China: Market or Competitor?

Report prepared for the California Institute for the Study of Specialty Crops

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China and the Economic Forces that are Driving the Evolution of Its Apple Economy

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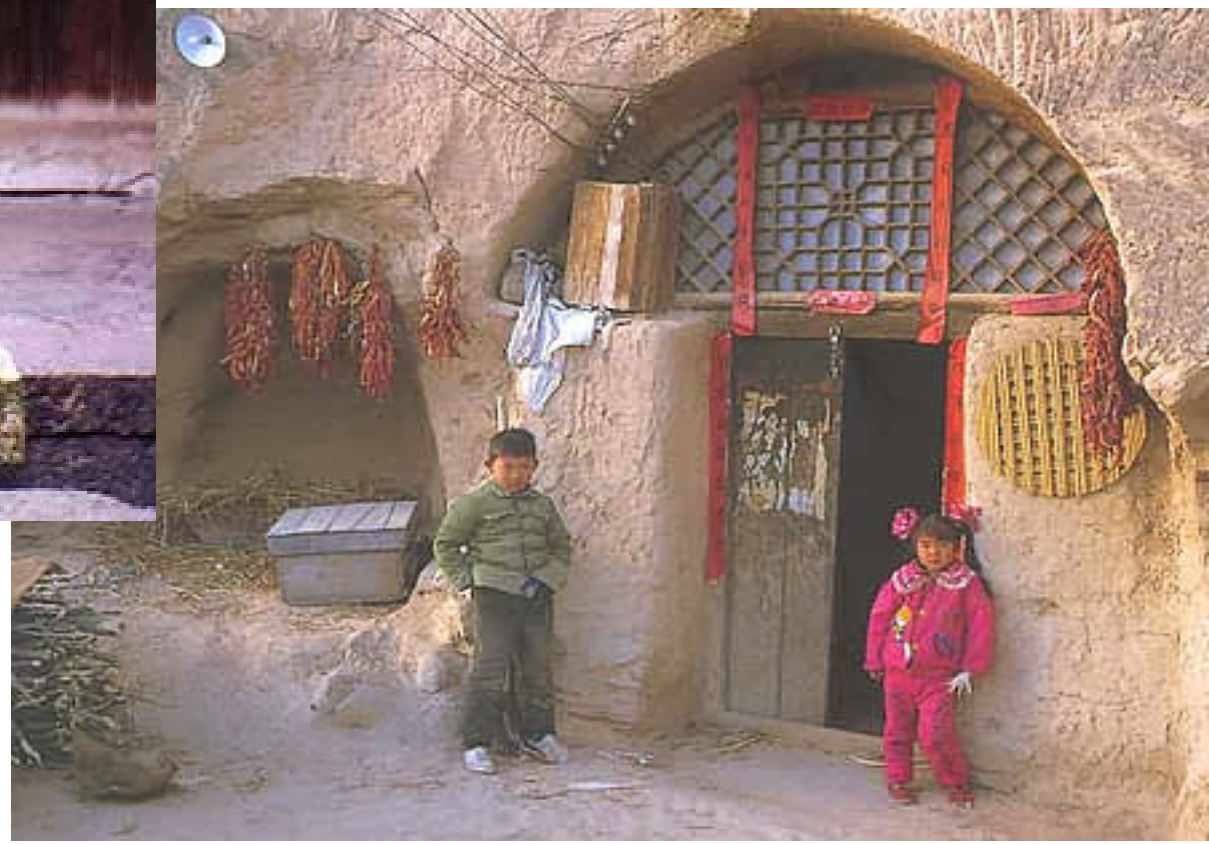
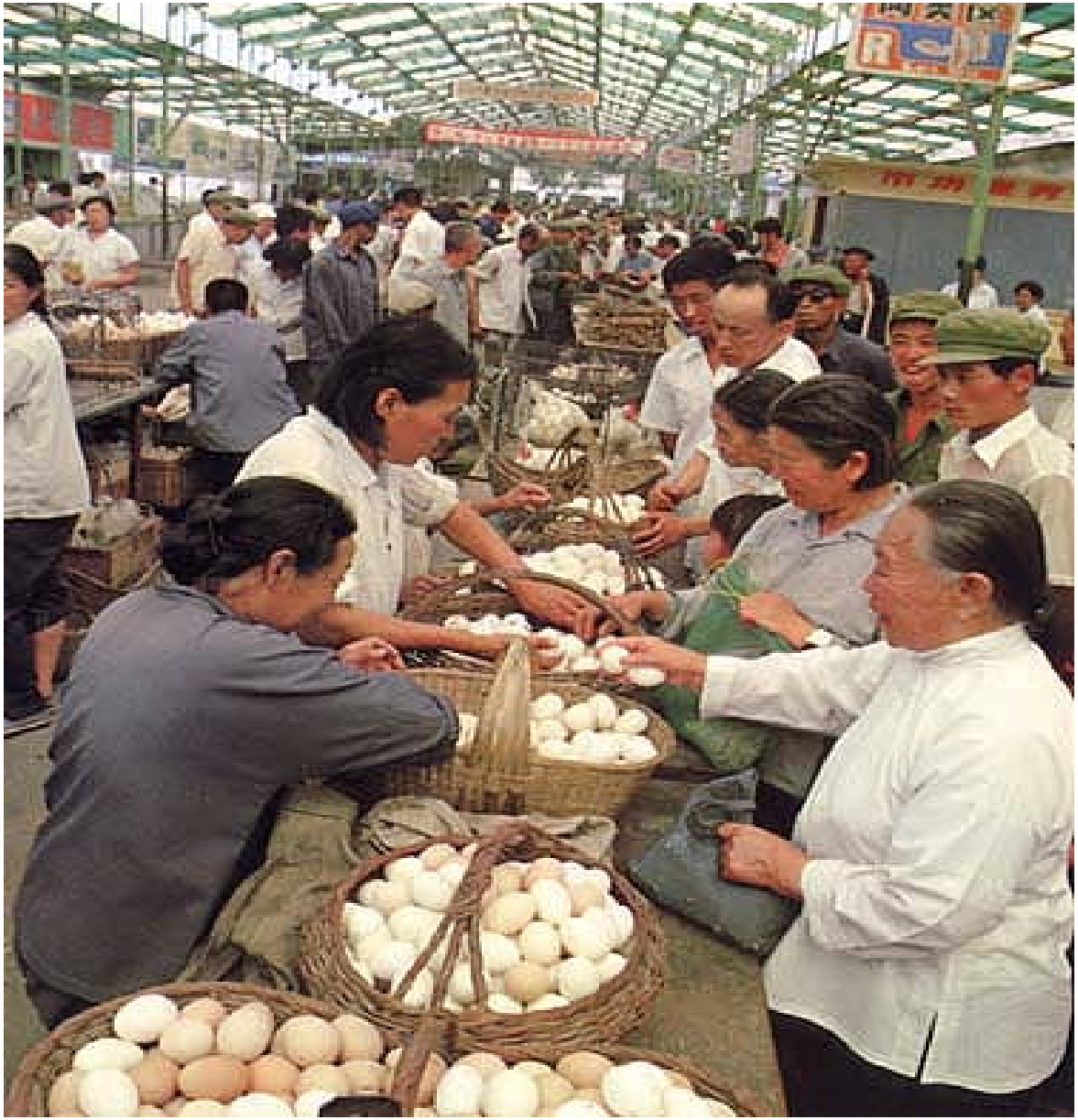
Rapidly Shifting Nature of China's Food Economy … almost defies description



