How to Satisfy the Dragon's Appetite

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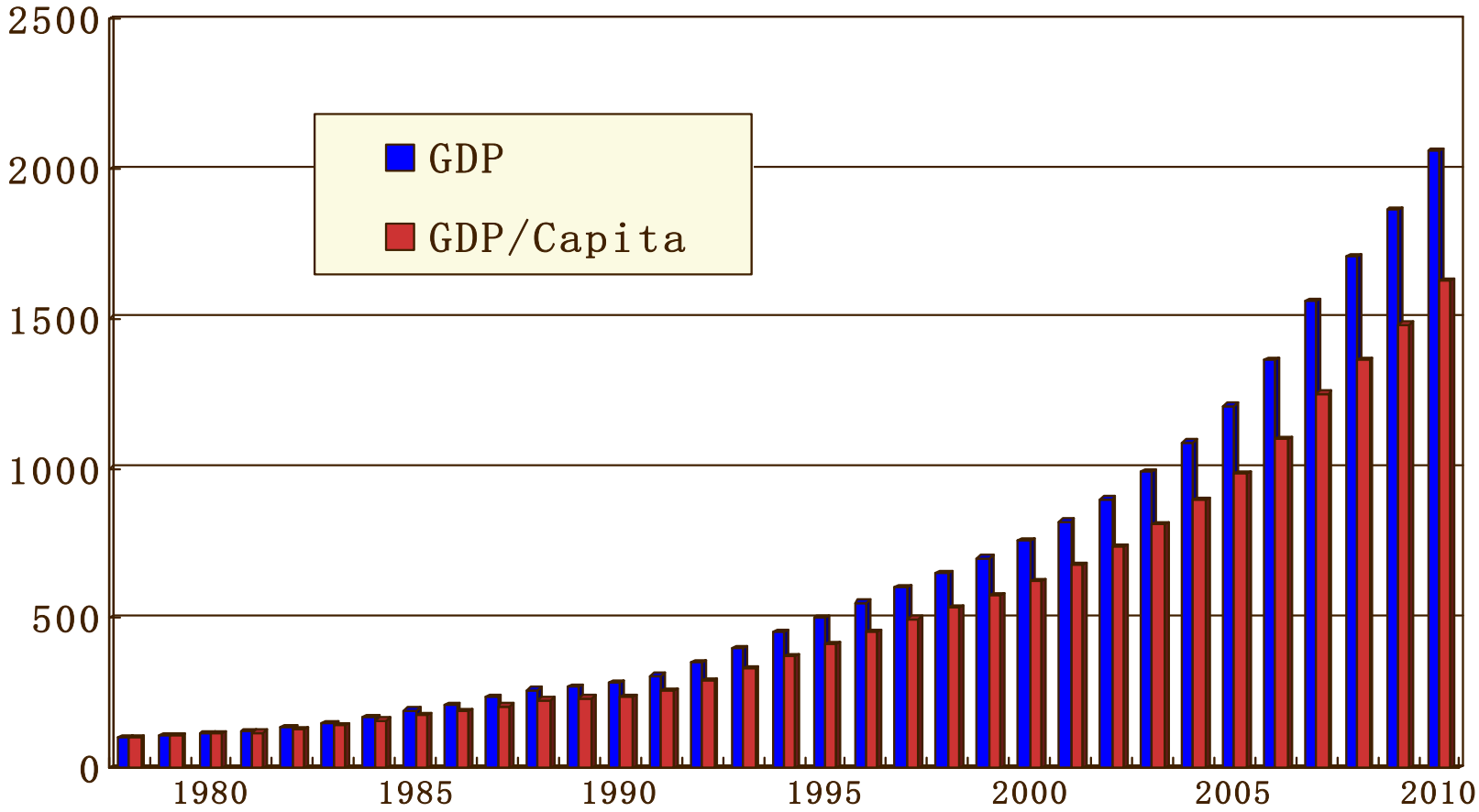
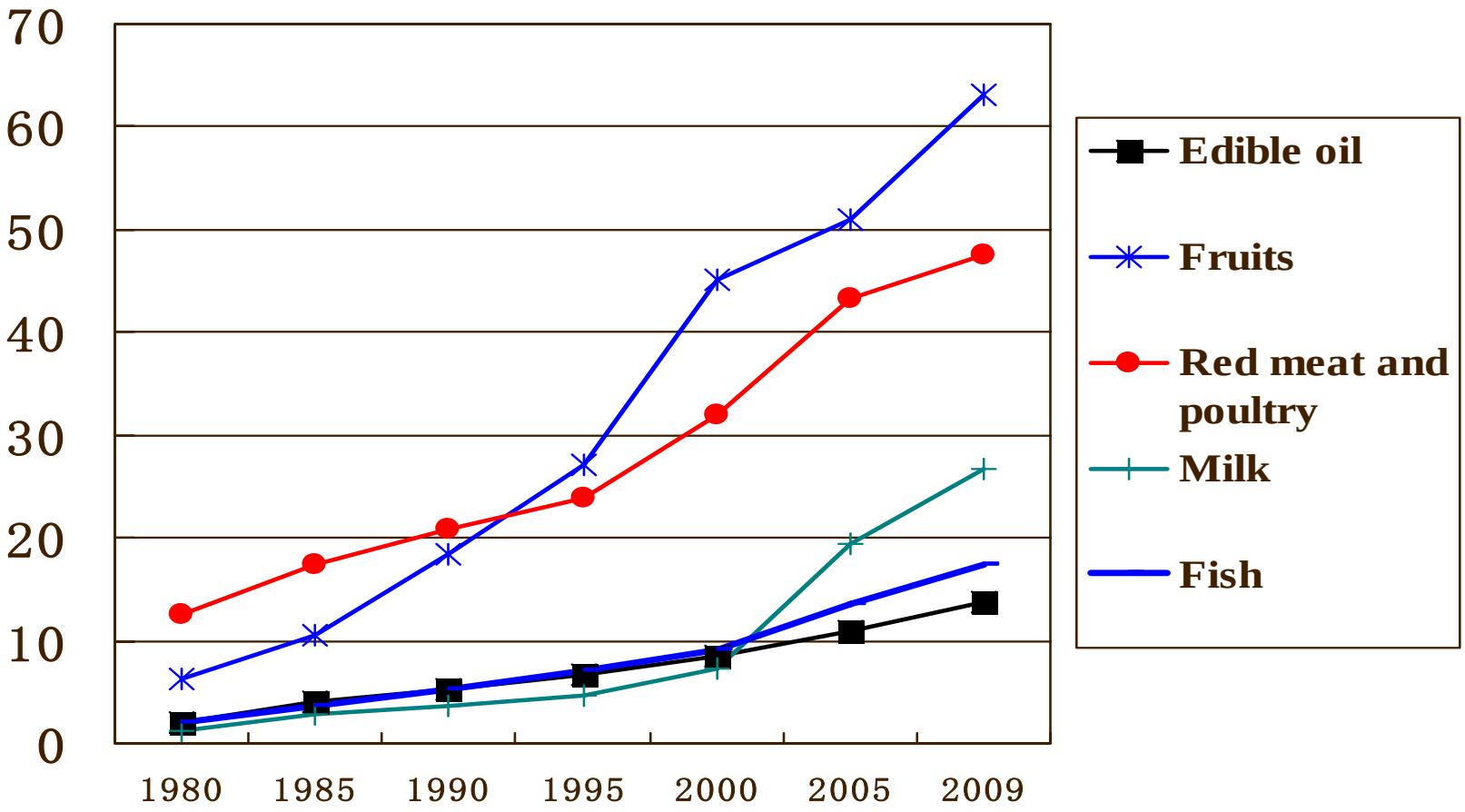
The rapid economic growth in China

GDP in 2010 was more than 20 times as that in 1978



Accompanied the rapid economic growth has been significant rise in food consumption

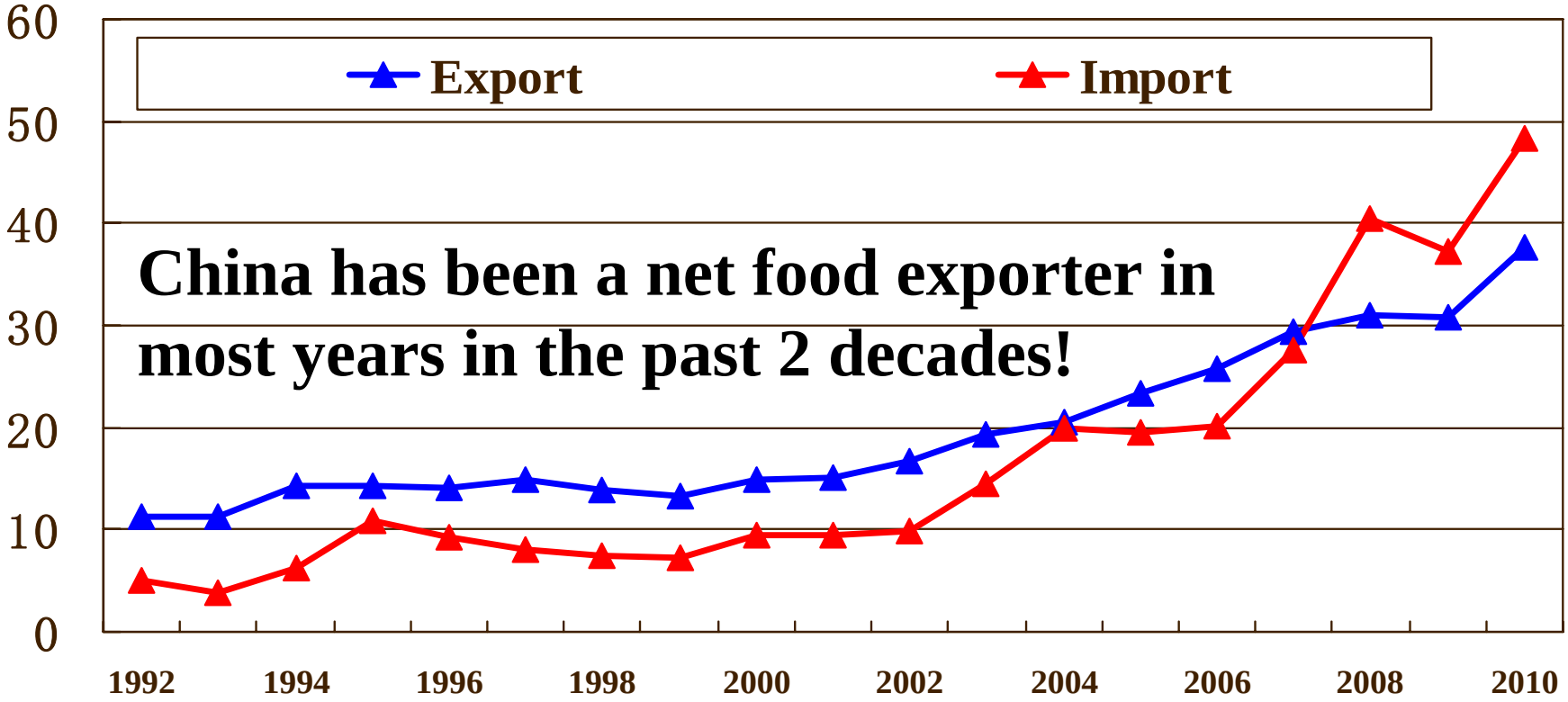
Per capita meat and other food consumption (kg/person)



Questions and concerns were raised in early 1990s

- “Who will feed China?”
- “Will China starve the world?”
- “When？ ”
  - “… by 2010 or so…”
- …

Food trade: export and import (billion US$) during 1992-2010



However, concerns/questions were raised again when China became a net importer in recent years

Questions:

How to Satisfy the Dragon's Appetite?

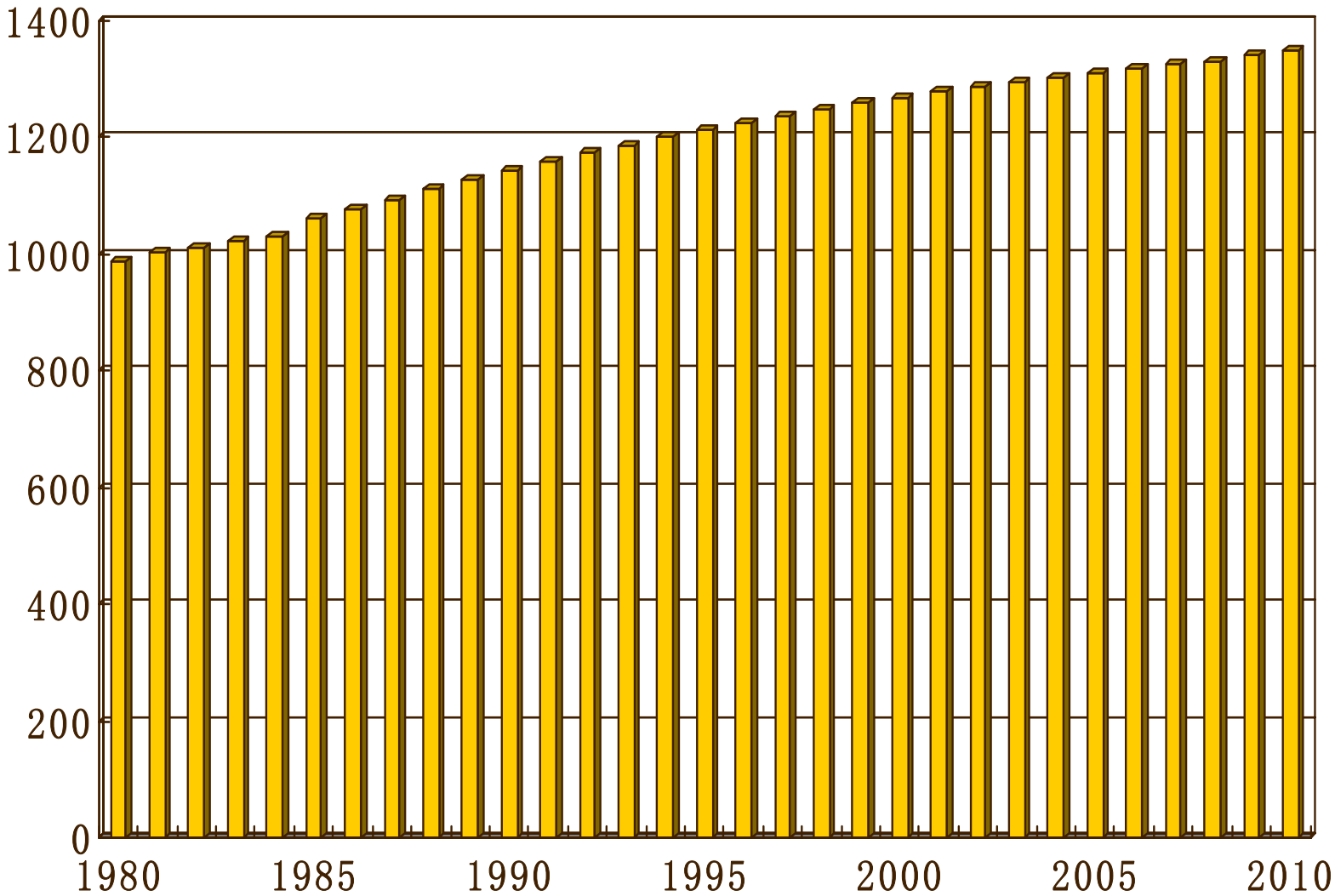
- **How China has been able to meet its growing demand for foods in in the past?**
  - **Driving forces of demand and supply?**
- **If the dynamics of China's economy will continue:**
  - **what will be implications for China's food security?**
  - **How will China contribute to a more food secure world?**

