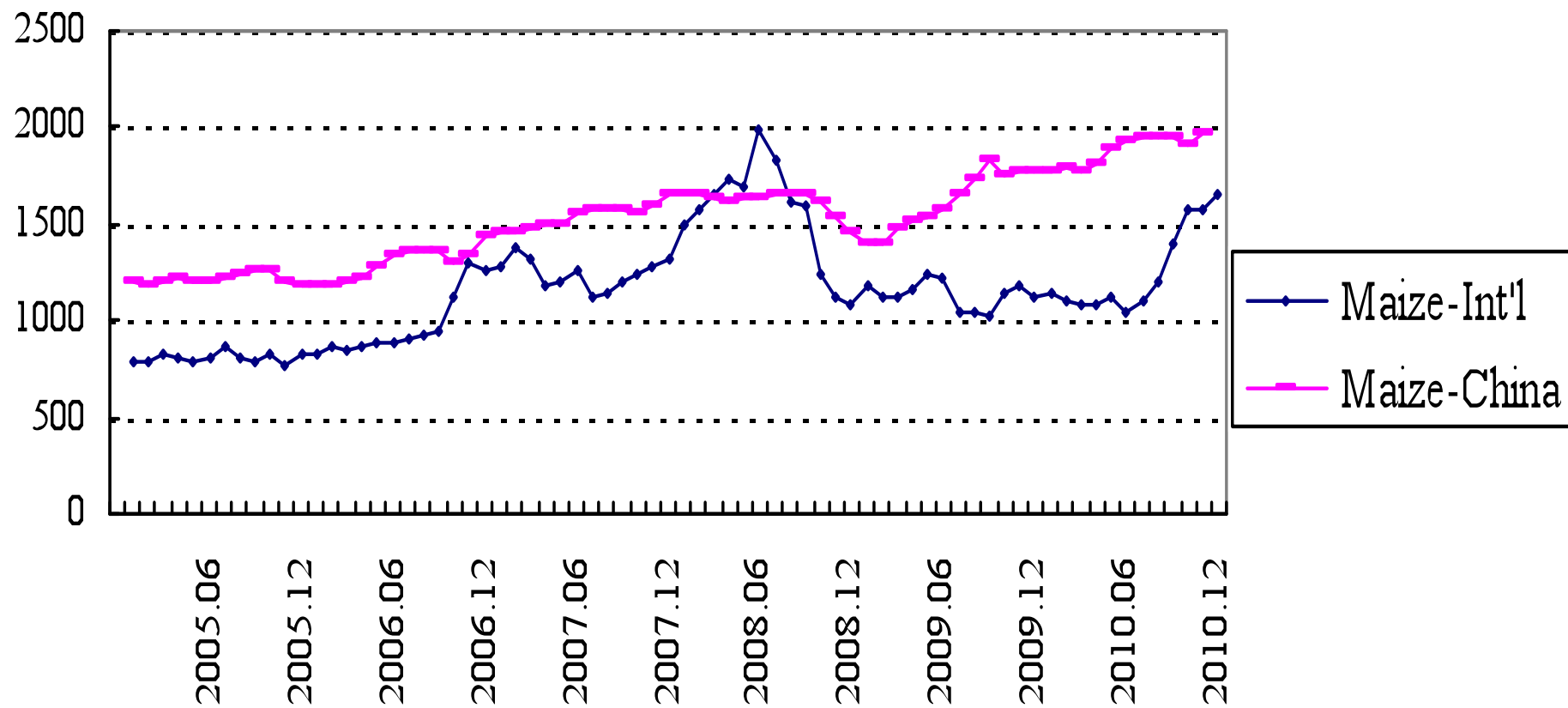
Rice price on the International and China's Domestic markets
(Yuan/ton)



Wheat price on the International and China's Domestic markets
(Yuan/ton)



Maize price on the International and China's Domestic markets
(Yuan/ton)



So China's record on trade liberalization is mixed

- On import side—quite liberalized
 - Average prices in China about the same as the world market prices ...
- But, on export side:
 - Less variable than world market
 - Use export restrictions when prices rise ...
 - [+ large buffer stocks]

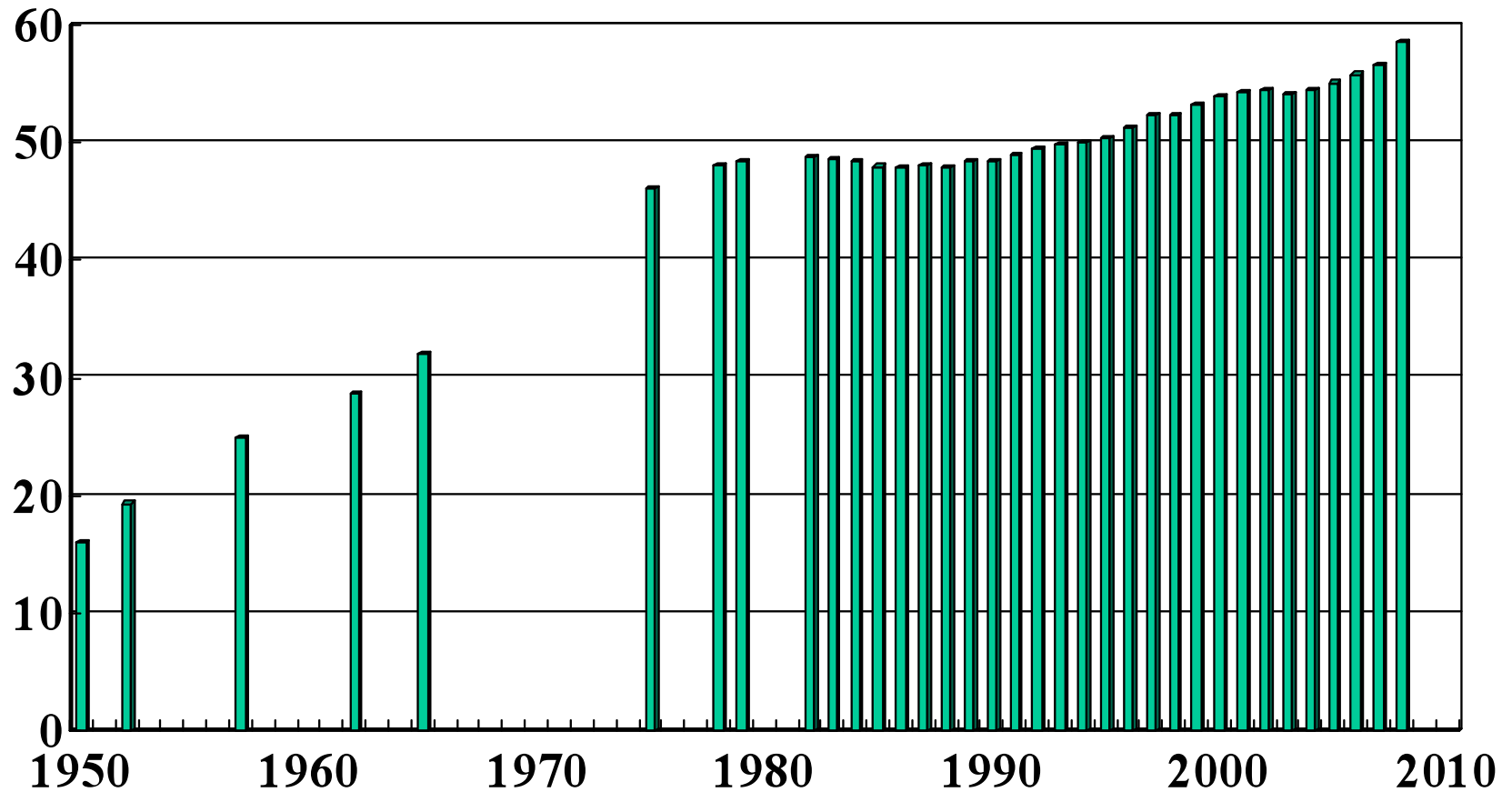
2c. Investment into agricultural sector

- Irrigation**
- Technology**
- Other**

Expansion of irrigated land in China

Nearly 50% of cultivated land

Million ha



Surface irrigation

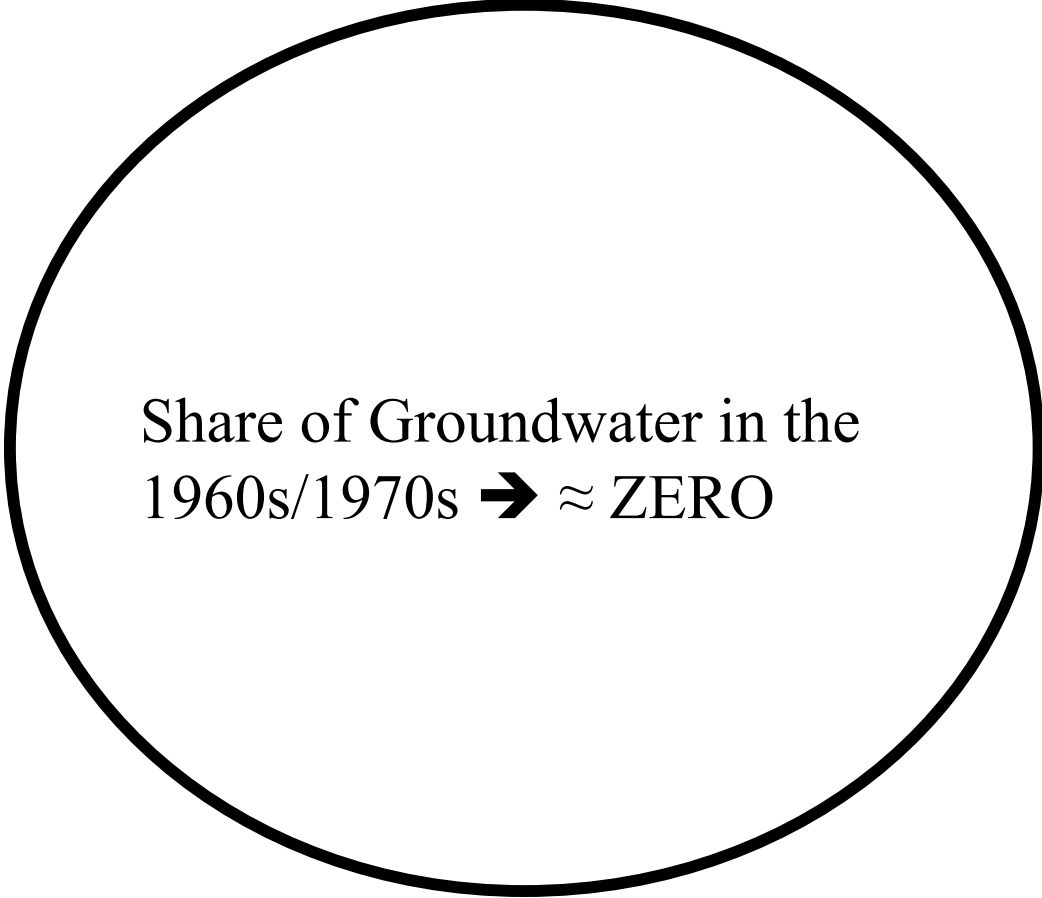


The state invested **HEAVILY** into surface water (construction and control)