Marketizing



More Open

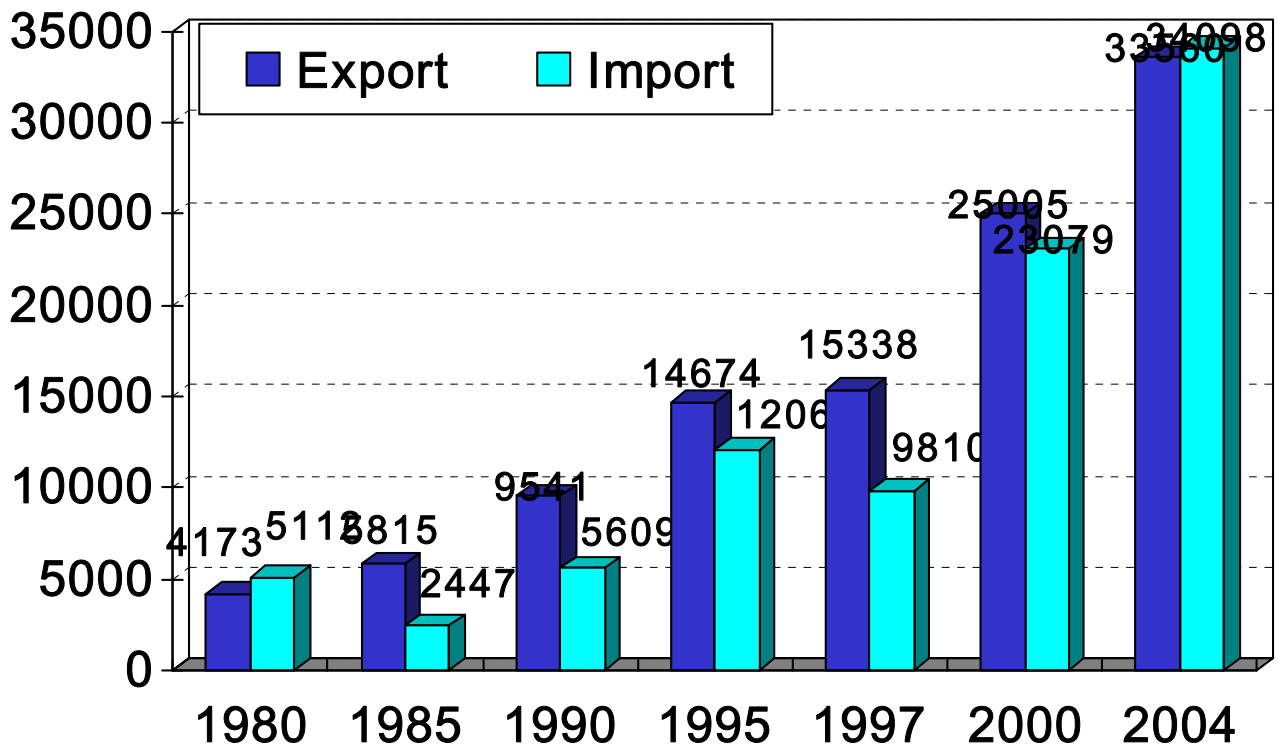
[Shenzhen in 1980 and 2000]