The rest of presentation

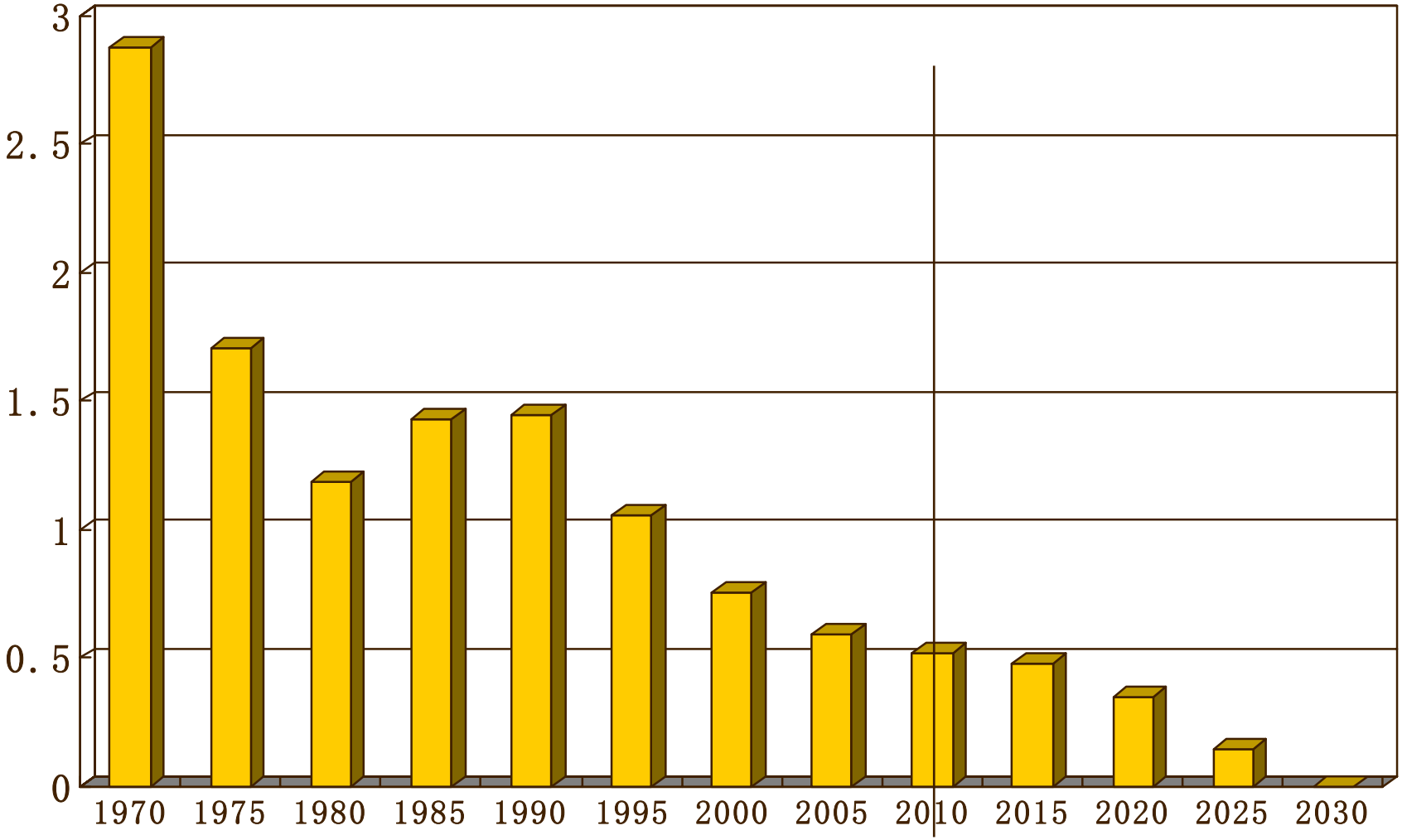
- **Major drivers of demand**
- **Agricultural growth and its major drivers**
- **Prospects of China's food security in the future**
- **Concluding remarks**

Population (million)

Average annual growth rate in 1980-2010: 1.1%

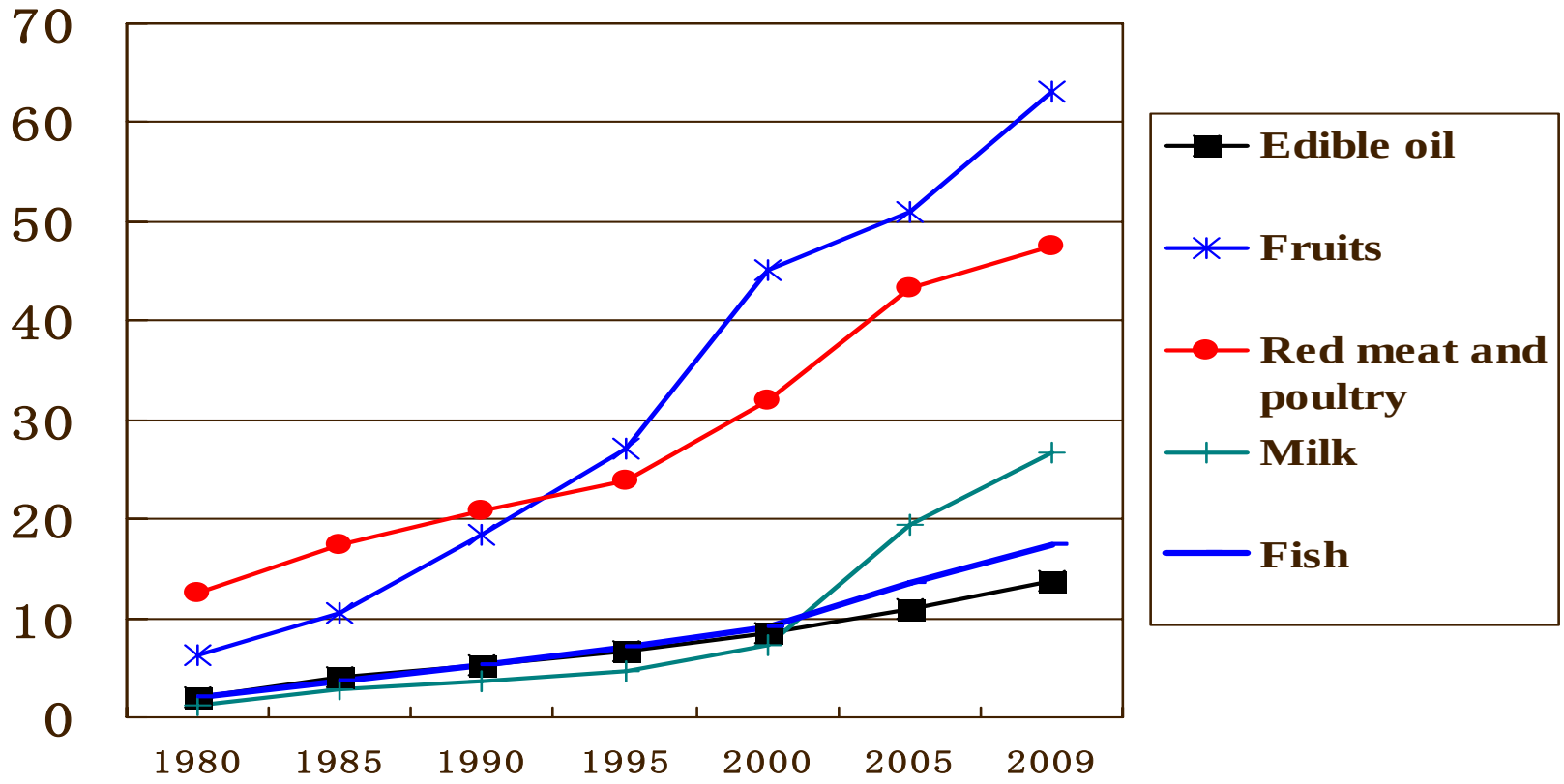


Population growth rate will decline significantly in the coming decades

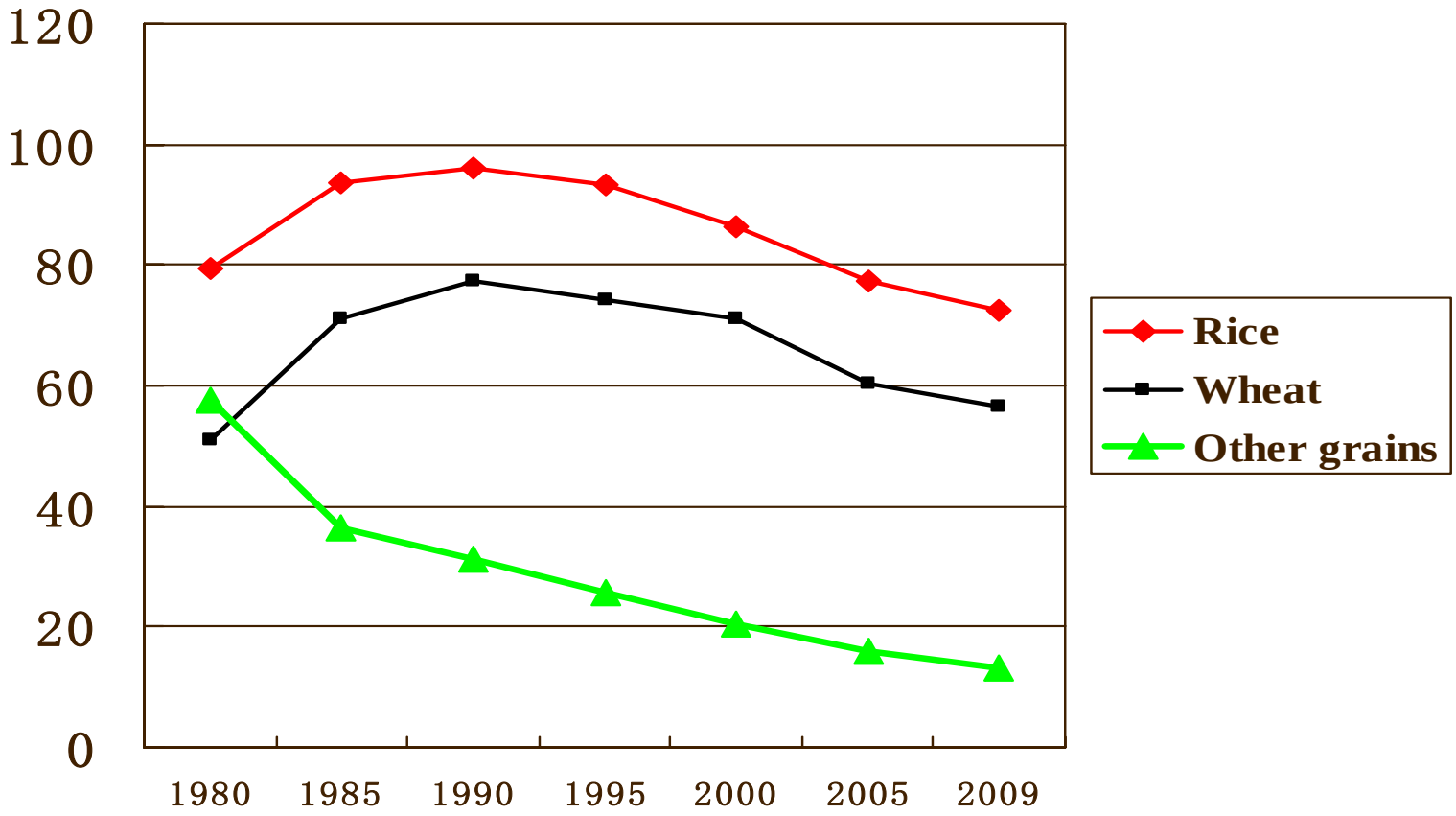


Rising income has been major driver of many food consumption in the past

Per capita meat and other food consumption (kg/person)