The state invested HEAVILY into surface water (construction and control)

BUT: groundwater was left to the private sector

**Virtually unregulated
No water/pumping fees
But, no subsidy of electricity**

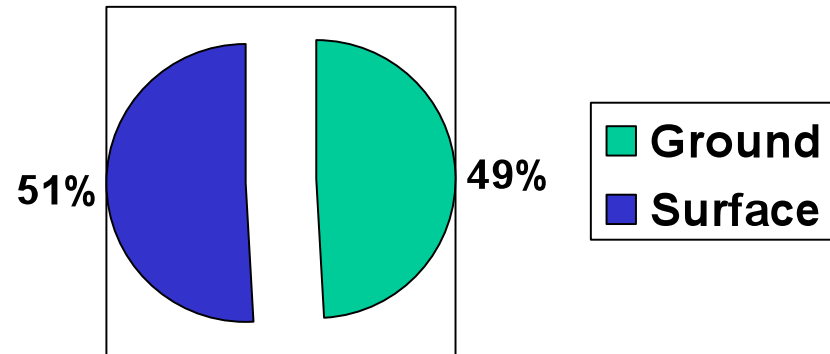


Share of Groundwater in the
1960s/1970s → \approx ZERO

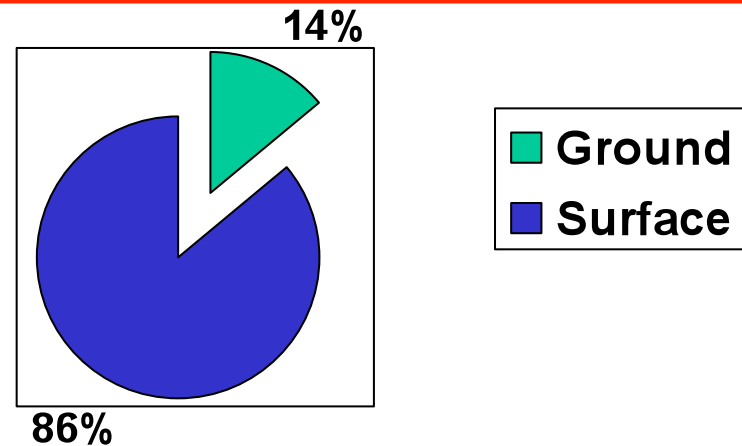
Importance of Groundwater in China



Water Supply by Source, 2002



North China

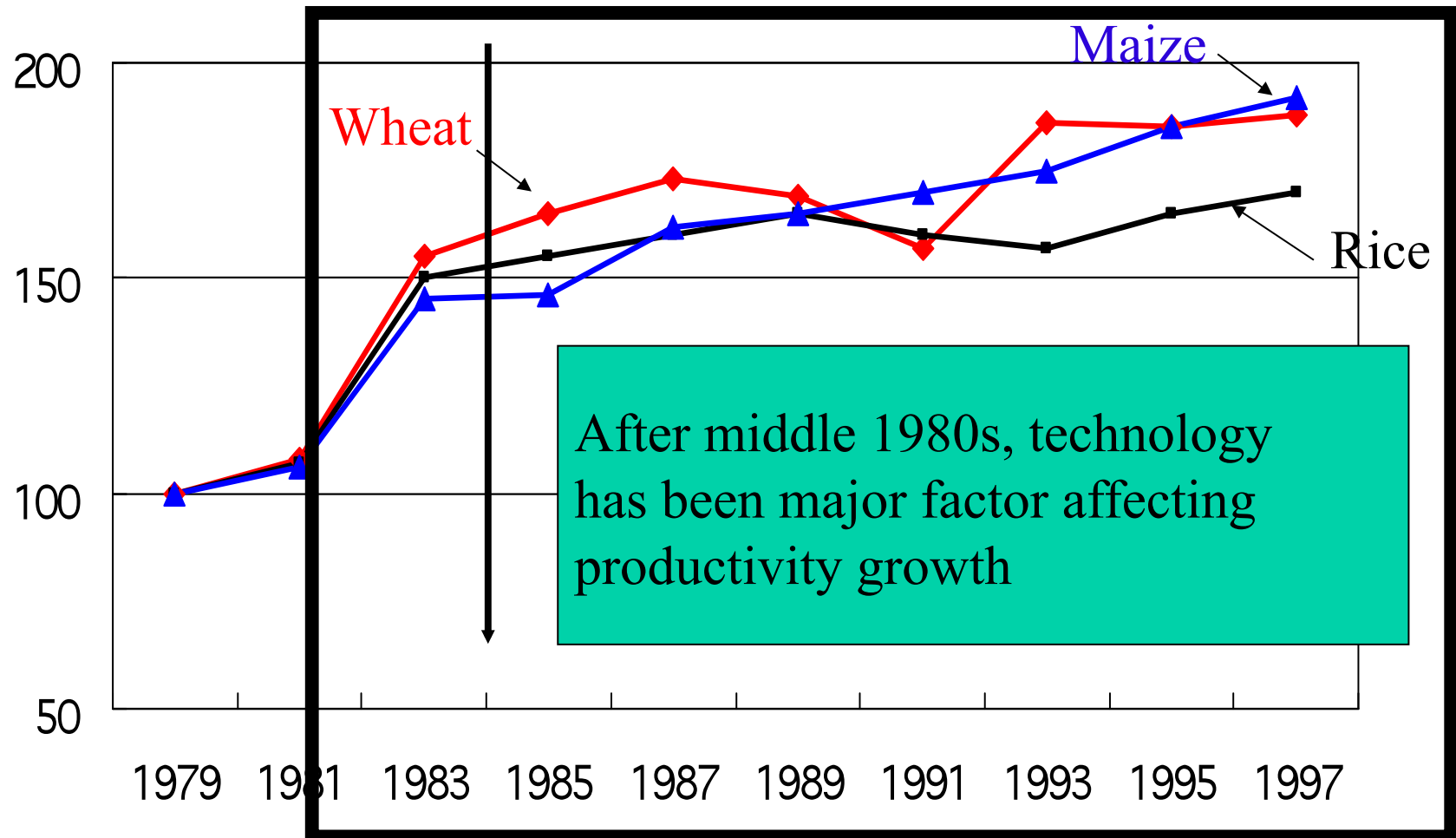


Rest of China

And investment into Agricultural
Research and Development (R&D)

Most all PUBLIC

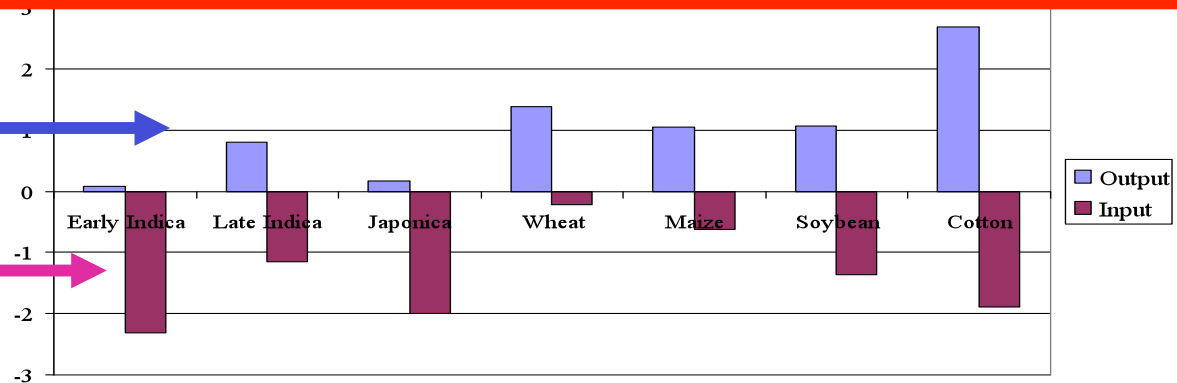
Impact of Investment and R&D on Total Factor Productivity for Rice, Wheat and Maize in China, 1979-94



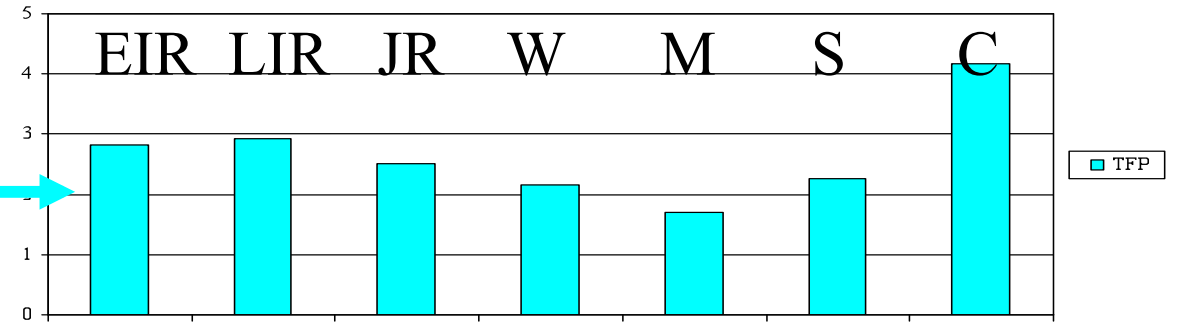
Output, Input, and TFP annual growth rate and Decomposition of TFP Main Grain Commodities and Cotton (1995-2004)