Industrializing

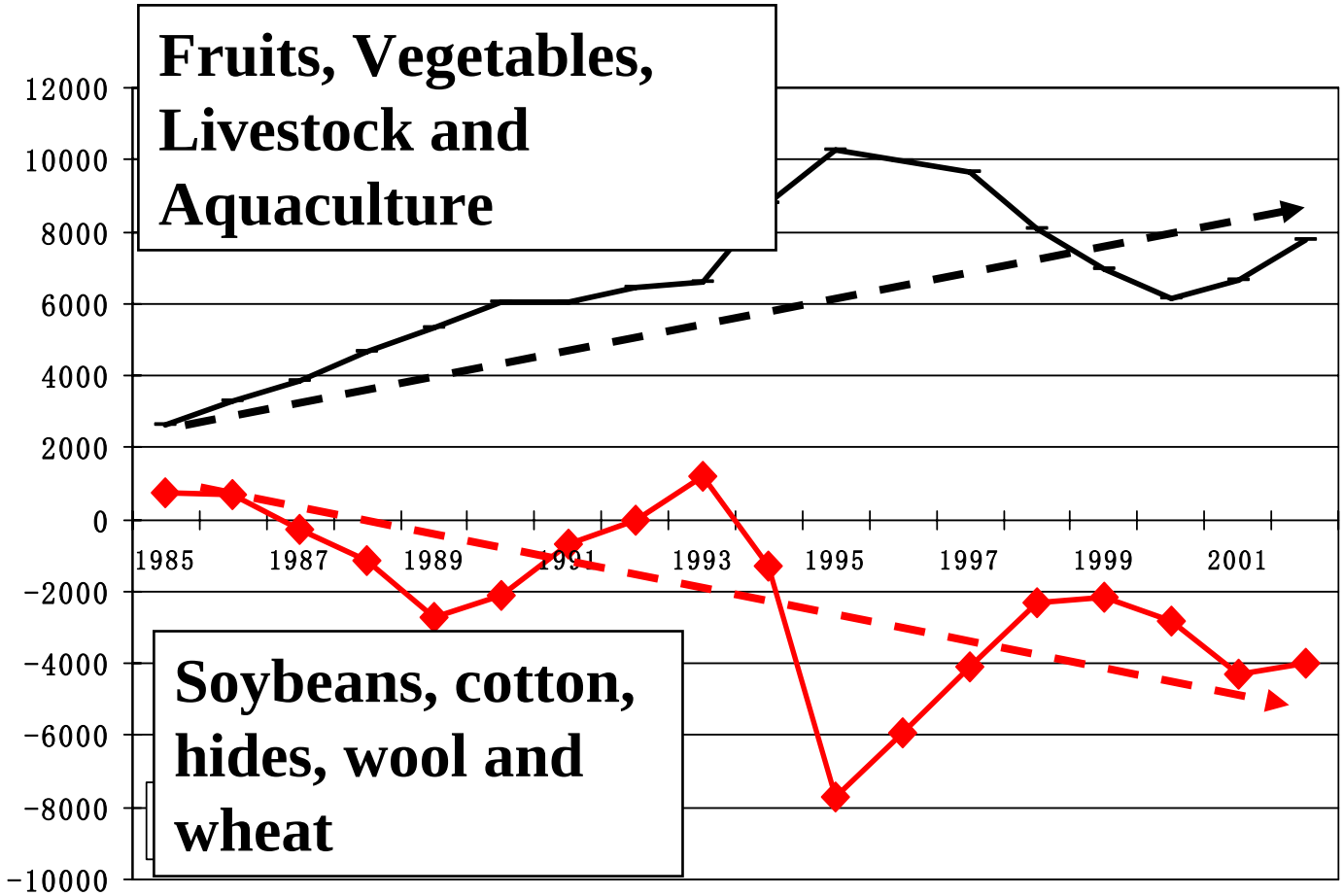
Urbanizing

Westernizing

Agricultural Trade (million US$)