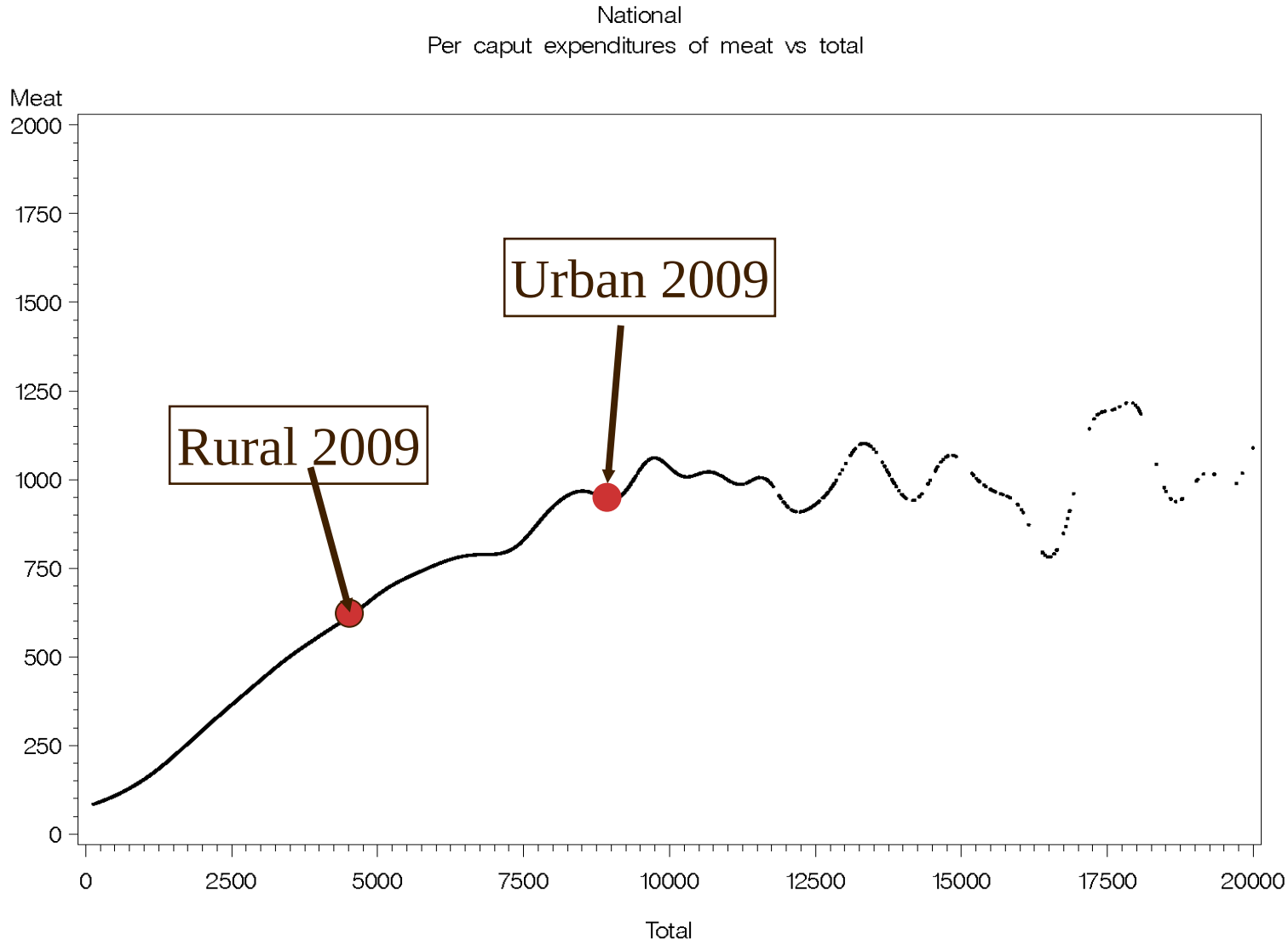


Per capita food grain consumption (kg)



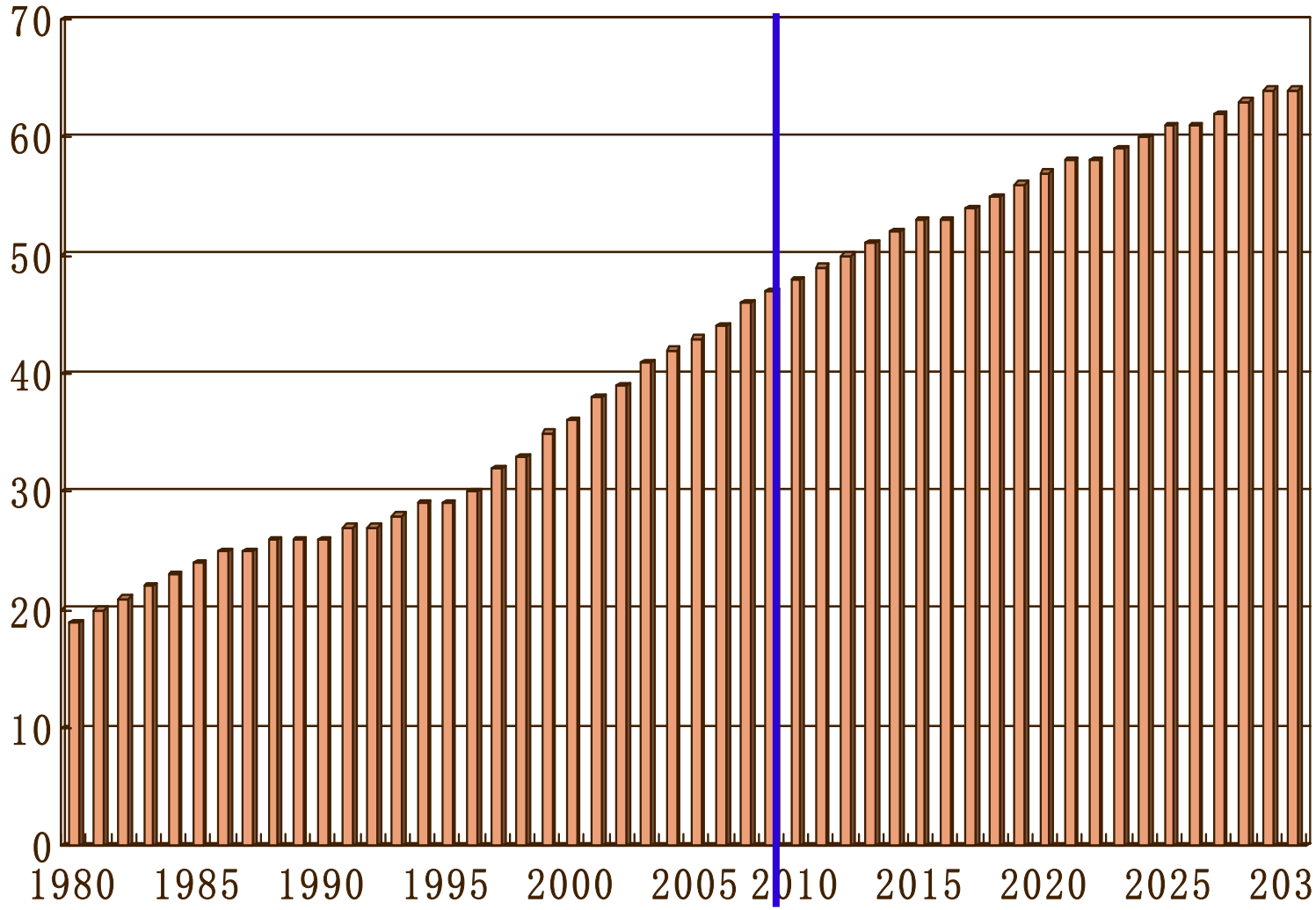
Significant fall in food grain consumption as income increased….

Meat and total expenditure in China



Source: CCAP and SOW-VU, 2002.

Urban population share (%)

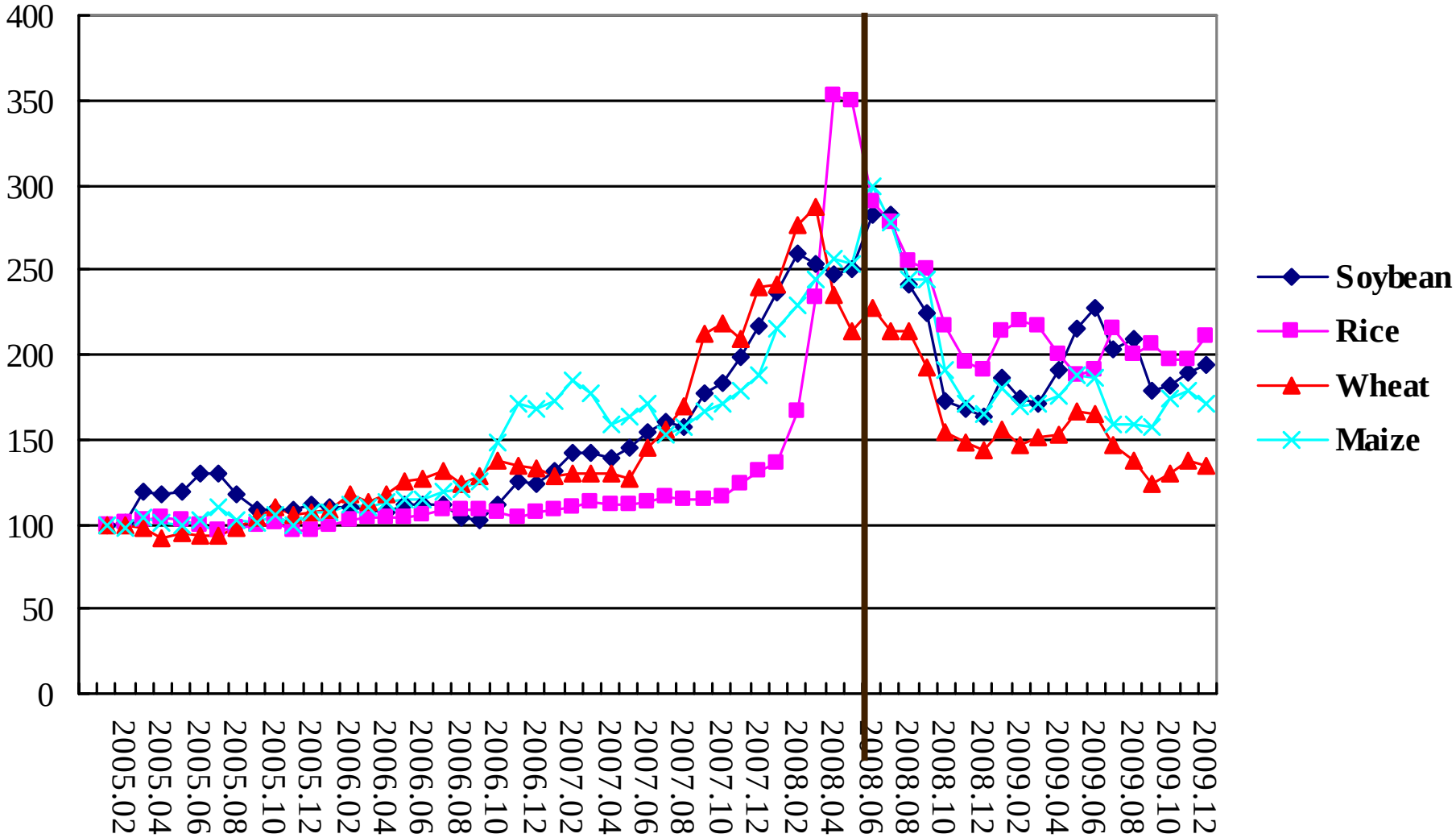


Average urban consumer demand for meats but less food grain

Biofuels: a new drviver?

- **Targets of China′s biofuels**
  - **Bioethanol: 10 mmt in 2020 (7.1 times of 2007)**
  - **Biodiesel: 2 mmt in 2020**
- **Incentive Policies in 2007**
  - **Waived 5% consumption tax for biofuel**
  - **Refunded VAT (17%) on biofuel production**
  - **Direct subsidy to biofuel plants (2130 yuan or about US$ 300 per ton)**
  - **Mandatory E10 gasoline used in 9 provinces.**
  - **Subsidy to the biodiesel feedstock production base, 200 yuan/mu (US$425 /ha)**

Price indices (January 2005 = 100) of rice, wheat, maize, and soybeans in international markets, January 2005 to December 2009.



Global food crisis in 2007-2008 → resulted in shifting China's policy on biofuels:

- **No expansion of biofuels based on grains**
- **Seeking for non-grain feedstocks**
- **Seeking for 2nd generation of biofuels**

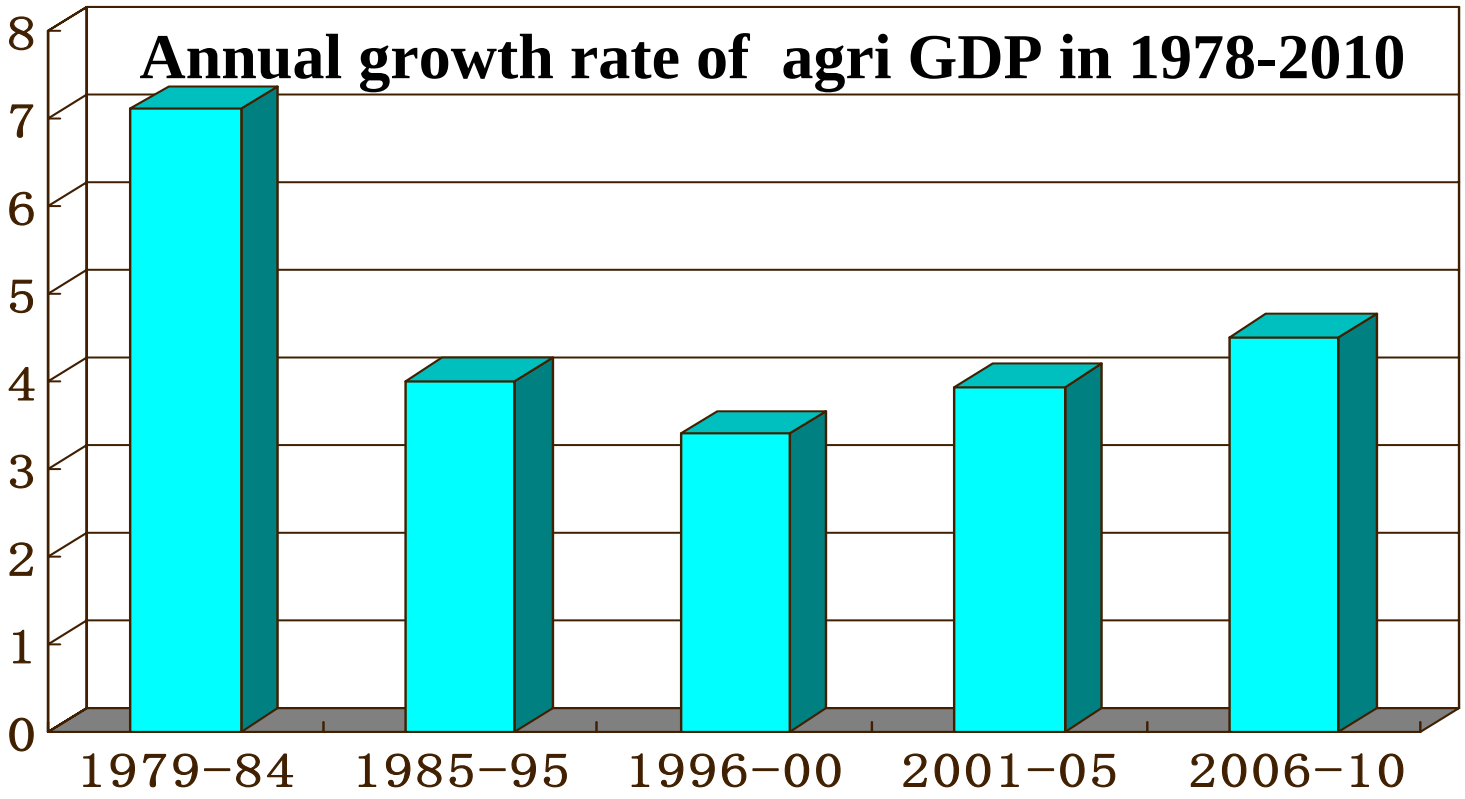
Driving forces of demand for agri/food

- **Population growth (++ → +)**
  impact has been weakening…
- **Urbanization (+ → -/+)**
  negative on food grain and positive for others
- **Ageing (0 → -)**
- **Income growth (++ → -/+)**
  impact will also be weakening…
- **Biofuels:** no trade-off with food security