Output rises

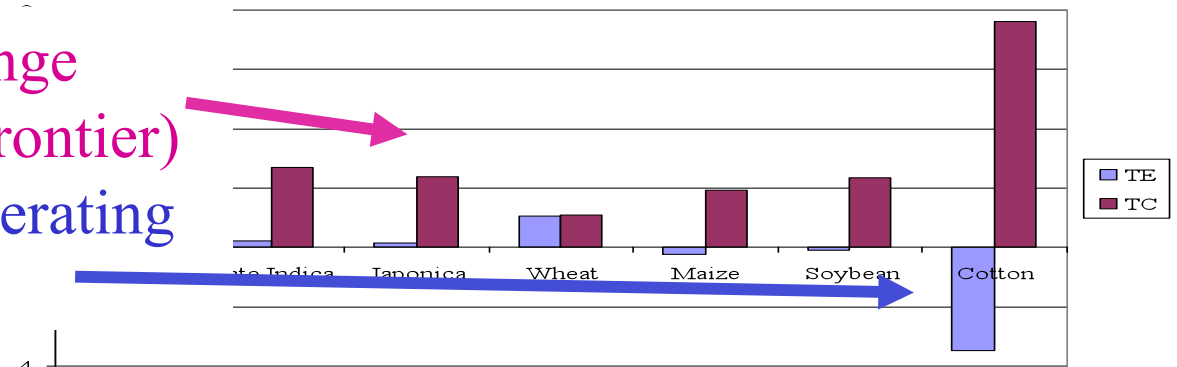
Input reductions



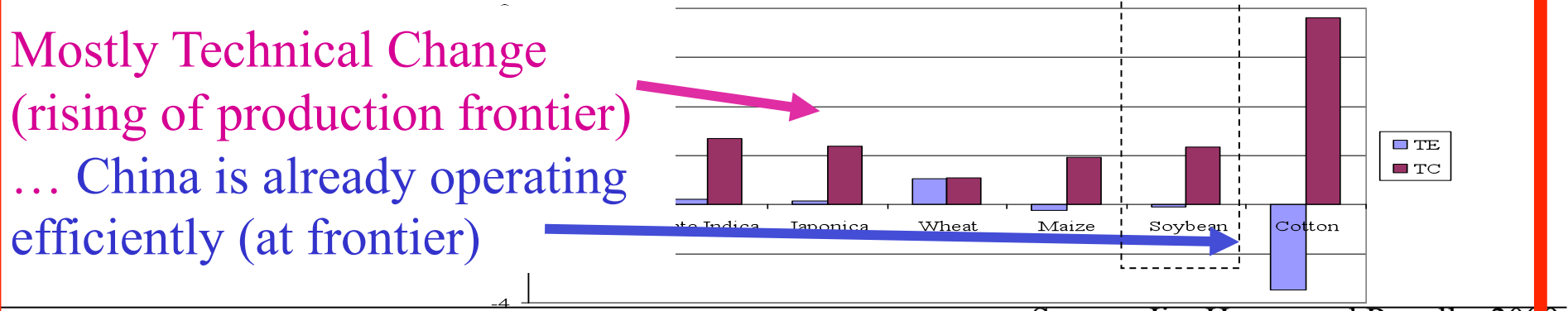
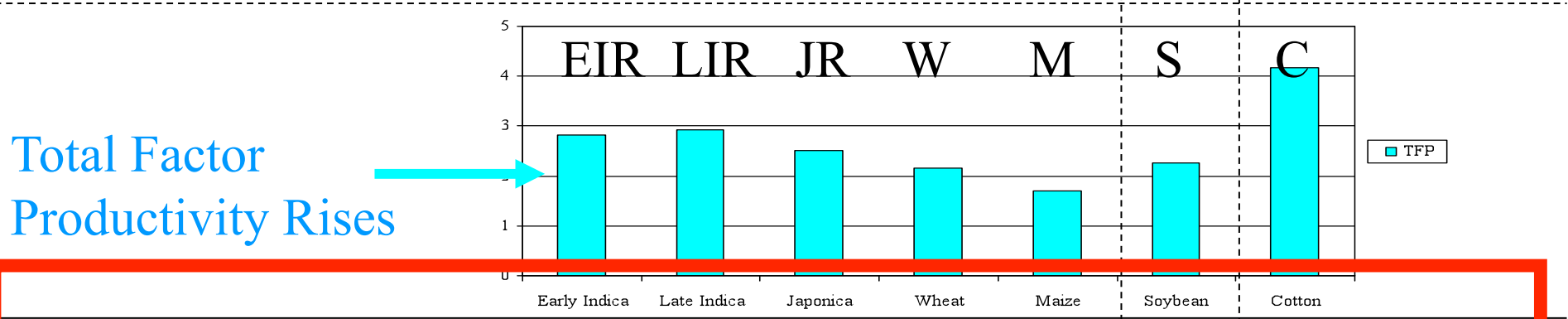
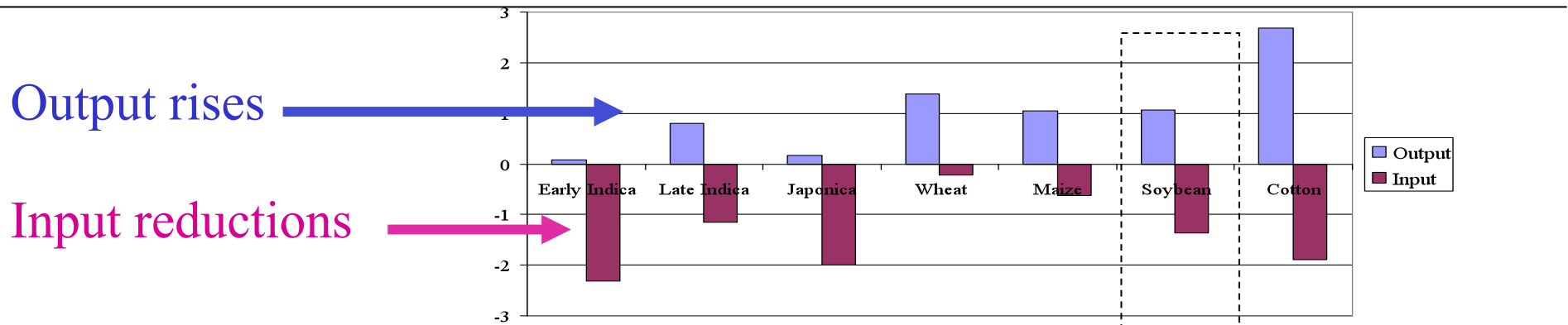
Total Factor Productivity Rises



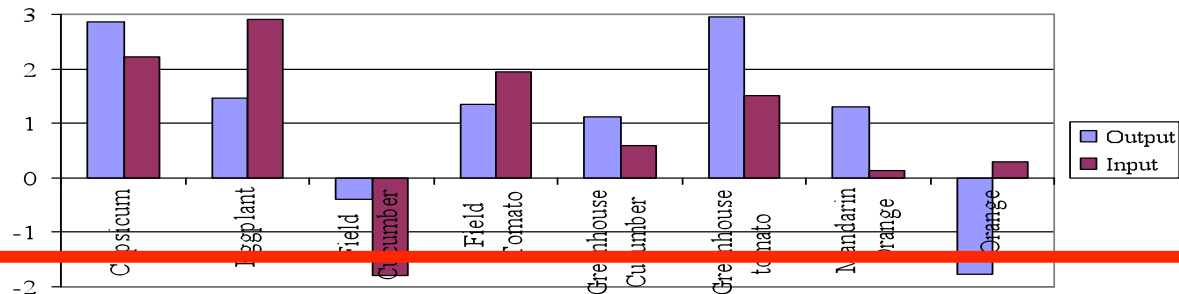
Mostly Technical Change
(rising of production frontier)
... China is already operating efficiently (at frontier)



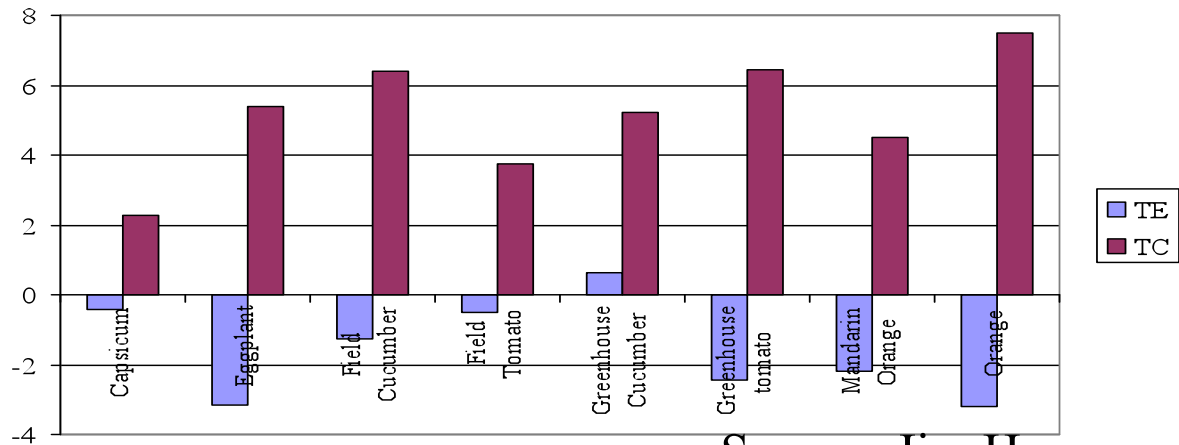
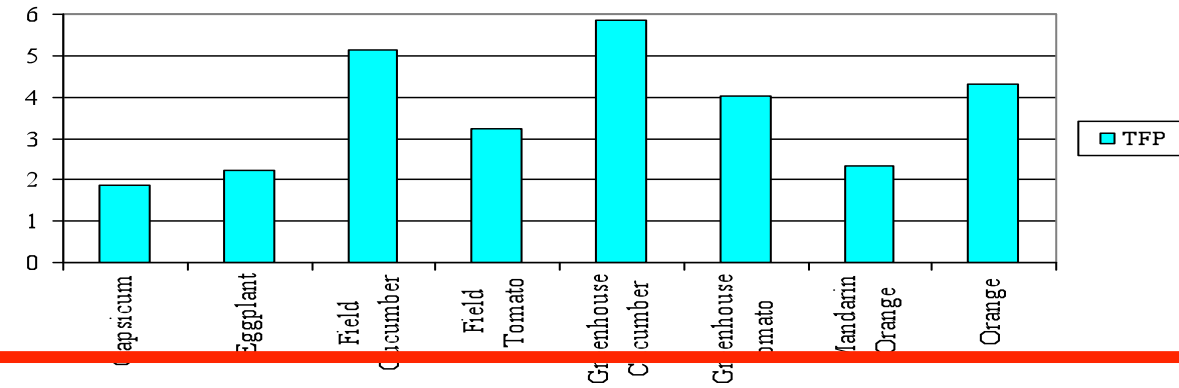
Output, Input, and TFP annual growth rate and Decomposition of TFP Main Grain Commodities and Cotton (1995-2004)



Output, Input, and TFP annual growth rate and Decomposition of TFP Vegetables and Oranges (1995-2004)