International Trade



Rising EXPORTS from China

Rising IMPORTS into China

Agricultural Trade Balance by Crop Type, 1984 to 2002 (mil US$) …. So what accounts for this pattern?

Outline of Presentation

- Horticulture Facts: Supply and Trade (bad news)
  - Competitiveness: US versus China
  - The Apple Industry
    - Changing efficiency / regional differences
- The Economic Drivers of Change
- The Apple Sector: Actors and Ability to Respond

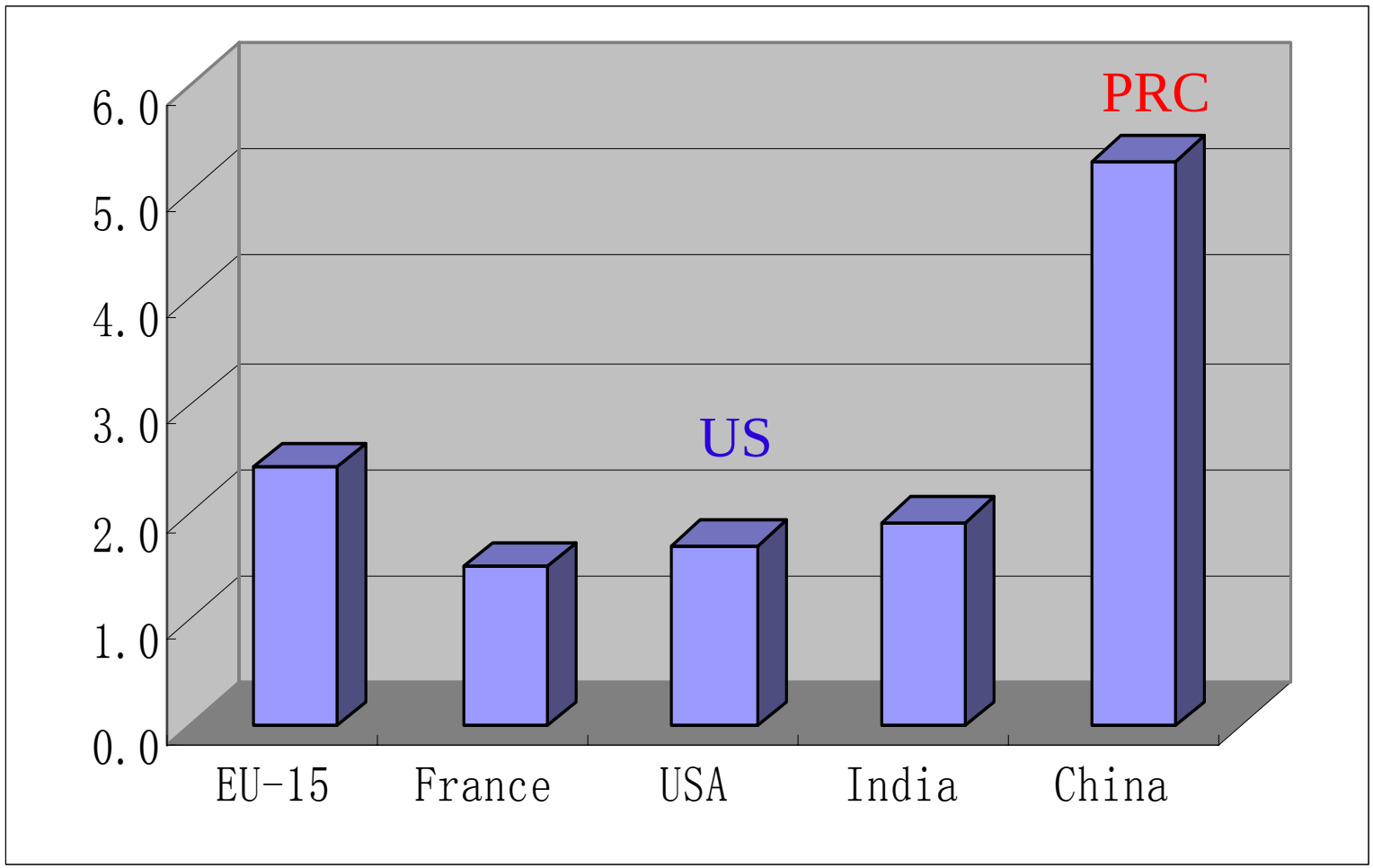
  Who is producing?