Drivers of demand, in general, will be weakening in the coming years…

Agricultural growth and its major drivers

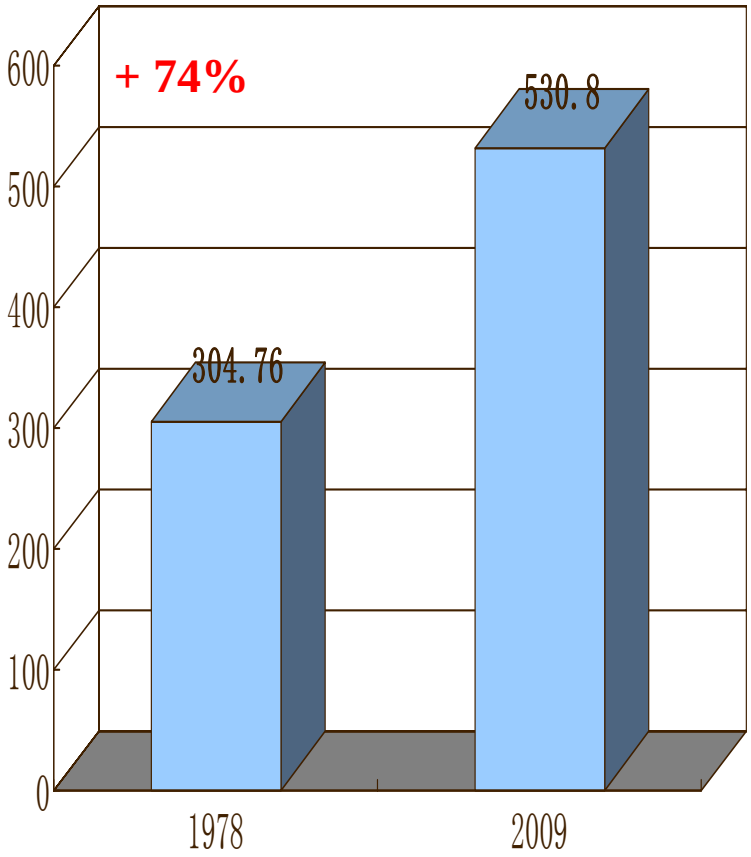
4.4% of annual growth rate of agri GDP in past 30 years



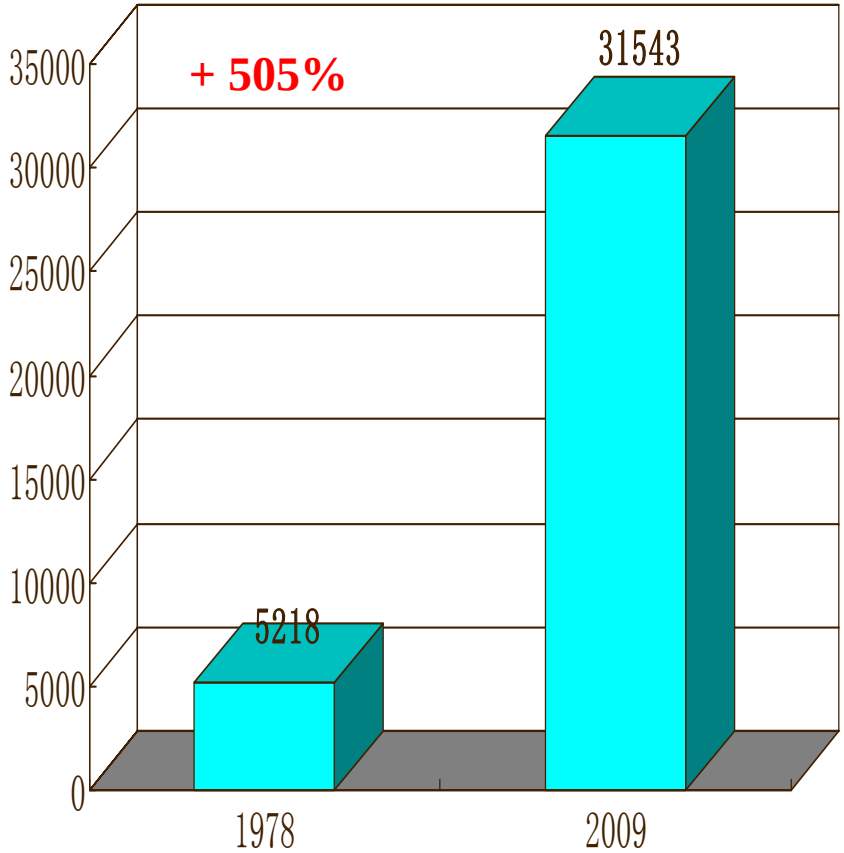
About 4 times of population growth rate

Production of grains

Grain (million tons)

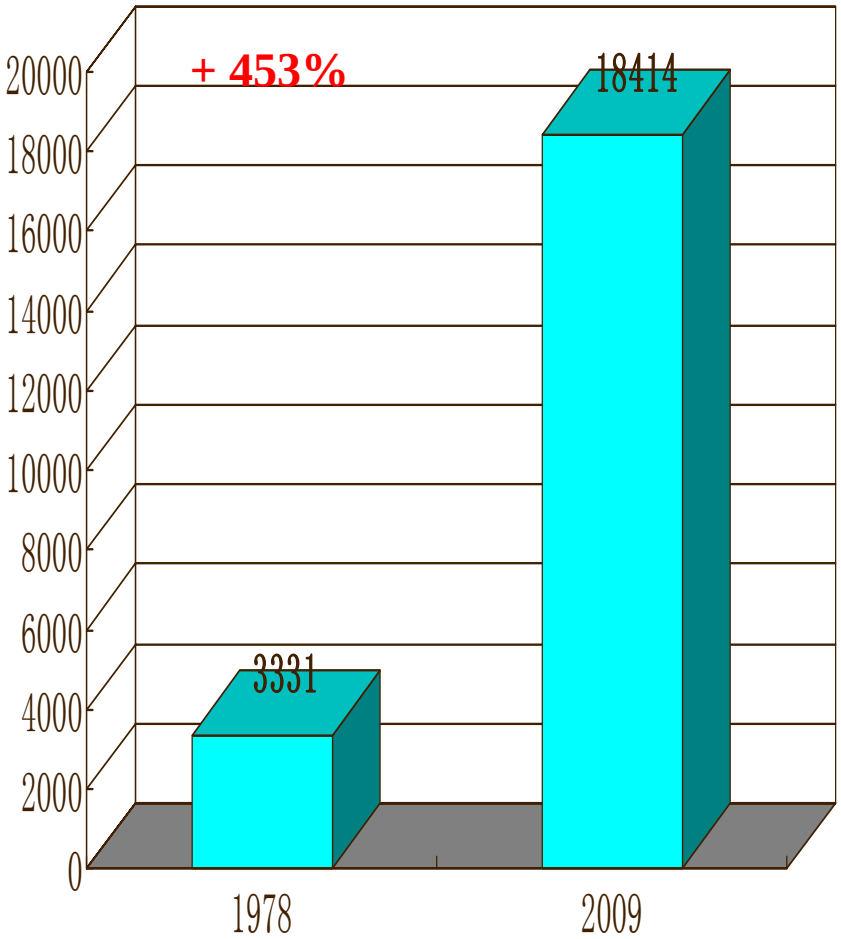


Oil crops (1000 tons)

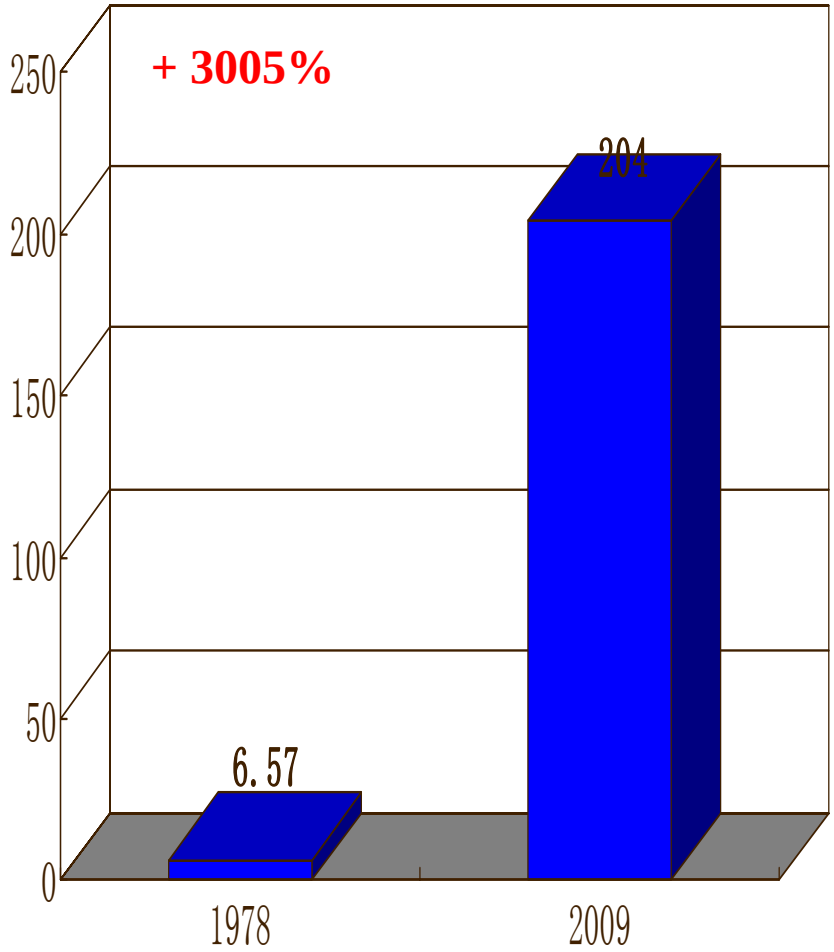


Vegetables and fruits

Vegetable area (1000 ha)

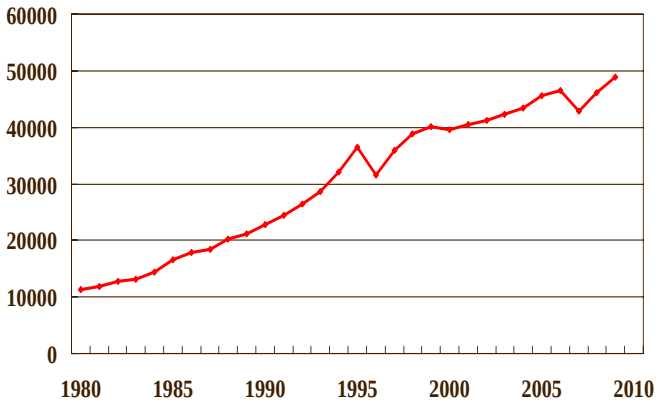


Fruit outputs (million tons)

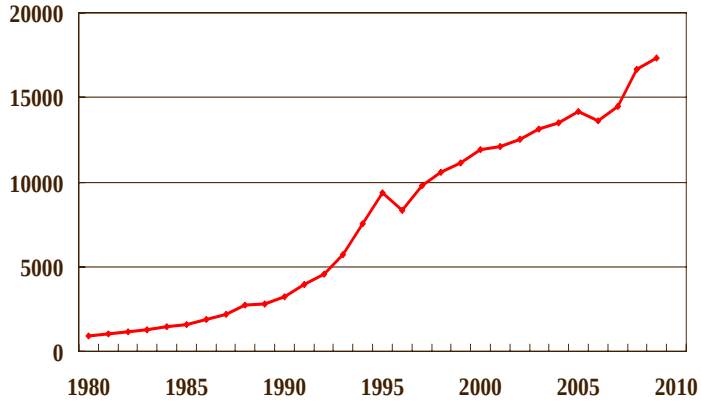


Meat production (1000 tons)