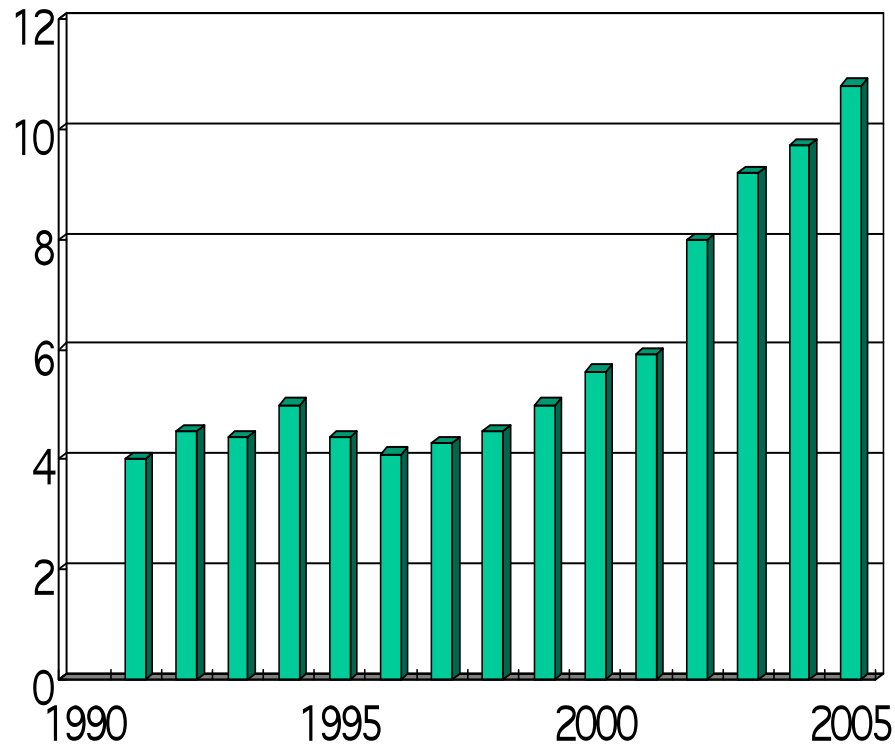


**Same story
for
vegetables
and fruit!!**

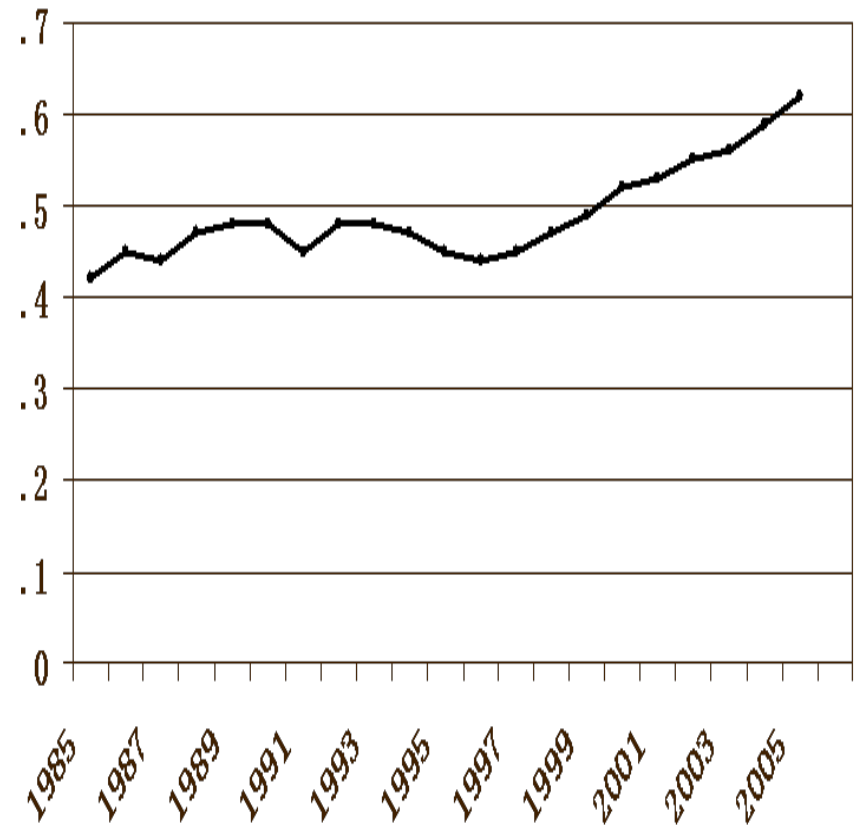


Source: Jin, Huang and Rozelle. 2009

What is policy initiative?
**Government fiscal
investment in
agricultural research
(billion yuan in 2005 price)**



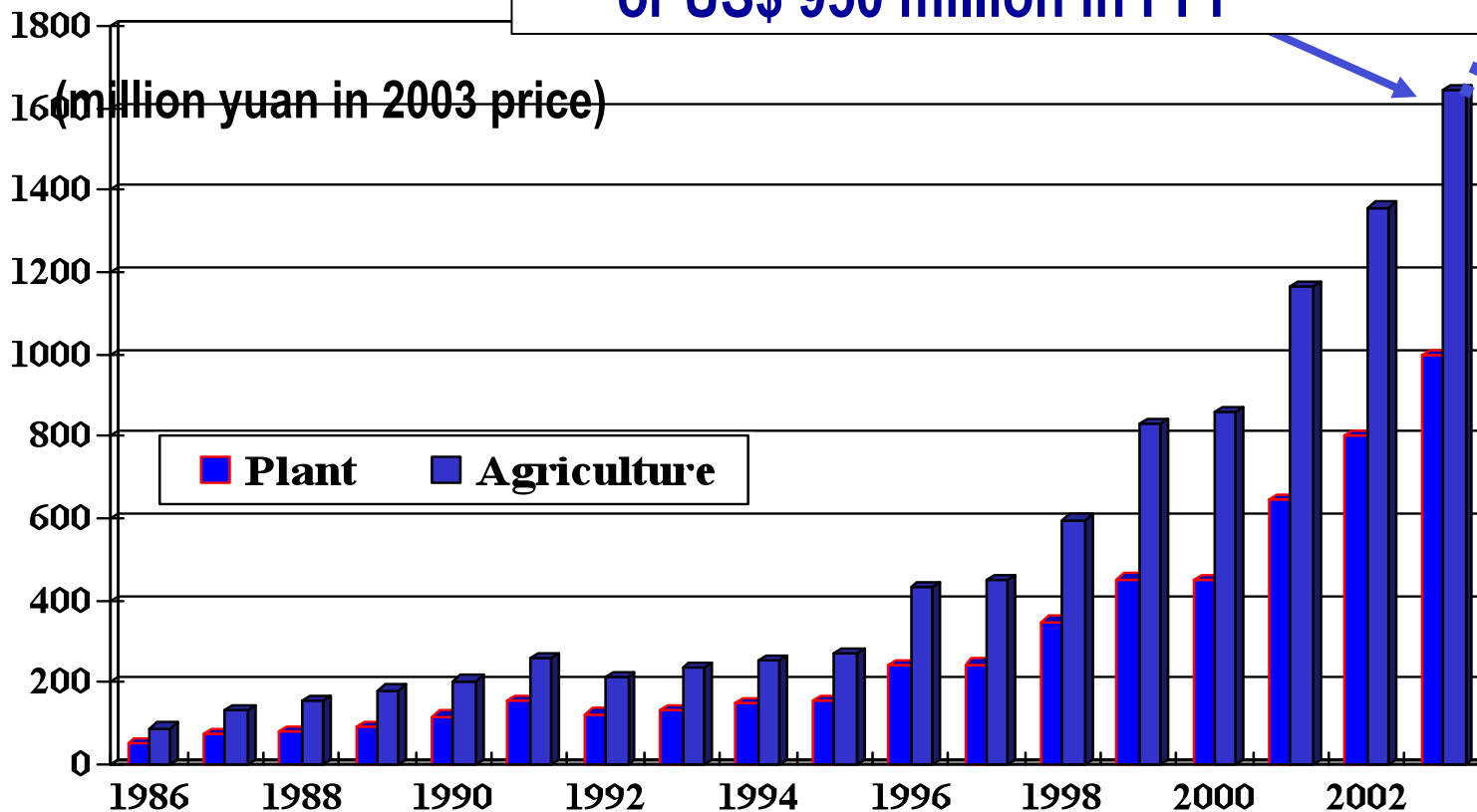
**Agricultural research
investment intensity (%)
in China**



Since 2000, the rise in research investment has been higher in China than any other country in the world ...