  Who is marketing?

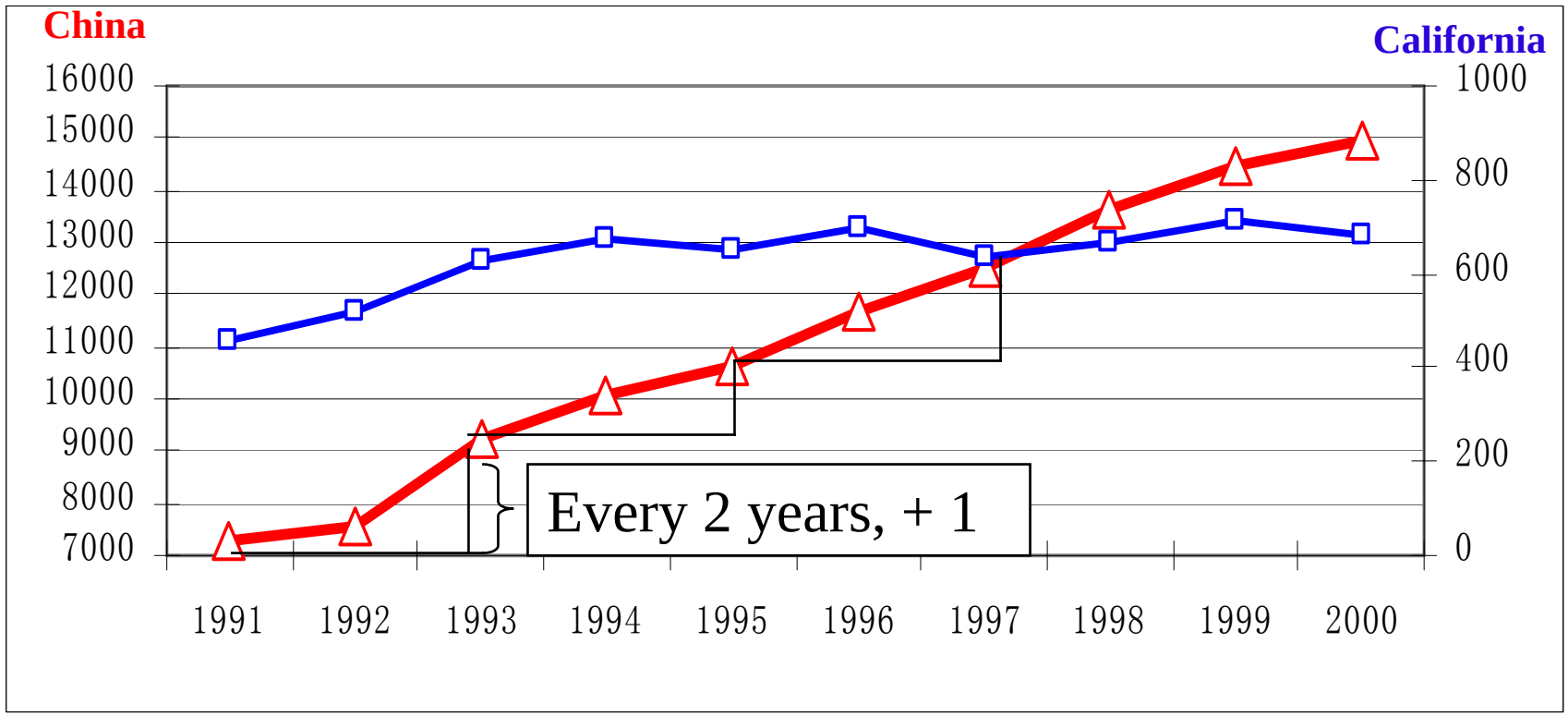
  The role of the government?
- Implications for US Apple Industry