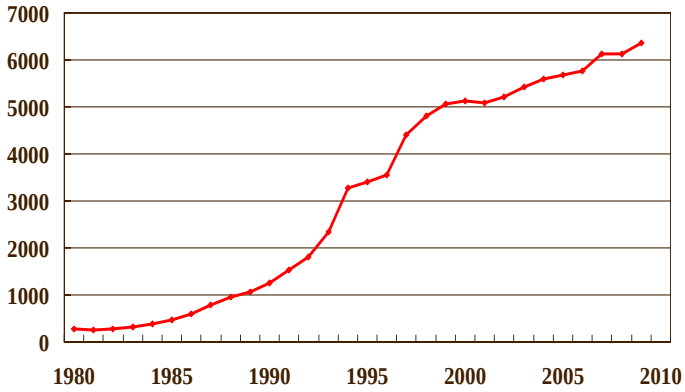
Pork



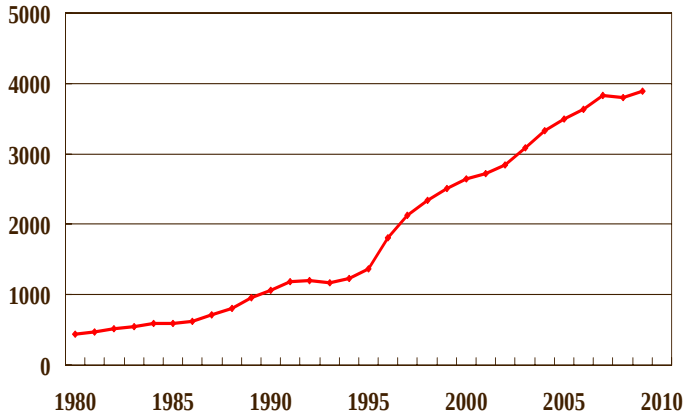
Poultry



Beef



Mutton

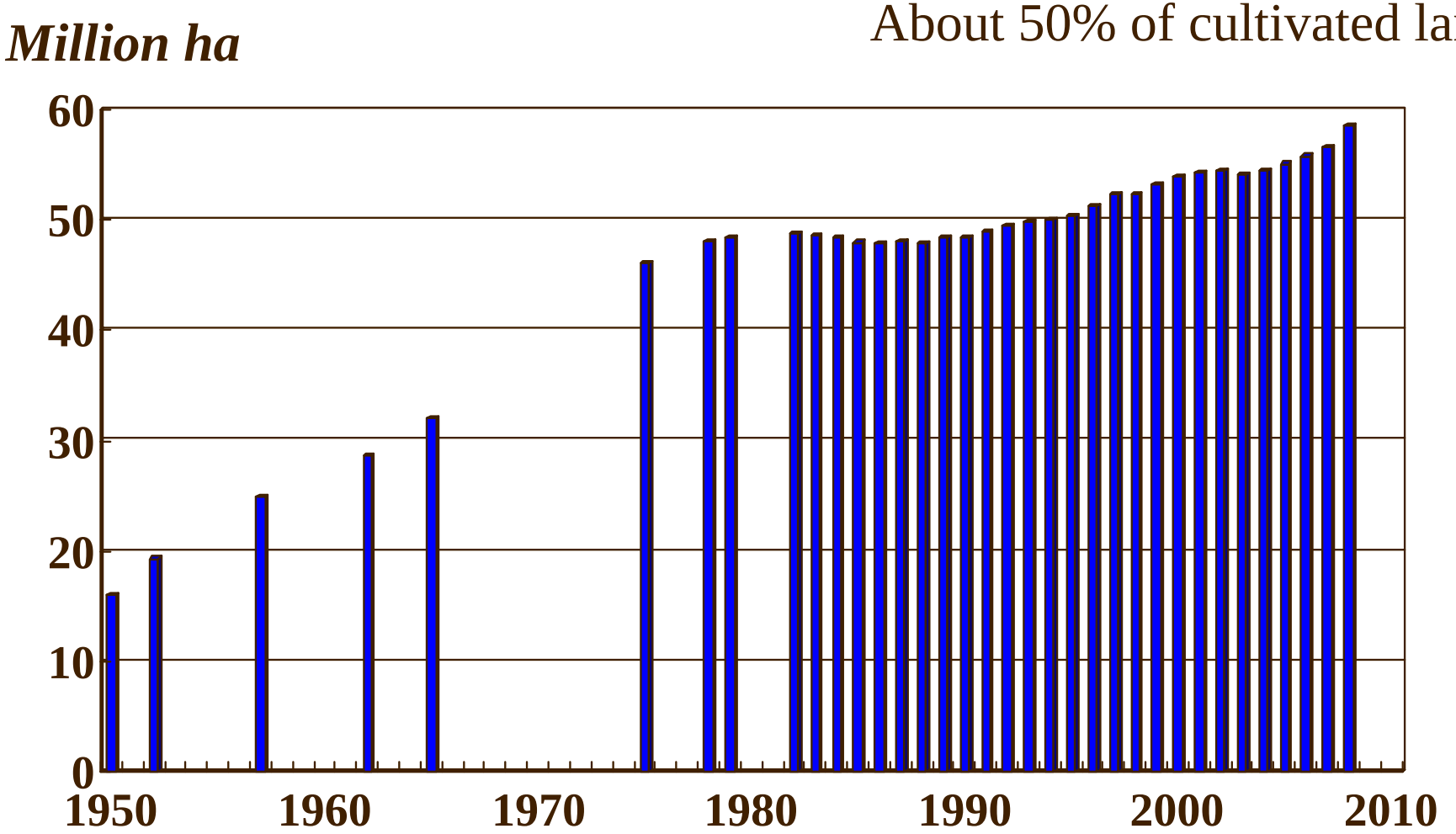


Major drivers of growth and structural changes

- **Demand changes**
- **Production:**
  - **Successes:**
    - **Institutional change** (not presented today)
    - **Market reform: domestic/international** (not presented today)
    - **Investment: overall and technology**
    - **…**
  - **Challenges**

Expansion of irrigated land in China

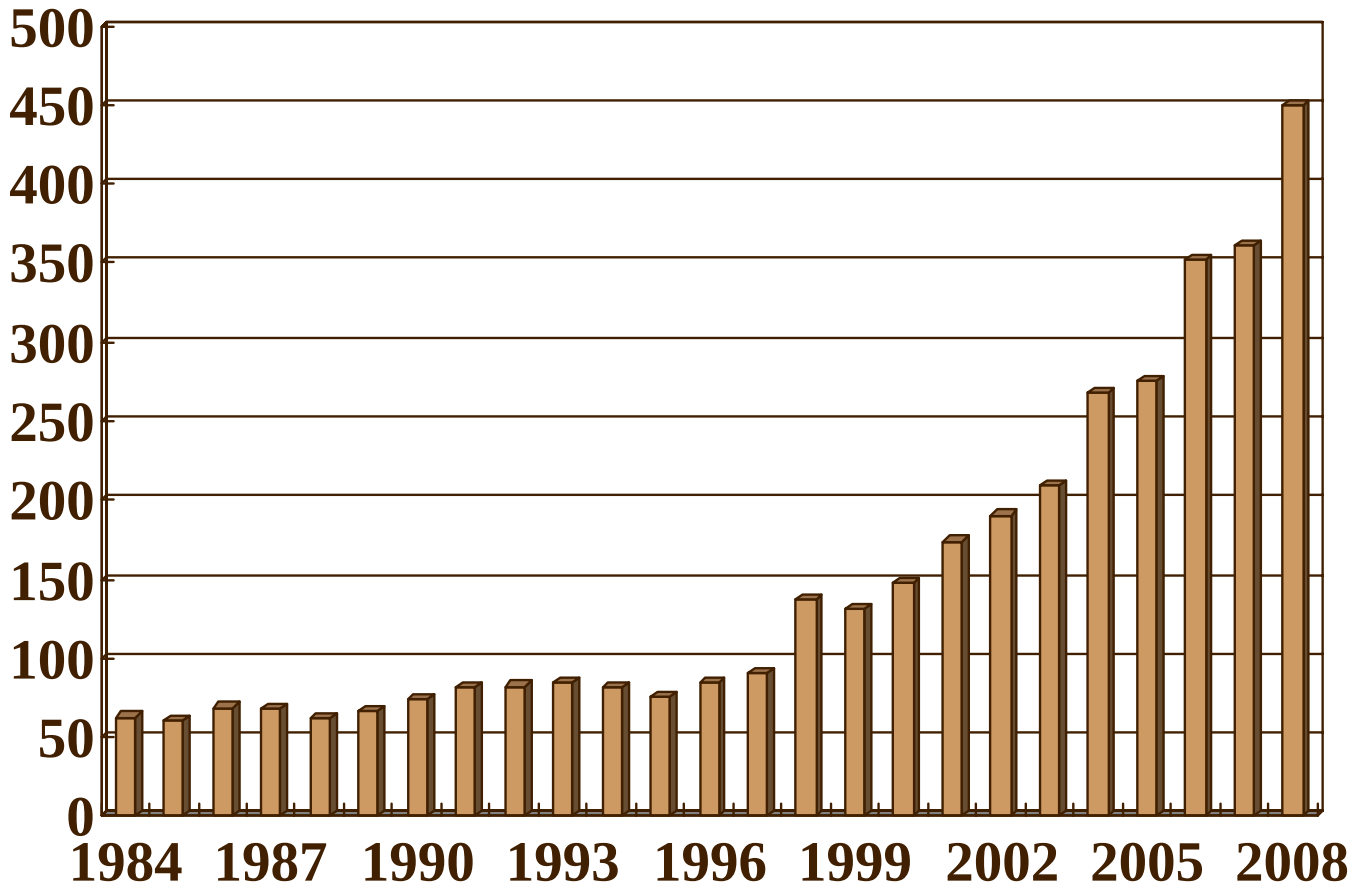
About 50% of cultivated land



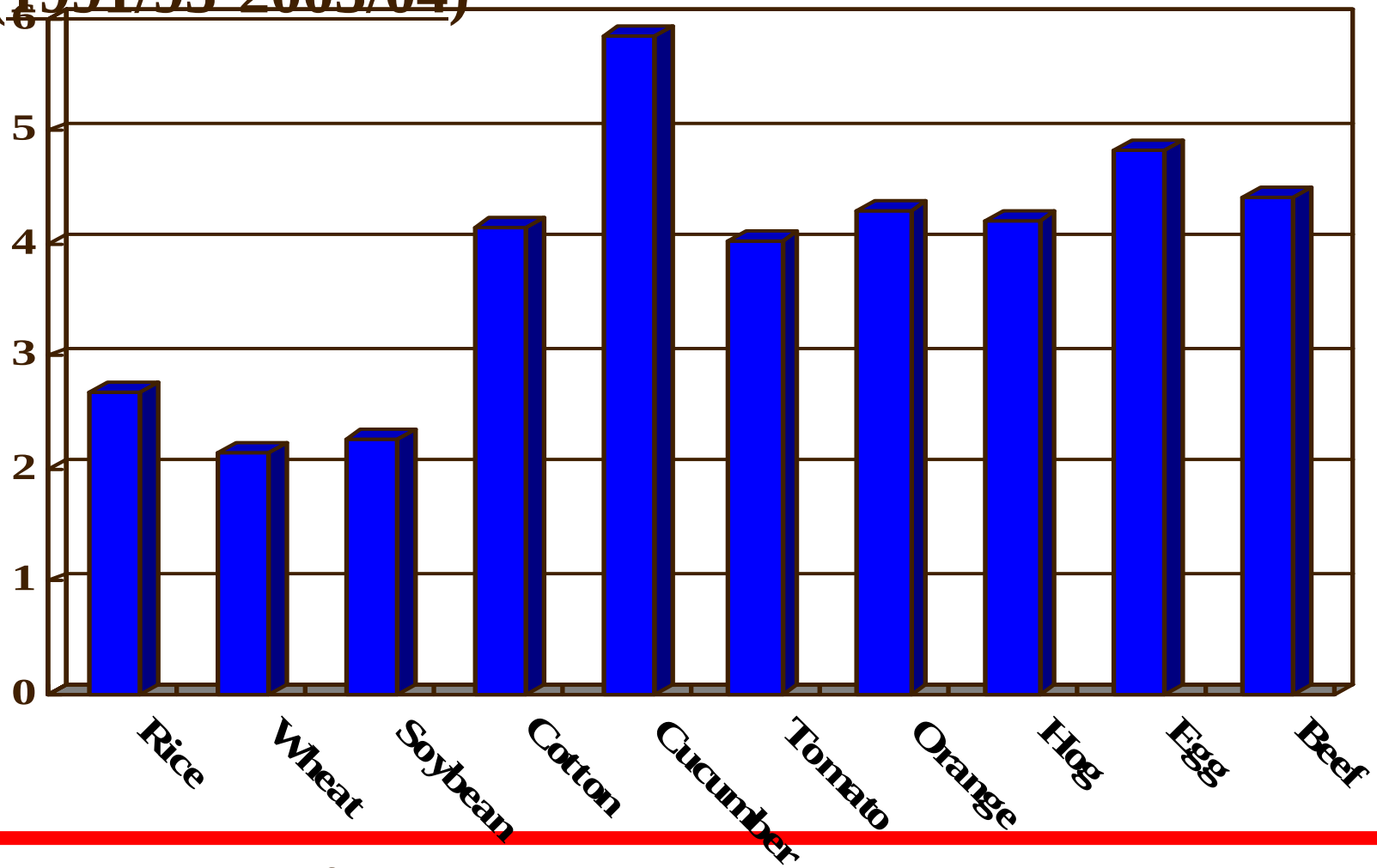
Investment into agricultural sector

Central government budget support

(billion yuan in 2008 prices)



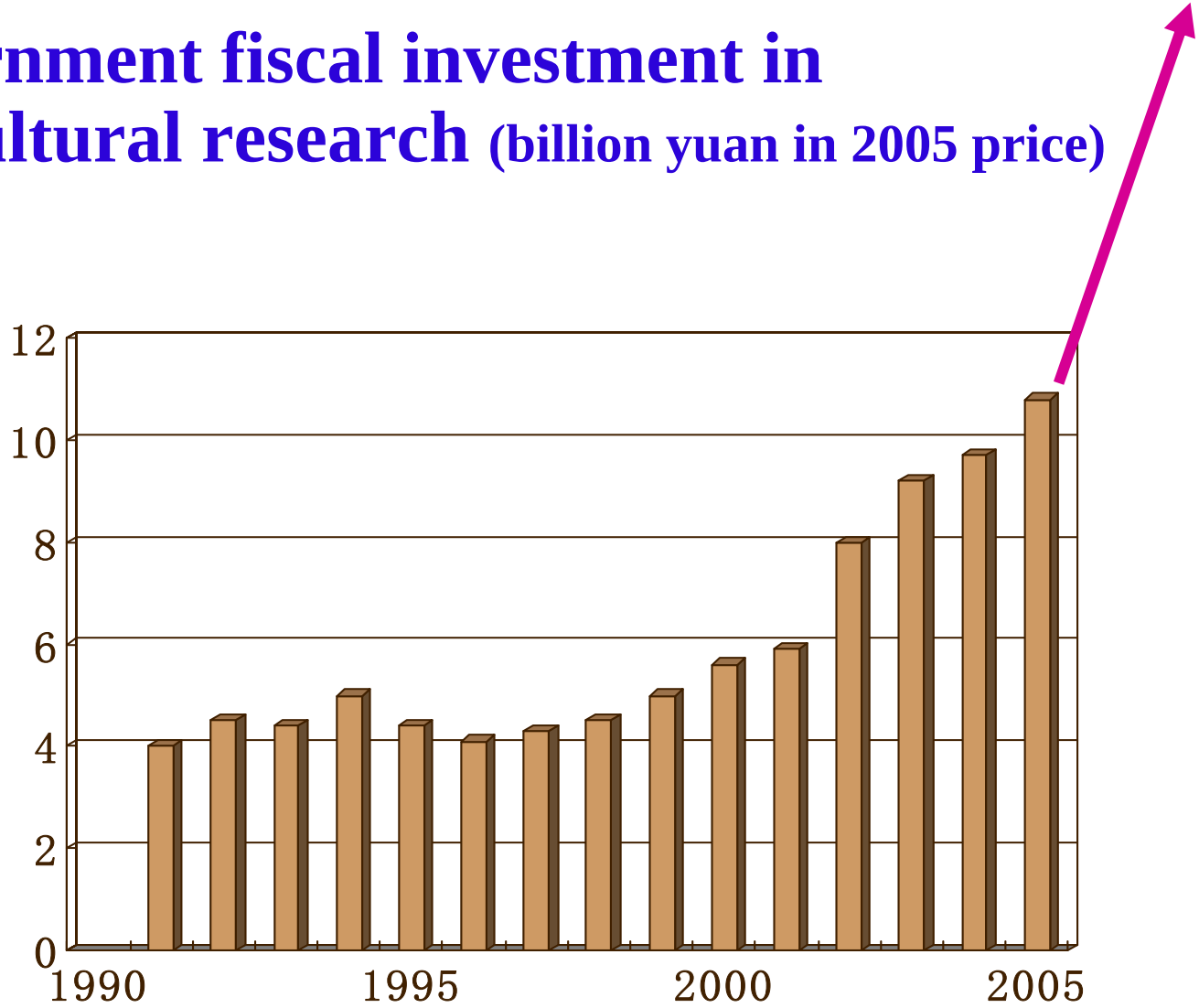
Annual growth rates of Total Factor Productivity (1991/93-2003/04)



Internationally, if a country's ag TFP rises more than 2% a year, it is GREAT … China's rate of rise is about 3 percent per year!