Agricultural biotech research investment

2003: 1.65 billion yuan = US\$ 200 million
or US\$ 950 million in PPP



The largest public investors in plant biotech in the world

Huang et al., 2005, April, *Science*

Impact on Farmers

Case 1: Cotton





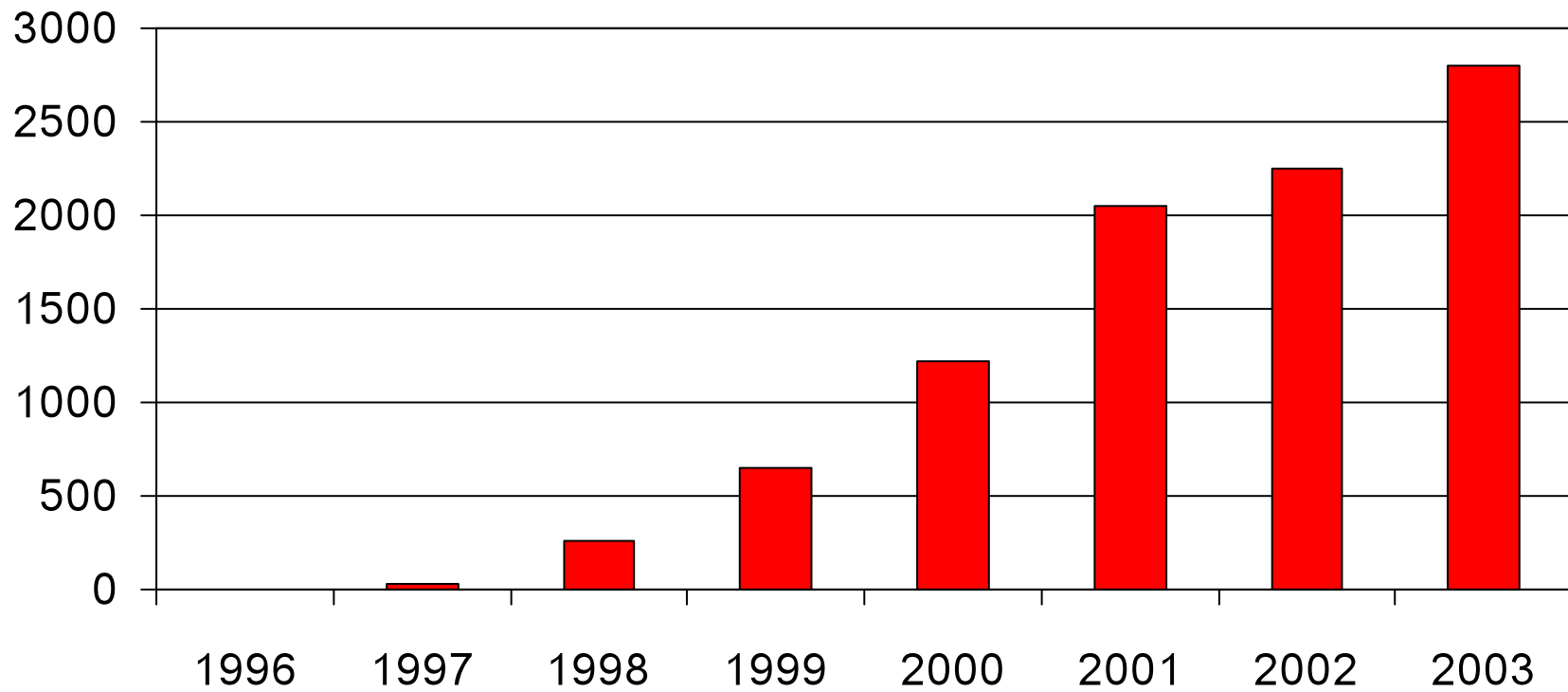
Non-Bt cotton



Bt cotton

Source: CAAS

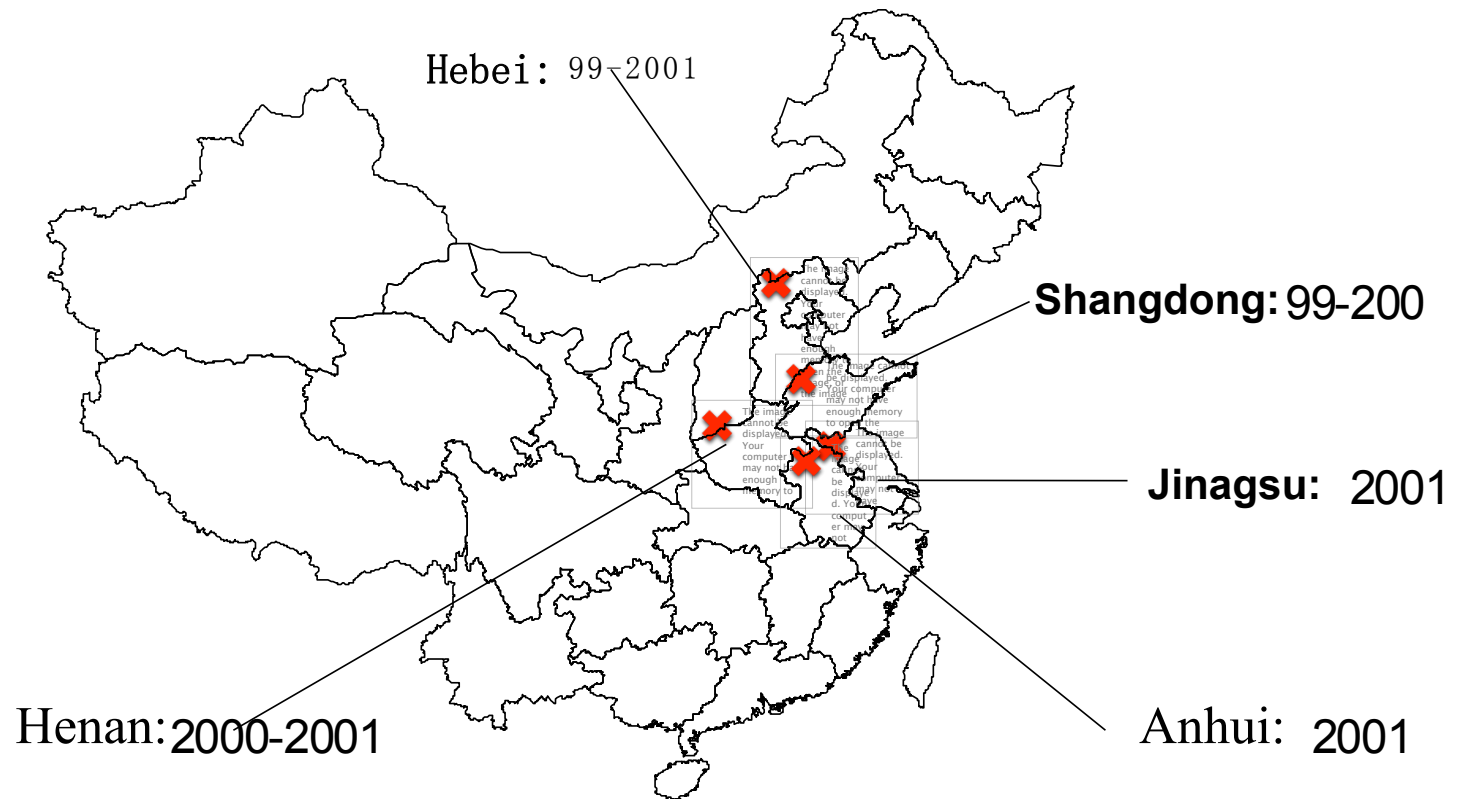
Bt cotton areas in China, 1996-2003 (thousand hectares)



More than 5 million farmers adopted Bt cotton in 2003

Case study: Bt vs Non-Bt

Samples' locations (1999-2001)



1999-2001: Samples – 1056 hhs

Case Study: Bt vs Non-Bt Cotton

Inputs levels:

No significant difference in:

Fertilizer use

Irrigation

Machinery

Harvest cost

Significantly different in

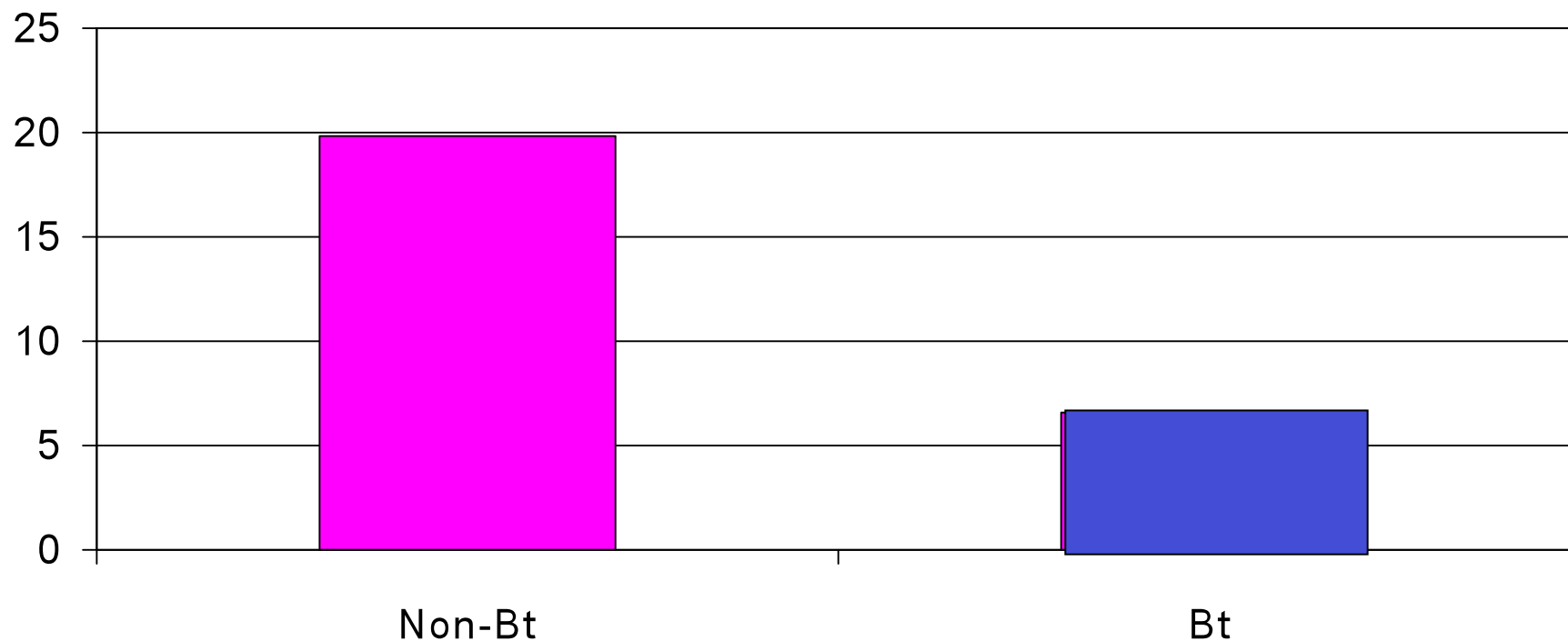
Pesticide use

Labor use

Seed price

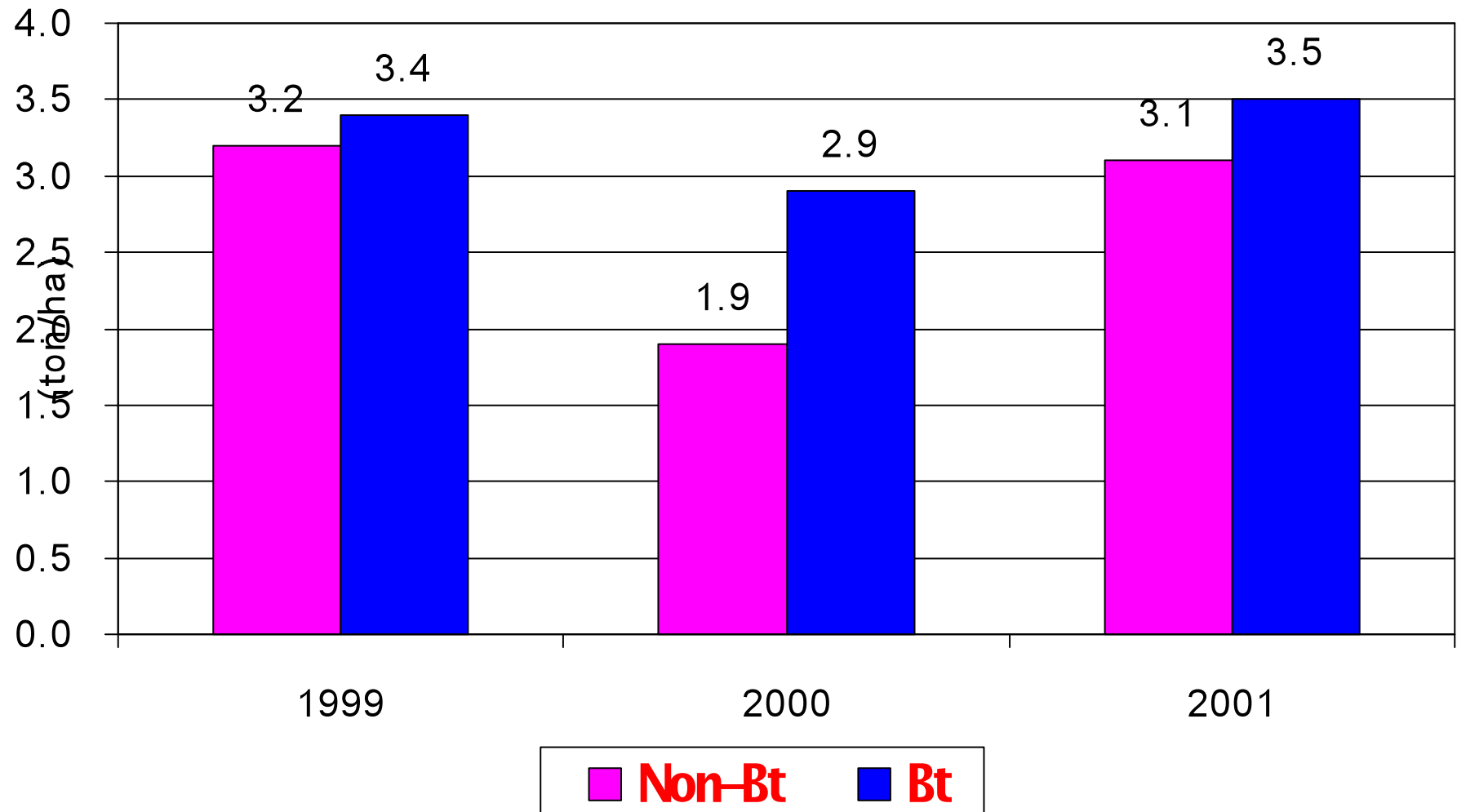
Numbers of pesticide applications in Bt and non-Bt cotton in Hebei and Shandong in 1999