Horticulture Facts: Supply and Trade

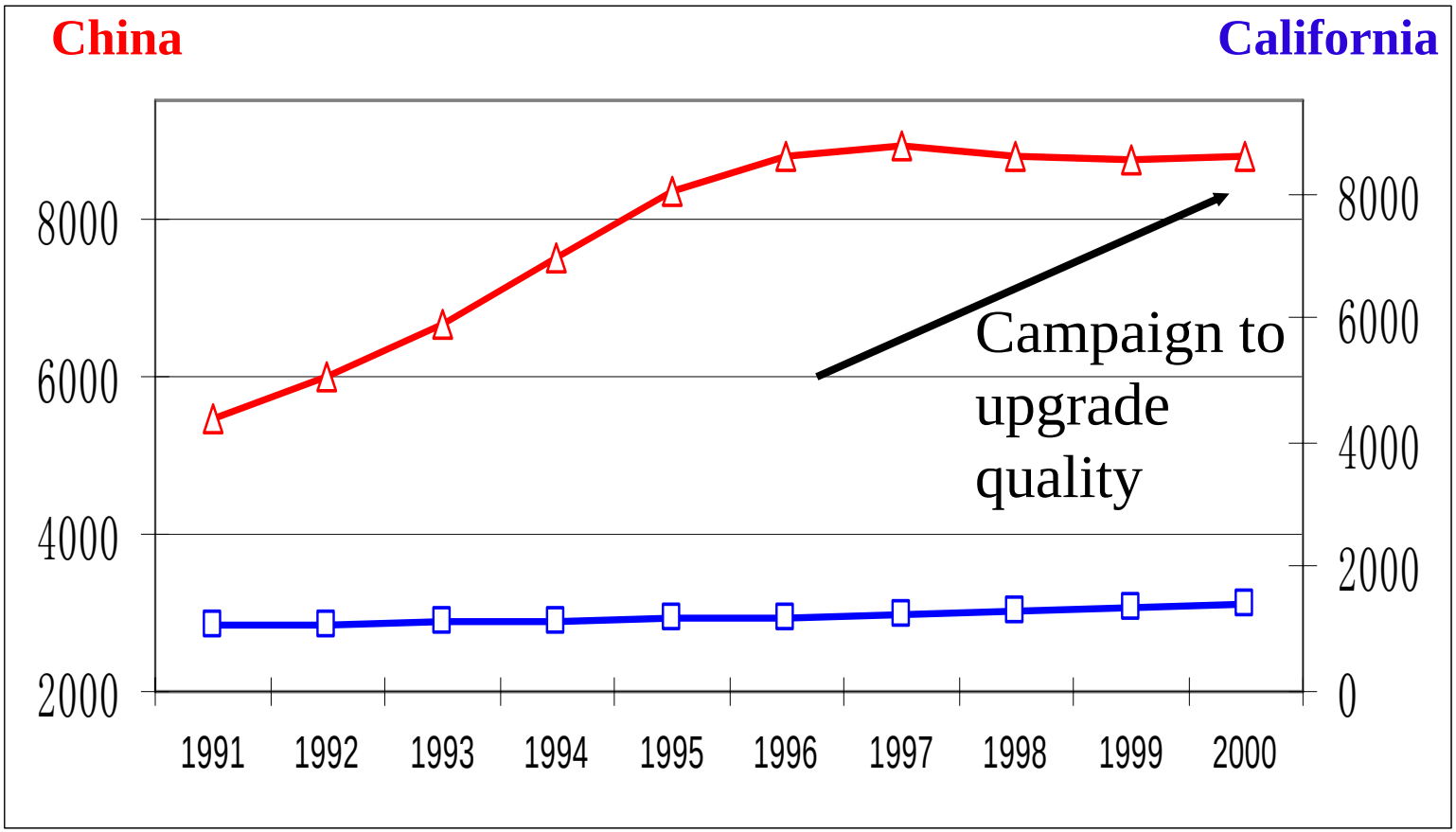
China has Higher Share of Land in Orchards than Most Other Countries