Question: will this growth rate be continued in the future?

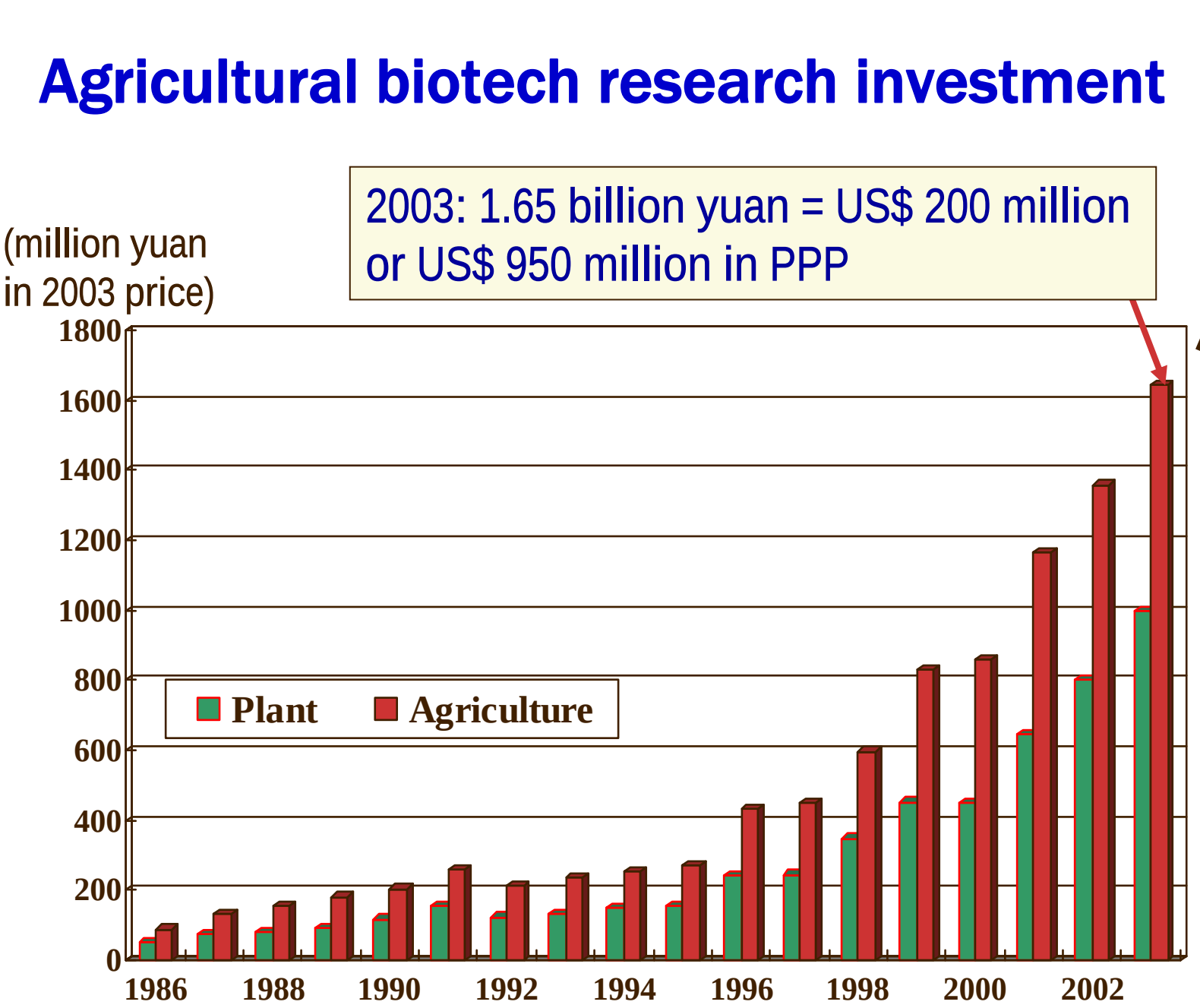
Government fiscal investment in agricultural research (billion yuan in 2005 price)



Since 2000, the rise in public research investment has been higher in China than most of other countries in the world …

Agricultural biotech research investment

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



New GMO program: 26 billion yuan (US$3.8 billion) in 2009-2020

Huang et al., *Science*, 29 April 2005: 688-690

Major findings on Bt cotton impacts in 1999-2001

(By empirical study， per hectare)

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

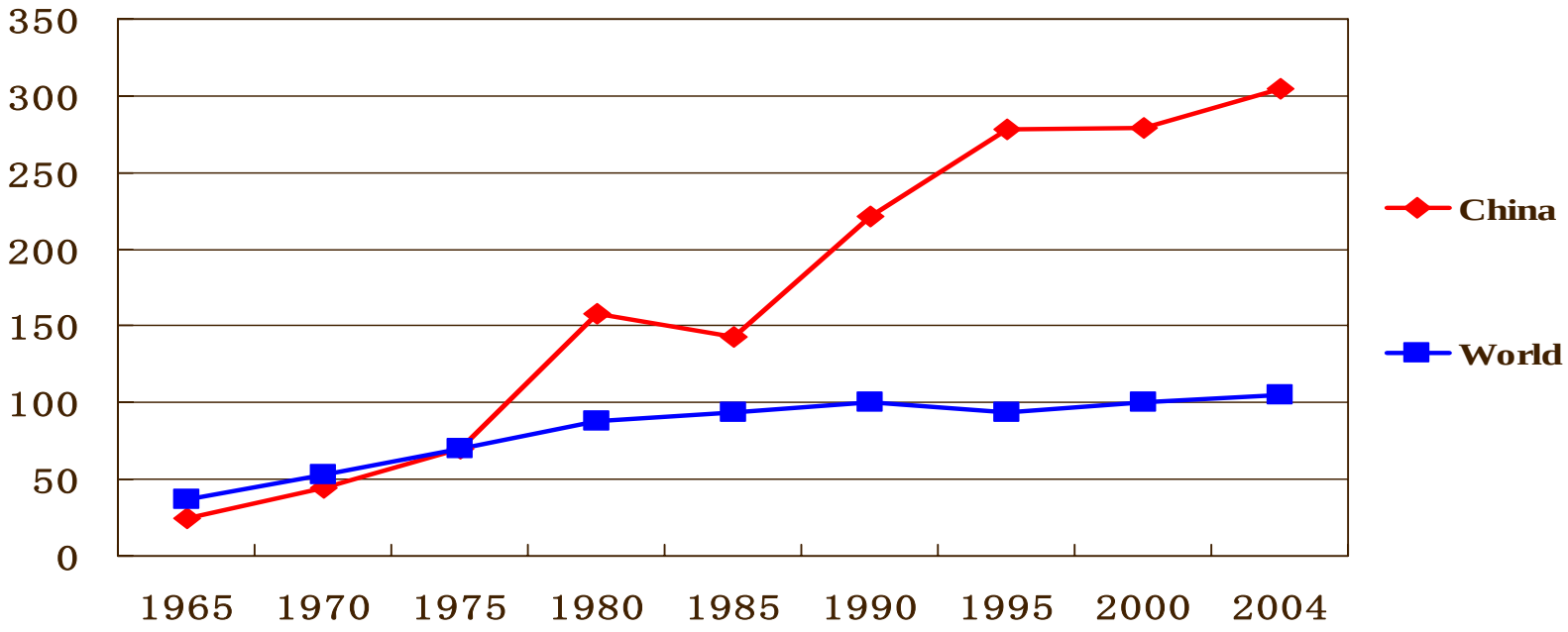
Sources: Huang et al., ***Science***, 29 Jan 2002: 674-677

Increase in the household income (average sample household): 14%

Challenges

- Land
- Water
- Sustainability
- Small farm

Fertilizer use intensity (kg/ha)



Greenhouse gas emission (GHG) from N-fertilizer production + use:

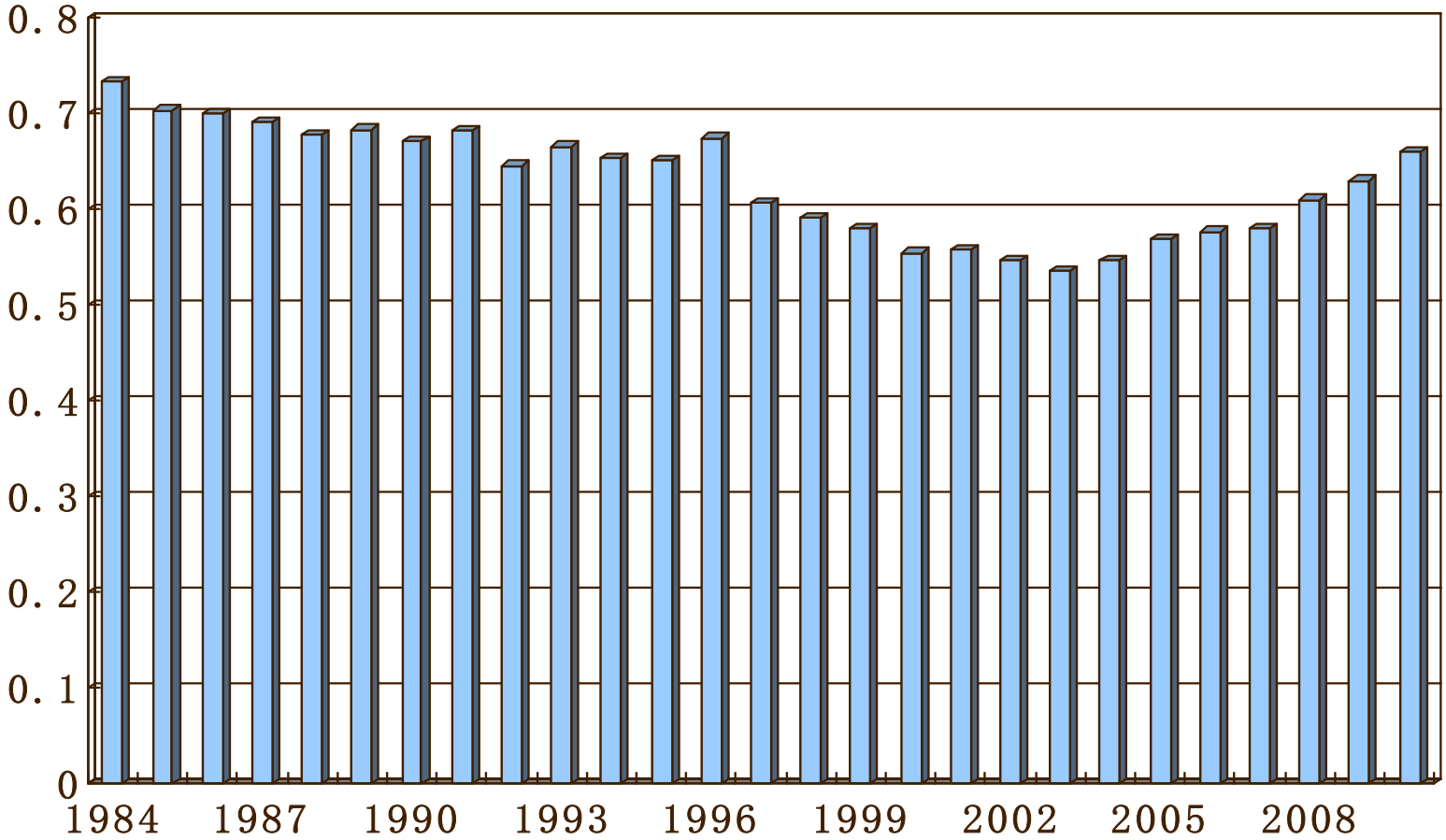
-- 30% of agricultural GHG

-- 5% of GHG emissions

Response: Low carbon agriculture (?)