-- reduced by 13 applications



In 2000: by 12 applications
In 2001: by 14 applications

Cotton yield (ton/ha): Bt vs non-Bt cotton



Major findings on Bt cotton impacts in 1999-2001 (per hectare)

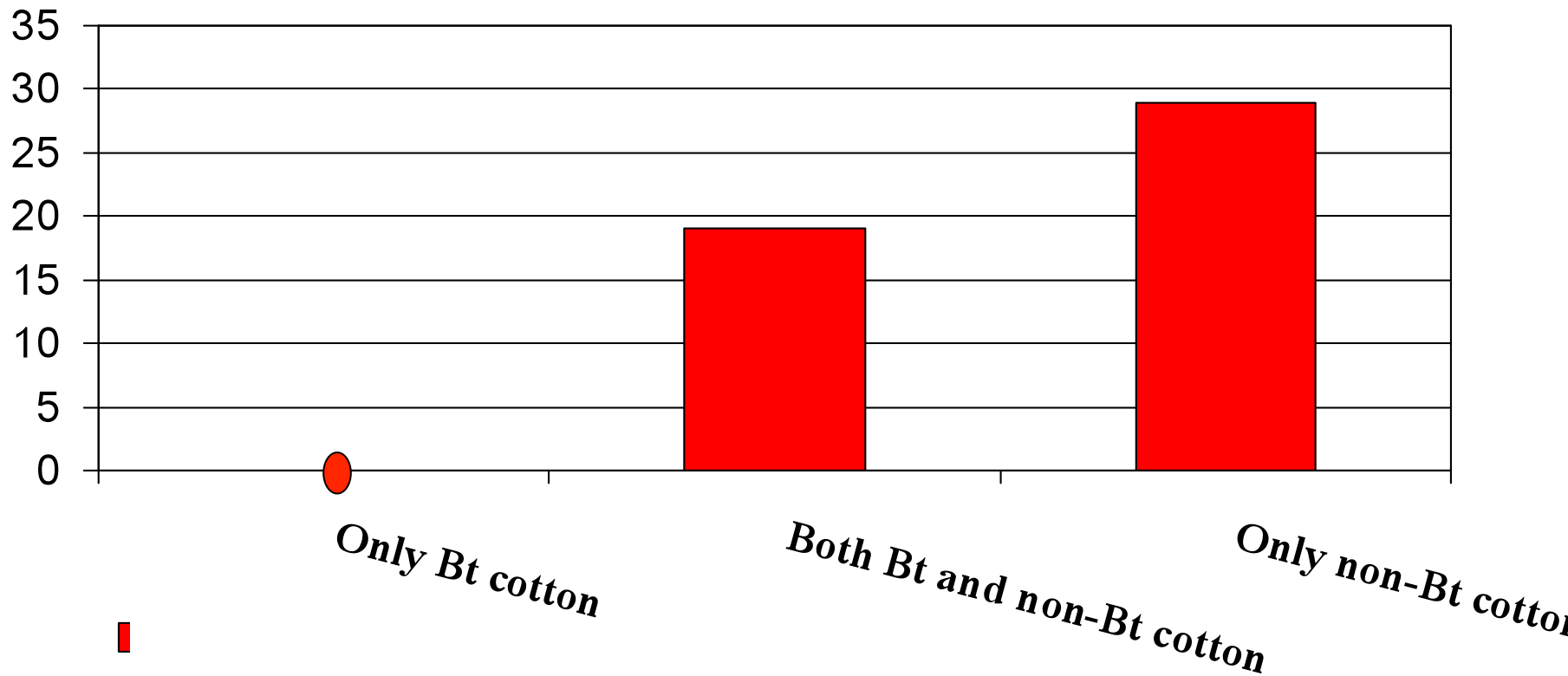
- Reduce pesticide use: 34 kg 923 yuan
- Increase yield: 9.6% 930 yuan
- Increase seed cost: 570 yuan
- Reduce labor input: 41 days 574 yuan
- Increase net income: 1283-1857 yuan
(US\$ 155-225)

A net increase of about 30% ...
this is a HUGE increase in
productivity!



GM technology's
benefits surpass
the direct
profitability
metrics

Percentage (%) of poisonings reported as numbers of farmers interviewed in Henan in 2000



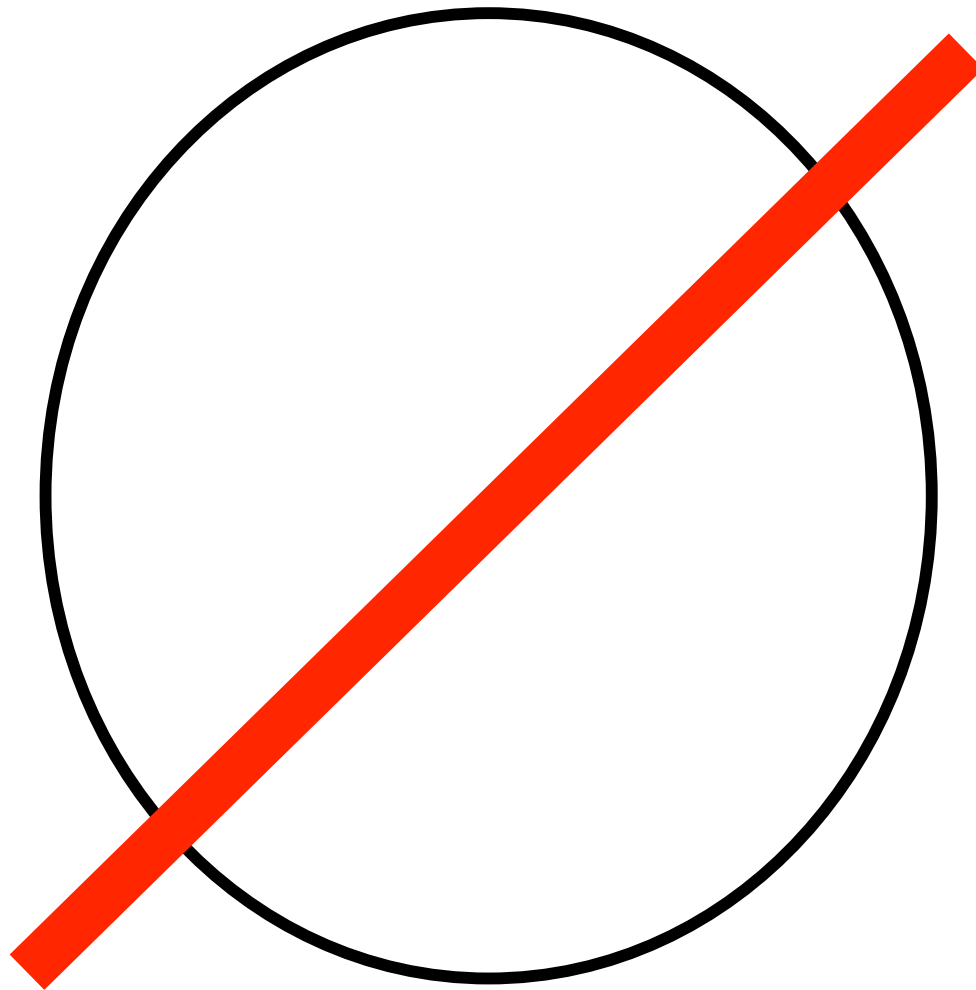
Summary of China's Ag Development and Status of Its Food Economy

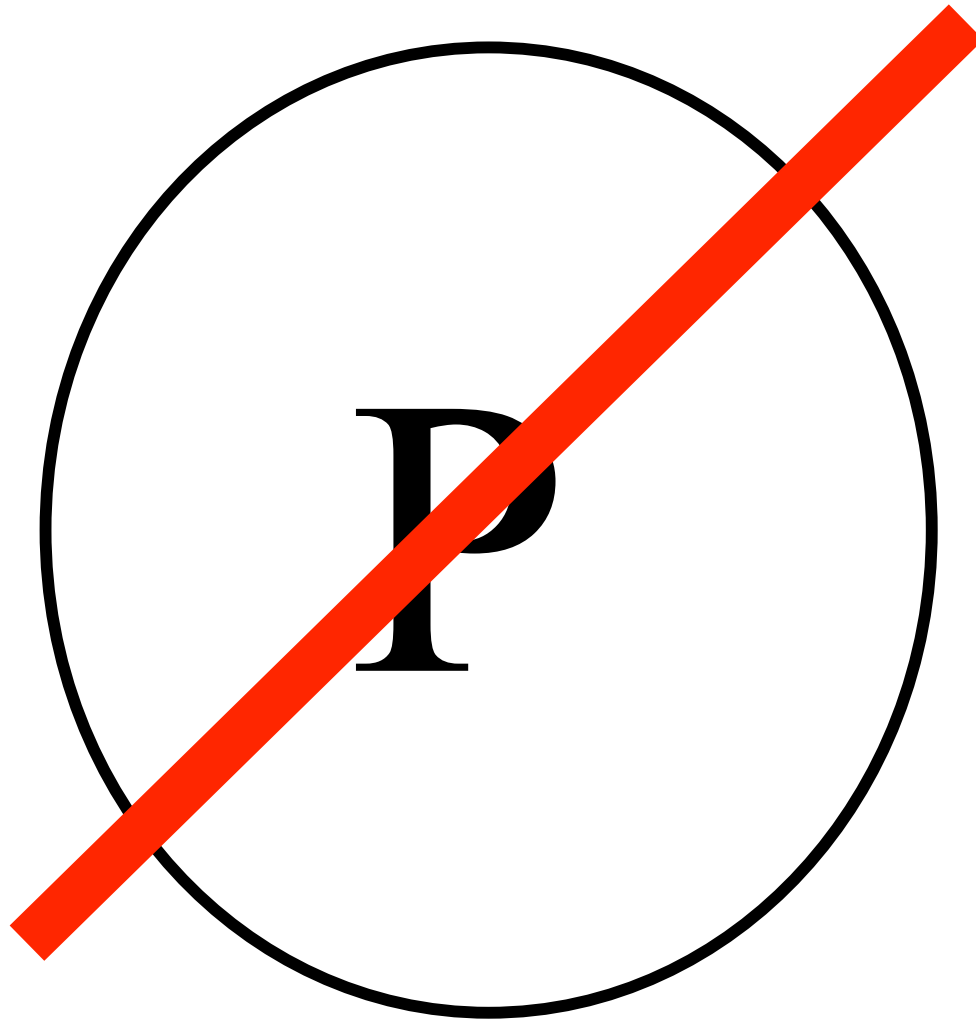
China's success in a “word”

- Land to all (incentives to farmers)
- Foster Markets
 - Do not over regulate markets
 - Key: do not distort
- Invest heavily in:
 - Water
 - Agricultural R&D

*Invest in roads
and
communications*

What China did NOT do





*They have not privatized cultivated
land → part of large urban/rural
inequality*

Barriers to privatization ...