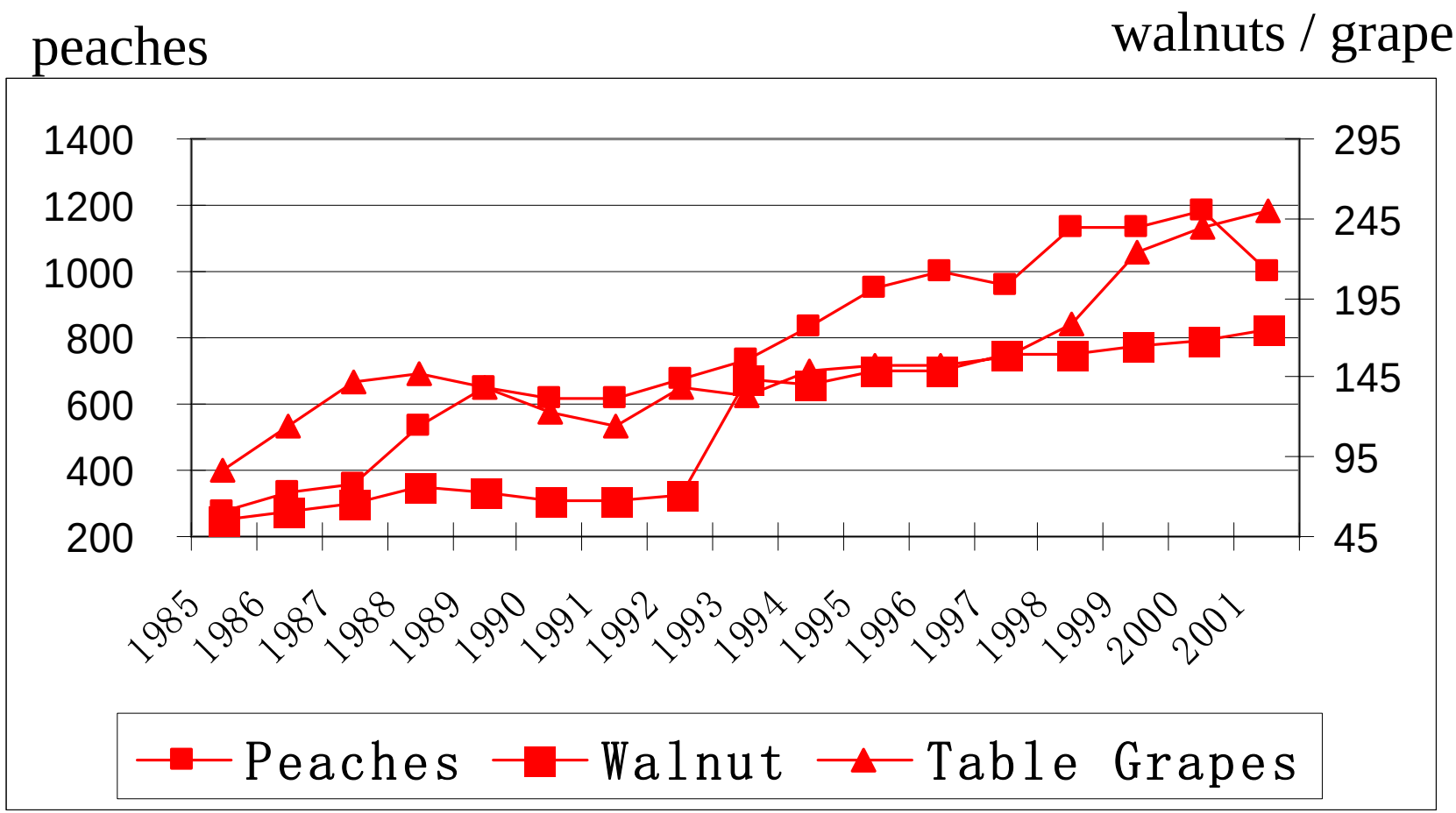
Increasing Sown Areas of Vegetables in China and California (1000 ha)



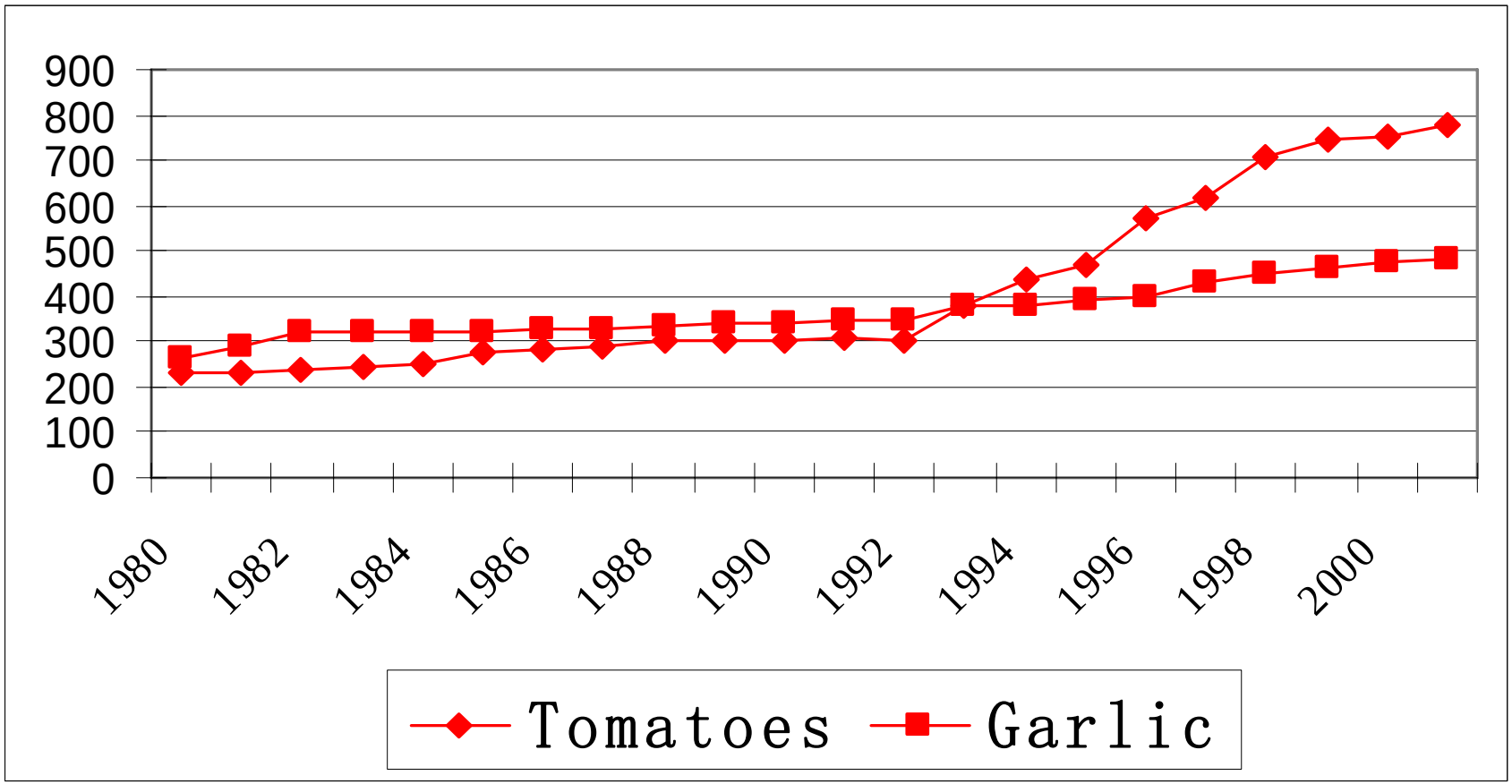
Trends of Cultivated Areas of Fruits and Nuts in China and California (1000 ha)