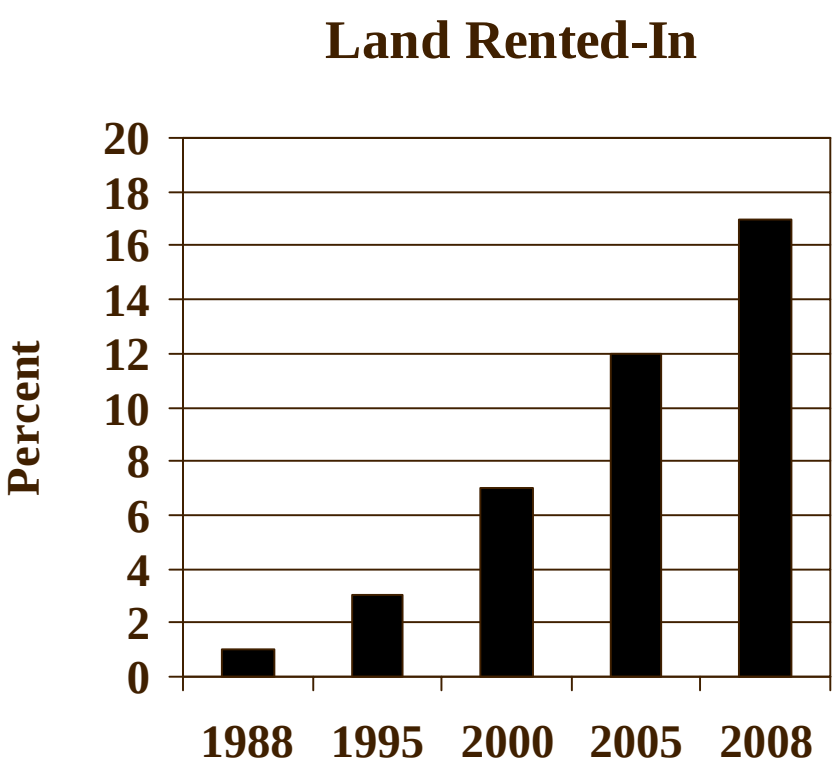
Small farming: Challenges for labor productivity, modernizing agriculture and food safety

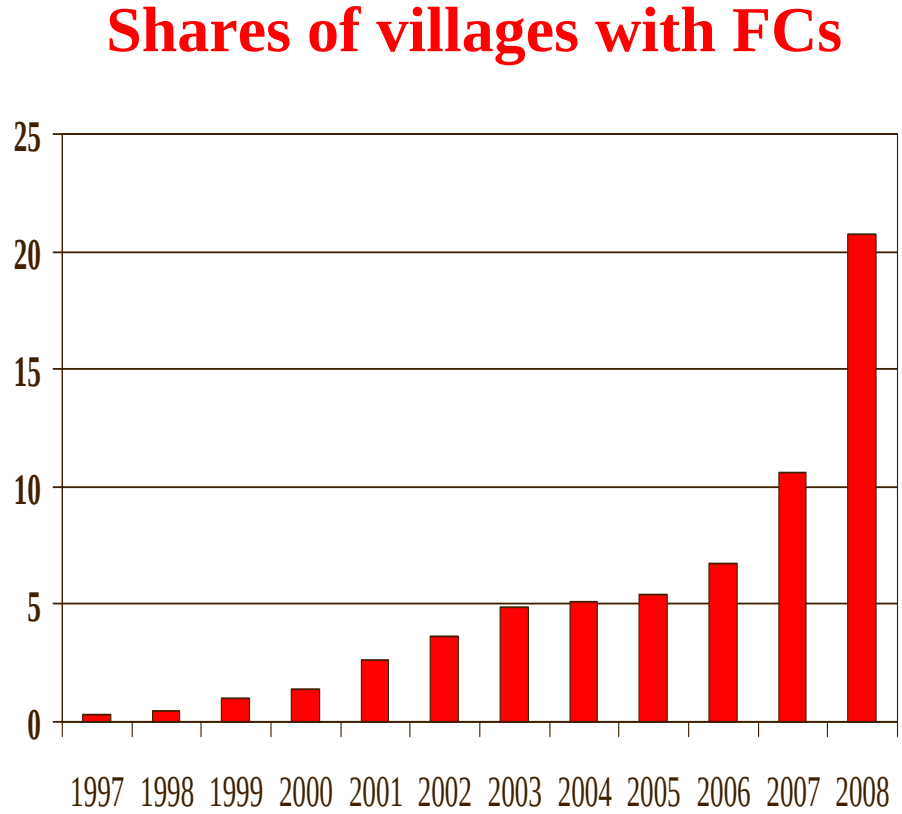
Average farm size (ha/farm)



Source: NSBC

Policy responses: rental market; farmers' cooperatives





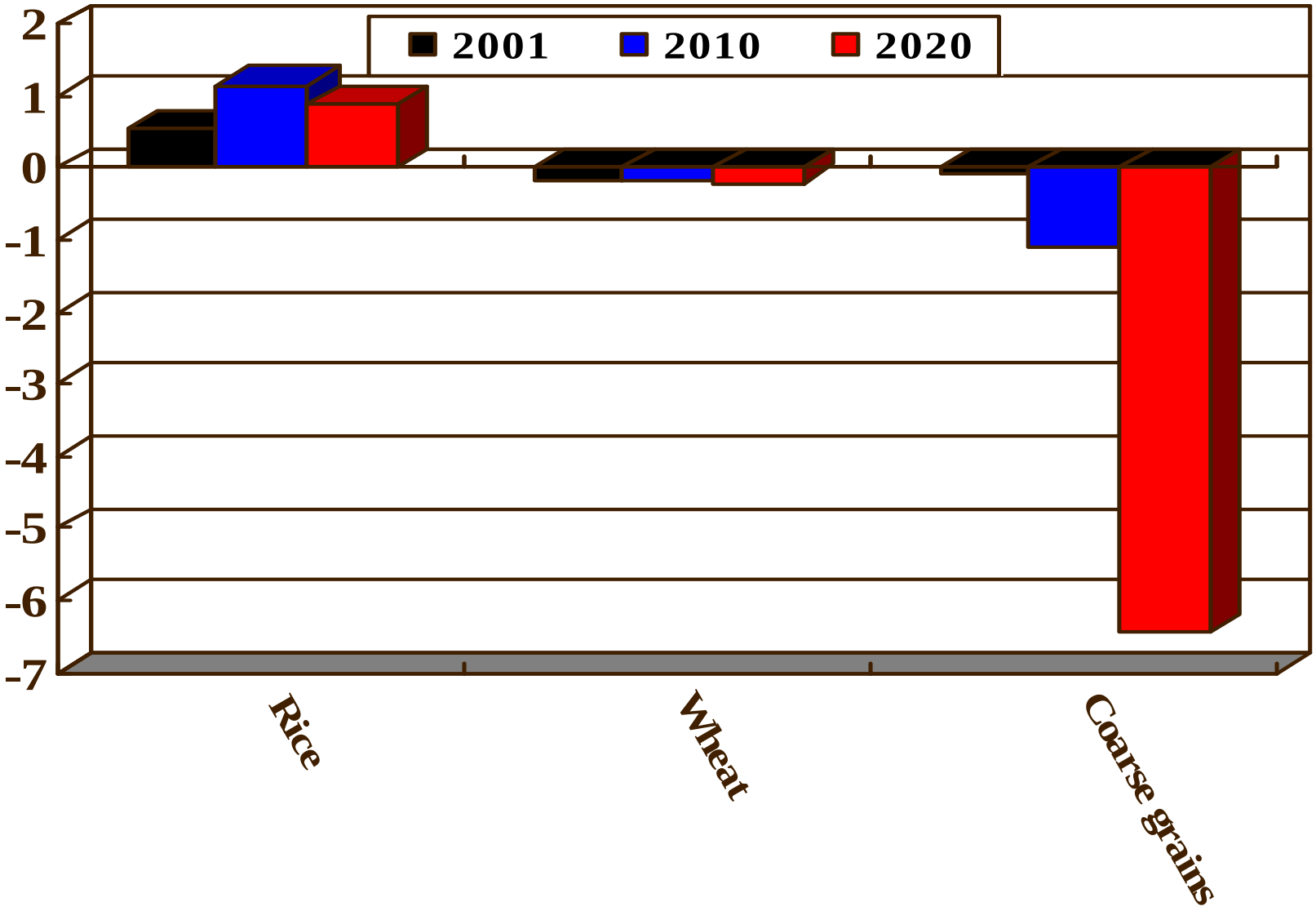
Prospects of China's food security in the future

- **GTAP (Global Trade Analysis Program)**
  - **Simulate the world price and trade**
- **China's Agricultural Policy Simulation and Projection Model (CAPSiM)**
  - **Partial equilibrium model**
  - **Commodities: 22 products**
  - **31 provinces and 11 farmer groups**

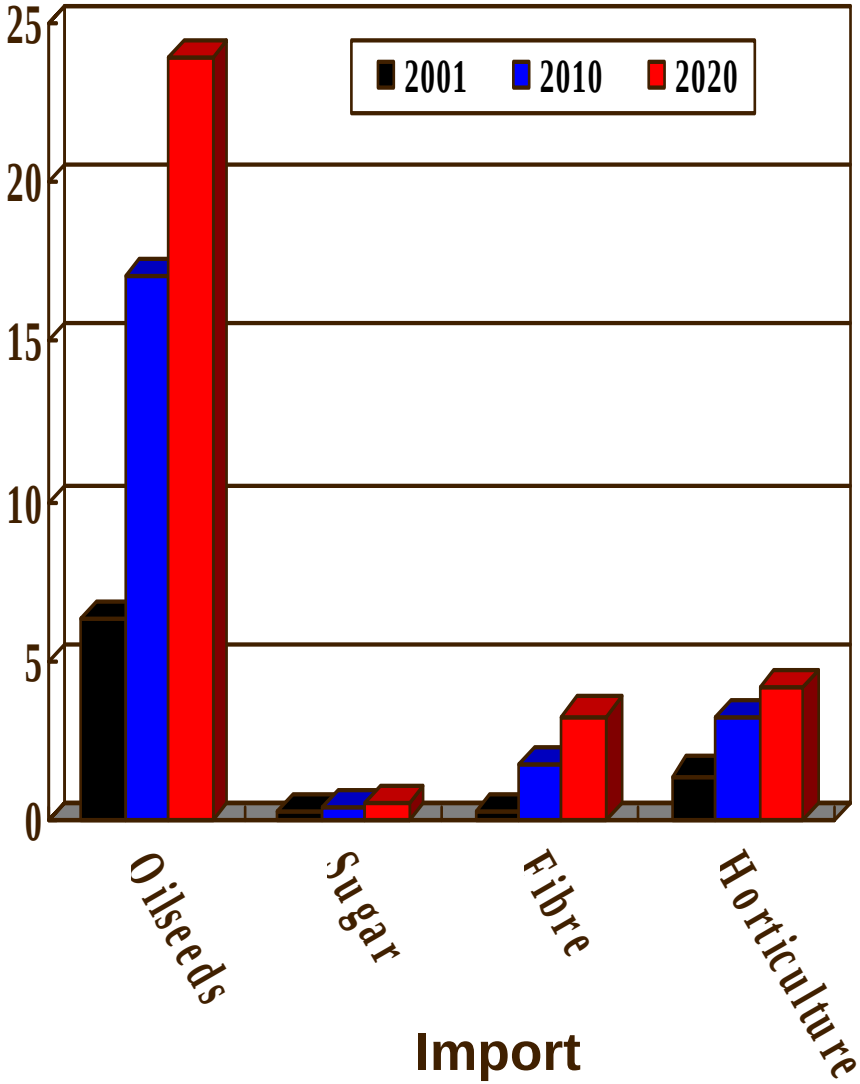
Scenarios

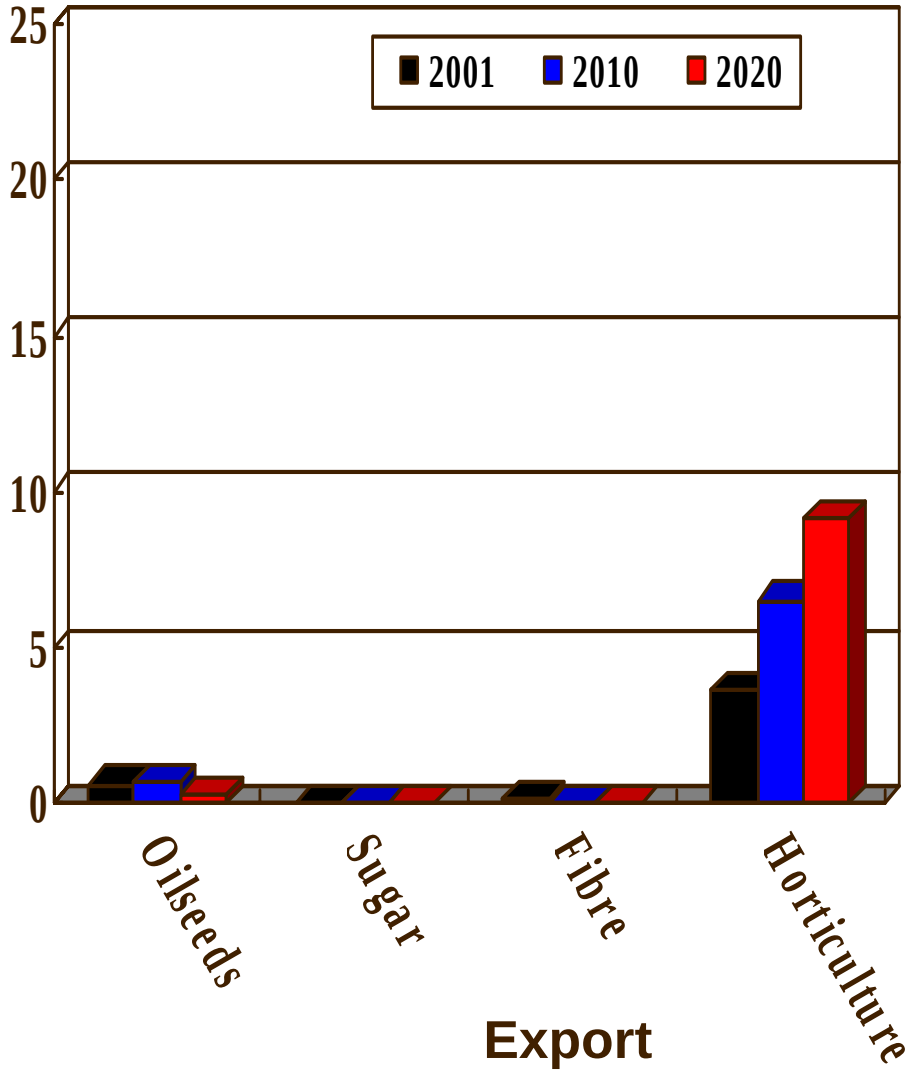
- **Baseline:** Considering major driving forces of:
  - **demand (e.g., population and income growth)**
  - **supply (e.g., Technology and irrigation)**
  - **trade liberalization (e.g., Doha)**
- **Alternative scenario**
  - **Impacts of technology**
    - (e.g., GM maize)