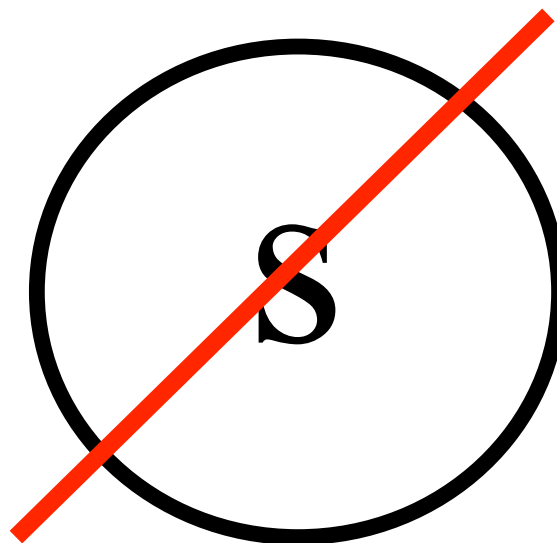
- Ideology ...
- Loss of control ...

Positive and negative effects

- : less incentive to invest / build larger farmers / no asset base to build wealth
- +: state to use land for investment with more ease (case of high speed rail)

No subsidies of inputs (in 1980s or 1990s)

- No fertilizer subsidies
- No pesticide subsidies



→ High incentives to suppliers / no barriers in the market ...

- No water subsidies

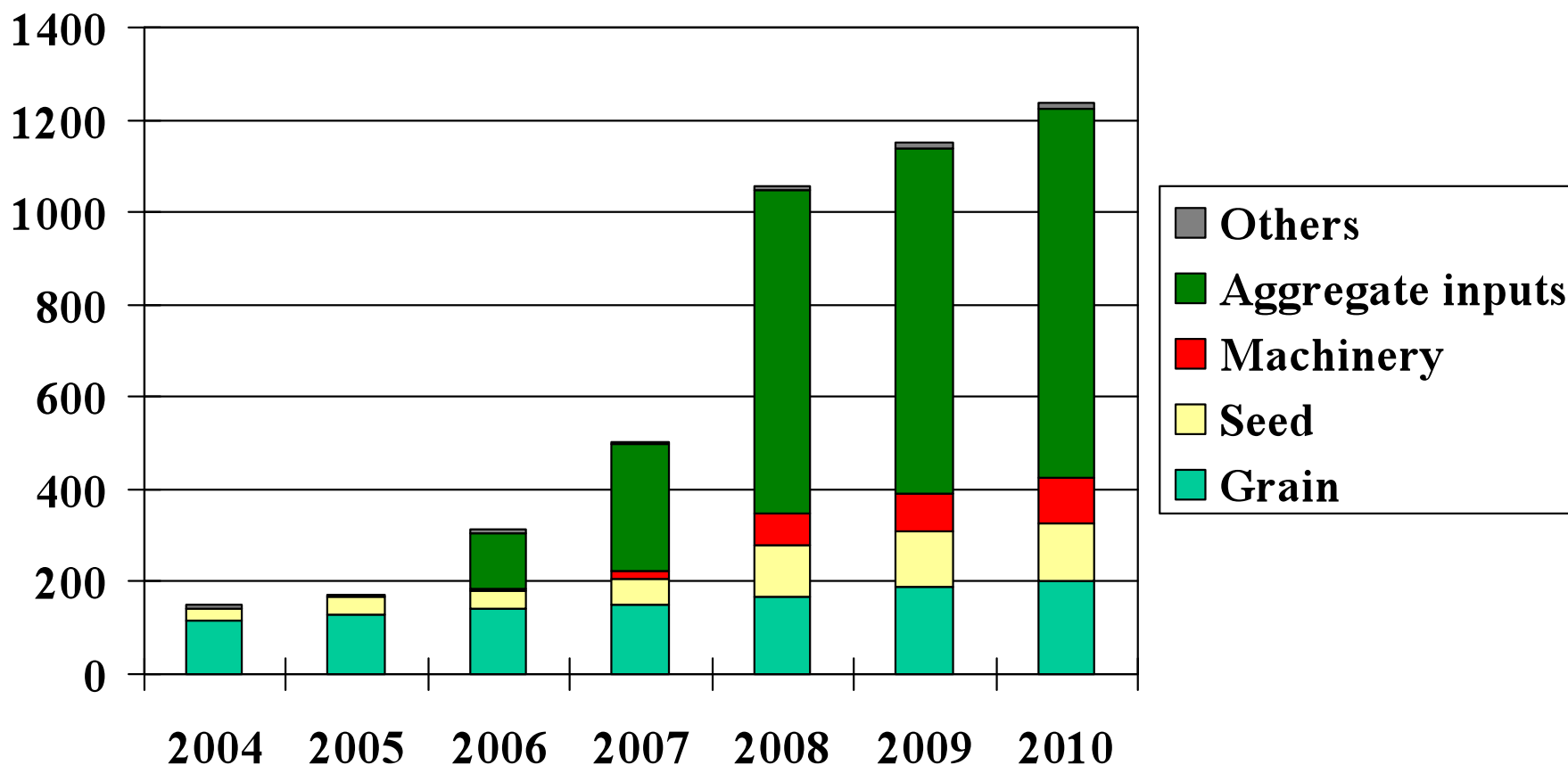
General subsidies in recent years

- US farmer in Illinois in 2011: about US \$50/acre
- China farmer in Sichuan in 2001: about US \$80/acre

But, at least through today, subsidies are given in a way that is non-distorting ... given as an income transfer to all farmers that have land

(regardless of what is being planted ... regardless of whether the “owner” is cultivating the land or renting the land out ... subsidy goes to “owner”)

Agricultural subsidies (100 million yuan)



Subsidies and supports have been rising significantly, reaching 3.1% of agricultural GDP in 2008

General subsidies in recent years

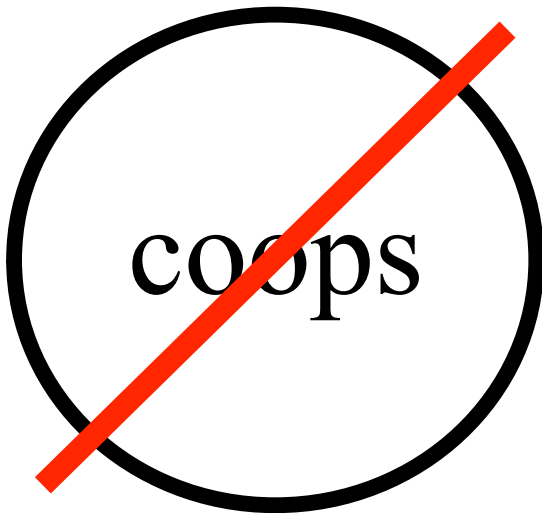
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Organization of production

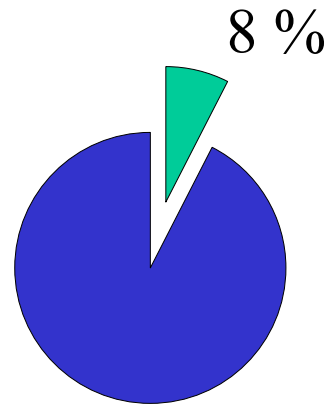
- Have not used Coops ... Farmer organizations



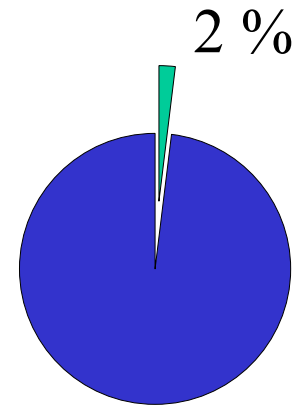
The government is afraid the a national system of coops might become focus of an opposition political party

And, these small farmers are mostly
“on their own”

Cooperative movement still small

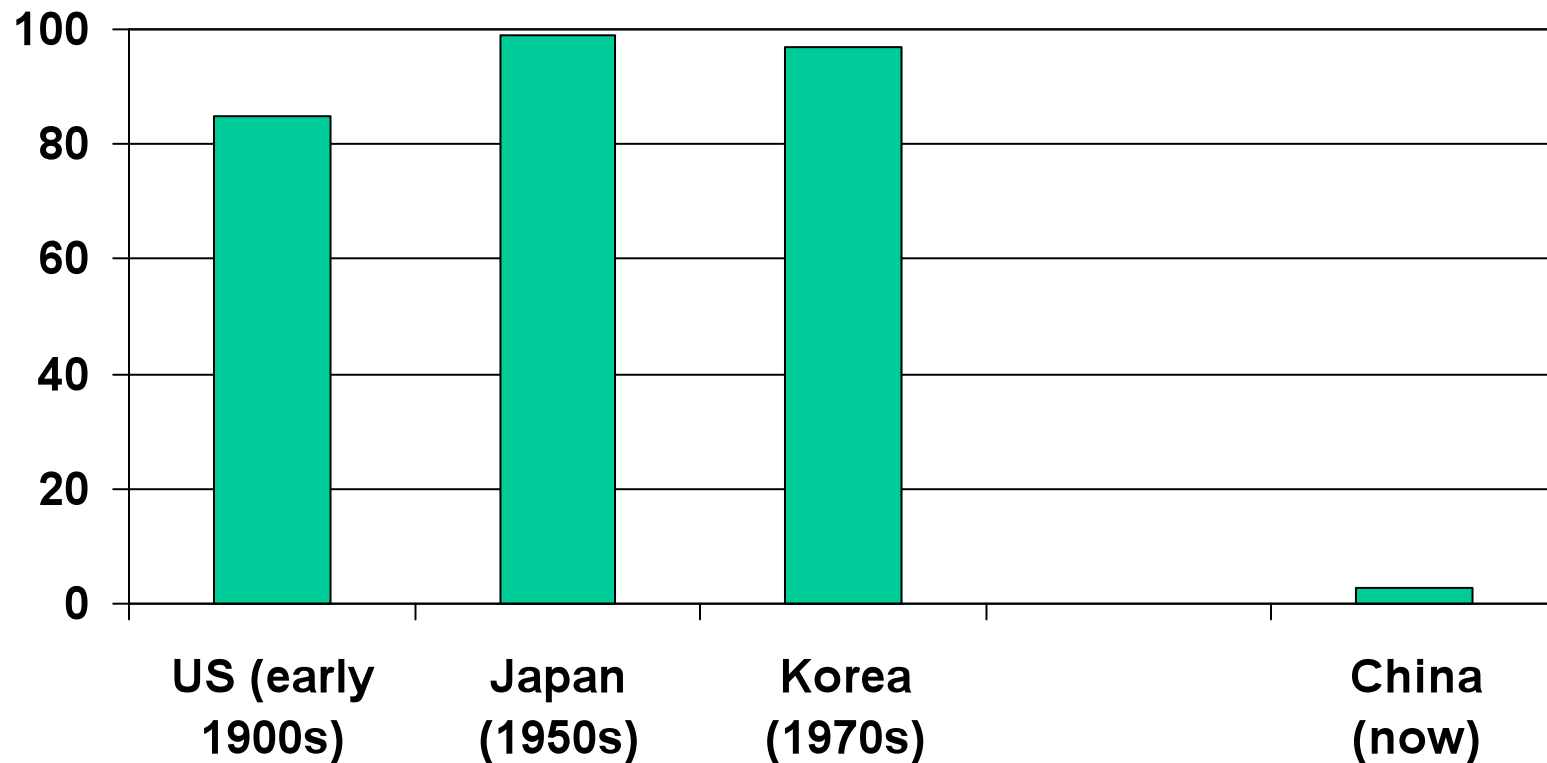


Percent of villages with
Cooperatives / FAs



Percent of households that
belong to Cooperatives / FAs

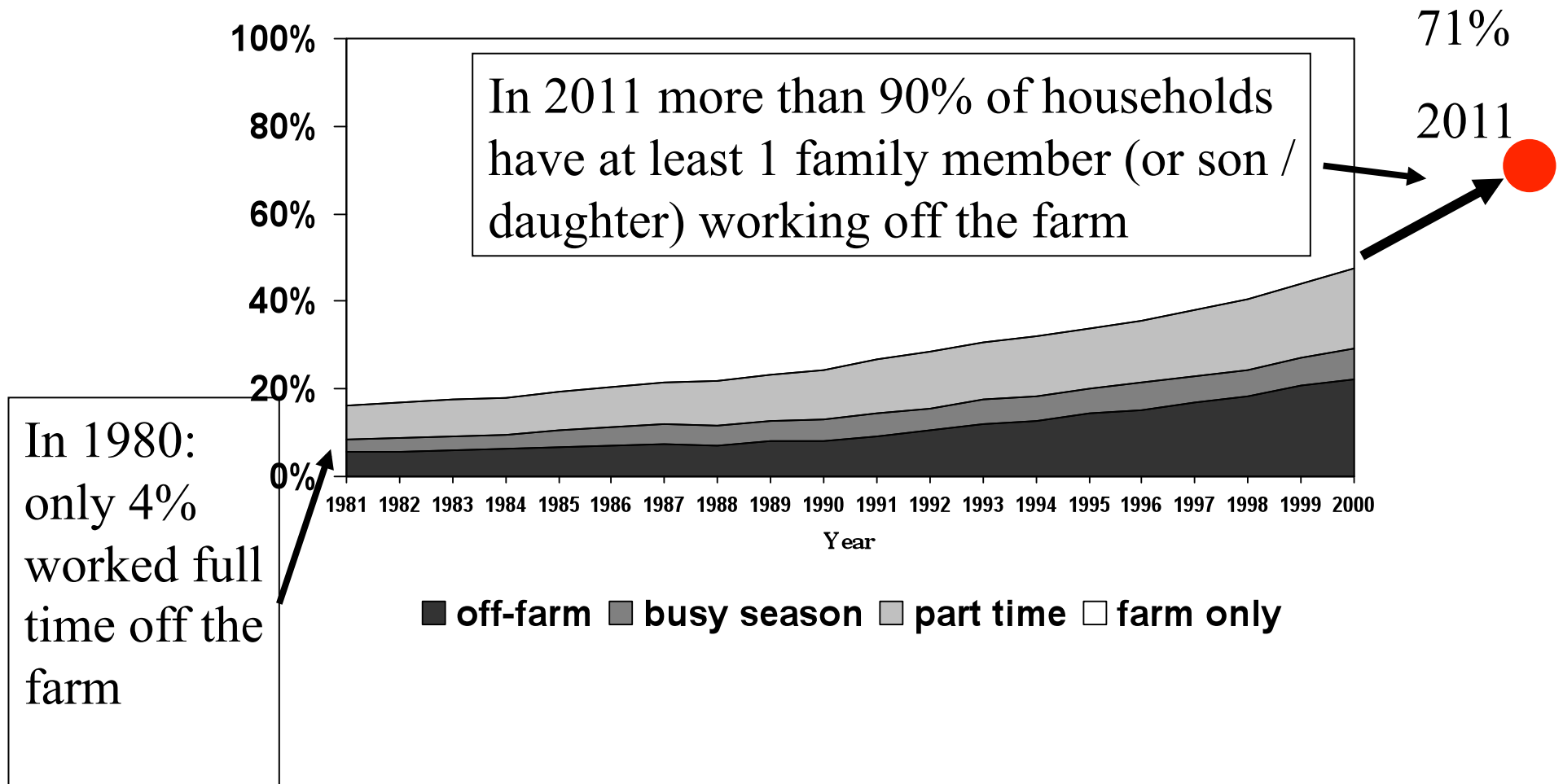
Comparing with other nations: Percentage of Households Participating in Coops/FAs



Status of China's Economy--2013

- China has solved Macro-nutrient Food Security Problem at the household level:
> 3000 Kcal/day/person
- Absolute Poverty Rate (US\$1.25/day):
from 40% in 1980 to less than 5% today
- Huge structural transformation

Overall Increase in Off-farm Work



Comparison of off-farm rates by age categories

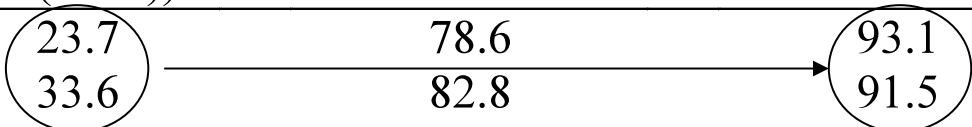
age cohorts	Percentage with off-farm work in:		
	1990 (from deBrauw et al. (2002))	2004 (our data)	2007 (our data)
16-20 ^a	23.7	78.6	93.1
21-25	33.6	82.8	91.5
26-30	28.8	71.0	89.4
31-35	26.9	65.1	87.2
36-40	20.5	54.0	72.7
41-50	20.8	44.0	54.1

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This is the REAL transformation

Investment into agriculture played key role in this transformation → created a virtuous cycle

- Agriculture provided income for farm households:
 - To build housing
 - To invest in education for kids
 - To finance move off the farm
 - For starting self-employed enterprises
 - It was a source of demand ... in the early stages of industrialization (in fact, early factories were set up in the rural areas)
- Off farm remittances and earnings from self-employed enterprises in turn financed agriculture at the household level:
 - High rates of fertilizer use in the world (no credit needed)
 - Investment by households in groundwater / pumps
 - Investment by households into vegetable and fruit production
 - Investment by entrepreneurs into custom plowing / harvesting
- High earnings from agriculture allow additional push off the farm ...

China's agriculture is NOT perfect (not by a long shot)

Concerns & Challenges:

Demand Side

- **High demand for meat / fish / fruits / vegetables**
- **Serious food safety concerns**

Supply Side

- **Land**
- **Water**
- **Small farm/Ageing farmers (farmer-ettes)**
- **Rising wages**

- **Rising net imports (and National Food Security concerns)**

What are the lessons for Africa?

1. Incentives are important ...

- Providing incentives are more important than formal property rights ... as long as farmers can be assured of the return to the effort, they will invest in farming activities ...
- Of course, more secure rights are better ... and will be needed to encourage investment in land-specific investments ... if State helps out in that (invest in irrigation / invest in rural roads), maybe can do without private land ...
- But, this can lead to equity problems.

2. Markets can be an effective tool of development. Markets can be pro-poor.

- Markets have integrated China's food economy. This has increased efficiency and has increased the income of the poor.
- What was the role of the government?
 - Mostly Nothing:
 - They got out of the way (shut down parastatals) ...
 - They let private sector emerge without regulation
 - No subsidies ... provided incentives for traders
 - Actually the government was involved in indirect way:
 - Investing in roads
 - Investing in communications
 - Enforcing free inter-province marketing

3. Greatest role for state: investment into public goods, especially into agricultural R&D ... however, state did not interfere (very much) into investments that could be (should be) made by households;
- China's government invested heavily into:
 - Roads
 - Water control—surface systems
 - Afforestation projects
 - Agricultural technologies
 - Agricultural extension
 - Households took responsibility for investing into:
 - Groundwater
 - Orchards and Vegetable Production
 - Machinery/Mechanization
 - Input Supply

4. Getting the incentives right for the government

- Government officials were given incentives to promote growth and structural transformation. They became co-beneficiaries. There was an incentive to promote programs and encourage growth.
- China's system of promotion was based on past performance and education.
- Policies designed to promote younger officials.

[But, are there lessons here? Is this the legacy of a one-party system ... with ambitious leaders at the top that have the goal of China becoming a world power and developed economy]

What countries can learn about what China's government did NOT do

- Setting up artificial barriers between rural and urban is extremely inefficient and creates high rates of inequality. This has not been a problem as long as there is growth. There are concerns that when growth slows, the high levels of inequality could lead to instability.
- Investment into rural health, nutrition and health is far from sufficient → China got basic education done (taught rural individuals to read, write and be disciplined) ... but, there are high barriers keeping rural individuals now from getting the education that they will need as China tries to move from middle to high income.

Thank you