China's net export of cereals (billion USD) under baseline in 2001-2020

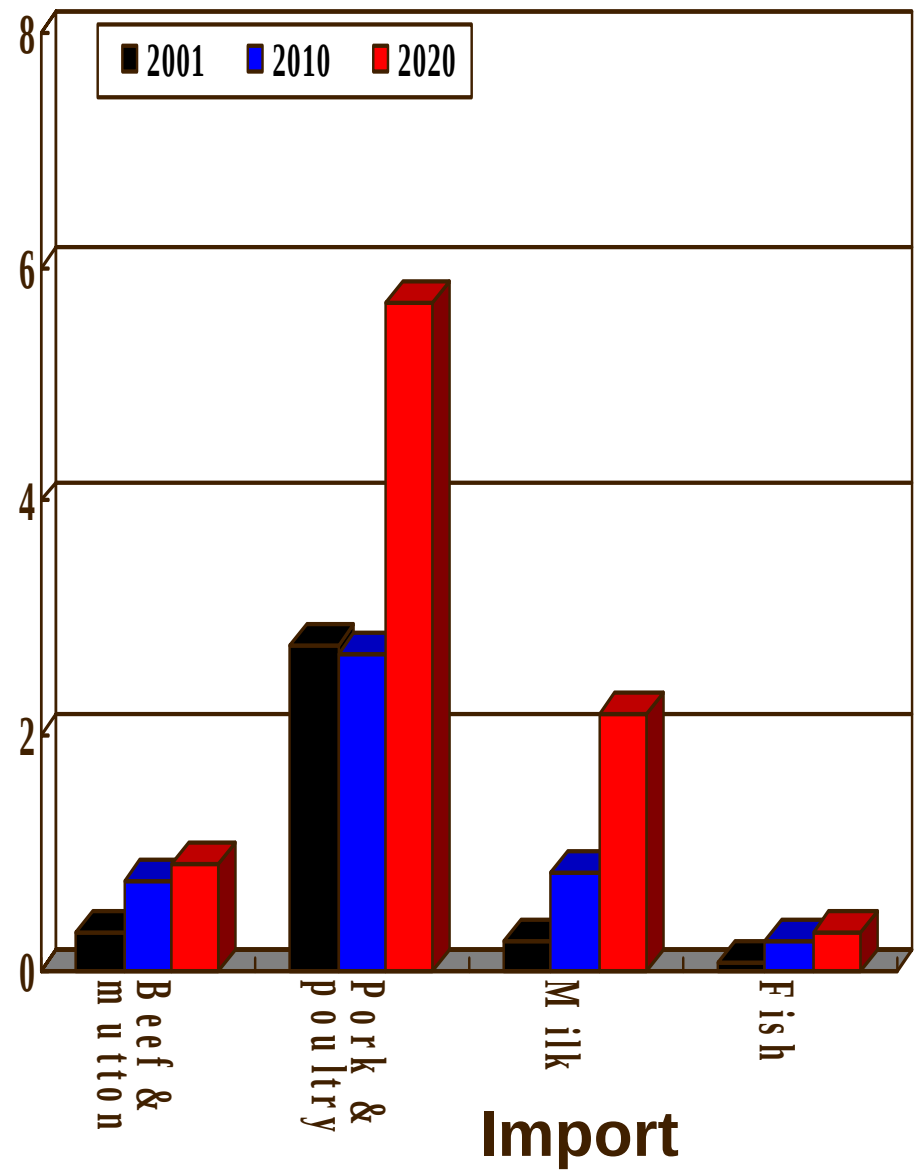


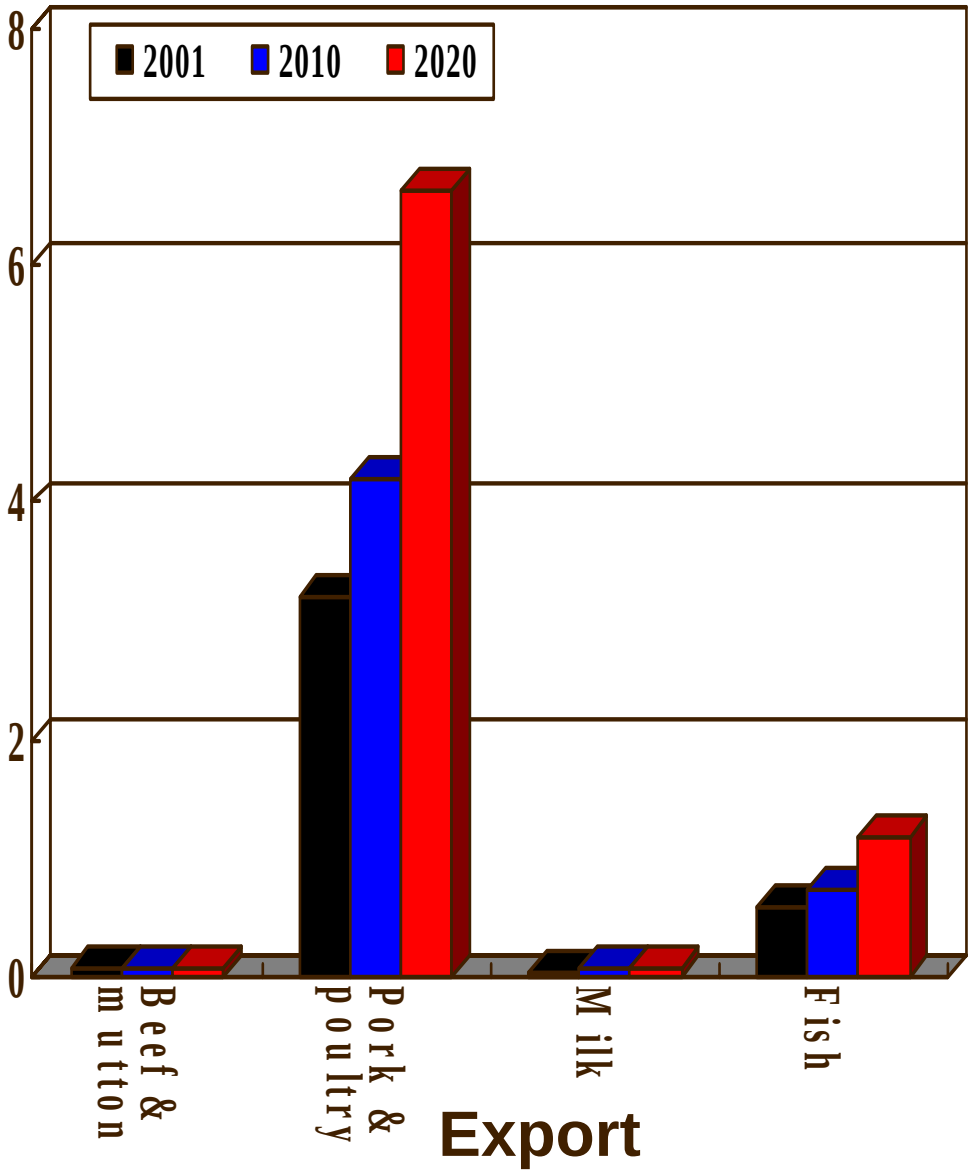
China's import and export of major cash crops (billion USD) under baseline in 2001-2020



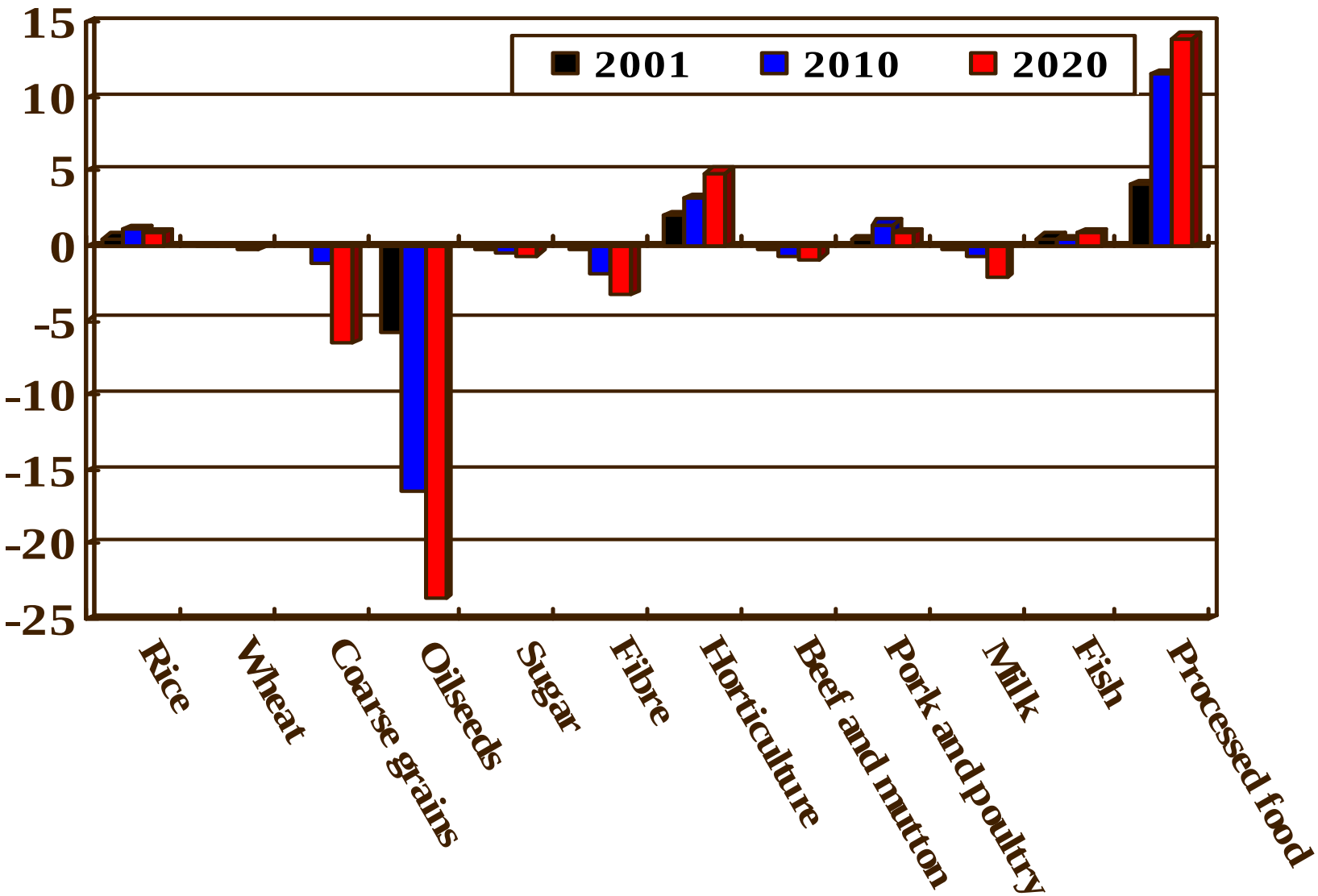


China's import and export of animal products (billion USD), baseline in 2001-2020





China's net export of agriculture and food (billion USD) under baseline in 2001-2020

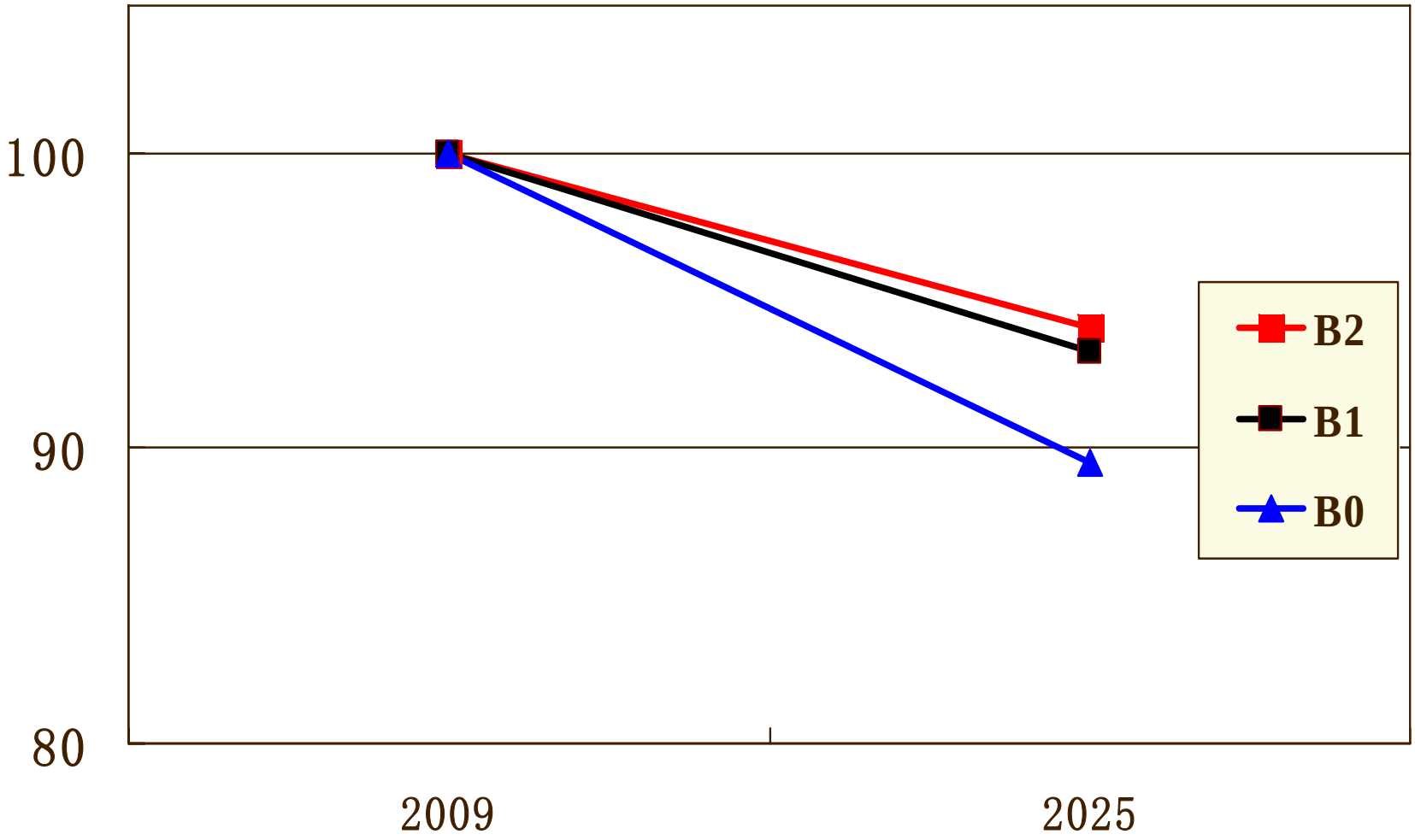


Scenario: Impacts of biotech maize

- **B0: Baseline**
- **B1: B0 + China GM maize**
- **B2: B1 + China and Foreign GM maize**

Scenarios: Impacts of biotech maize

Maize self-sufficiency (%) in 2009 and 2025



Concluding Remarks (1)

Major driving forces of demand for food have been income growth, population and urbanization, however, their impacts have been weakening.

China's experience shows that investment in agriculture and policy reforms are crucial to agricultural development and food security.

Concluding Remarks (2)

- **China will continue to heavily invest in technology and rural infrastructure to maintain its overall food self-sufficiency**
- **While China is expected to increase import of land intensive products (e.g., feeds, cotton, edible crops, sugar, dairy, etc);**

  China will also continue to be a major exporter of labor & capital intensive products (e.g., vegetable, fruits, some livestock products, fishery, and processed foods) and contribute to global food security.

Concluding Remarks: (3)

- **Overall, China will produce most of food to meet its rising demand and contribute to global food security through investing in agriculture:**
  - ✓**The dragon's appetite will mainly be satisfied by China itself.**