Walnut, Grapes and Peaches -- China Area Trends, 1985-00 (1000 ha)



Tomatoes and Garlic – China Area Trends, 1985-00 (1000 ha)



Relative Competitiveness: China versus US

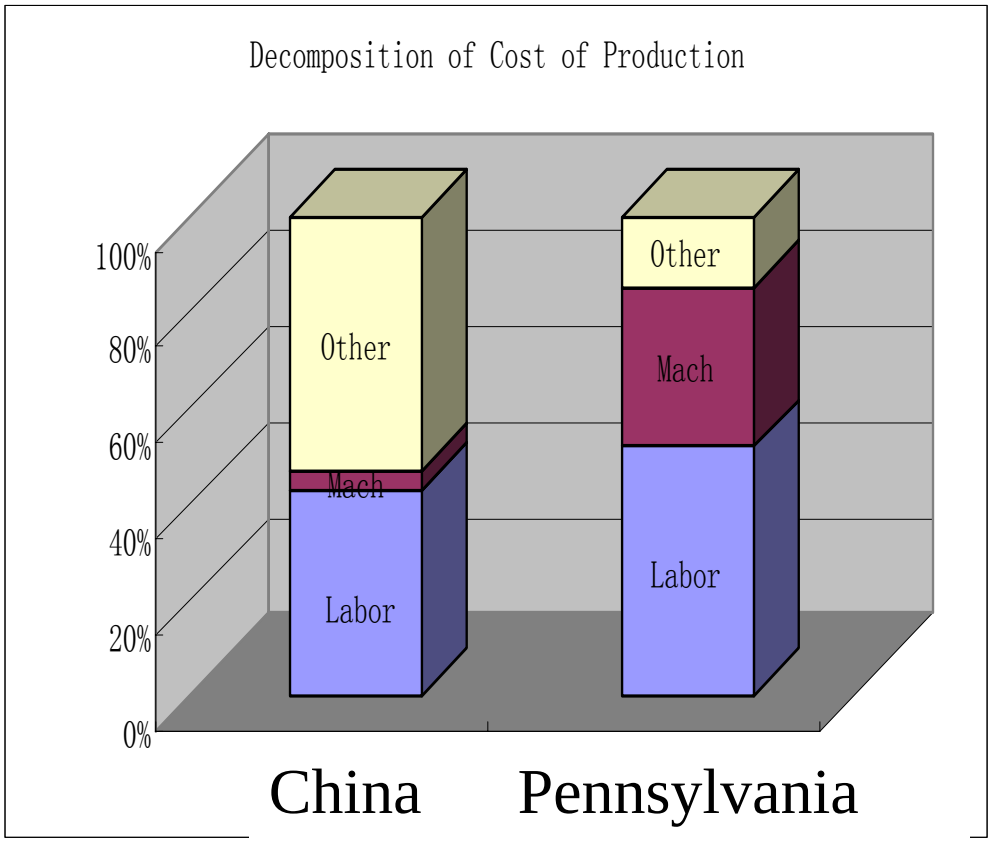
- Comparing the Level of Cost of Production of Major Agricultural Commodities in China and US

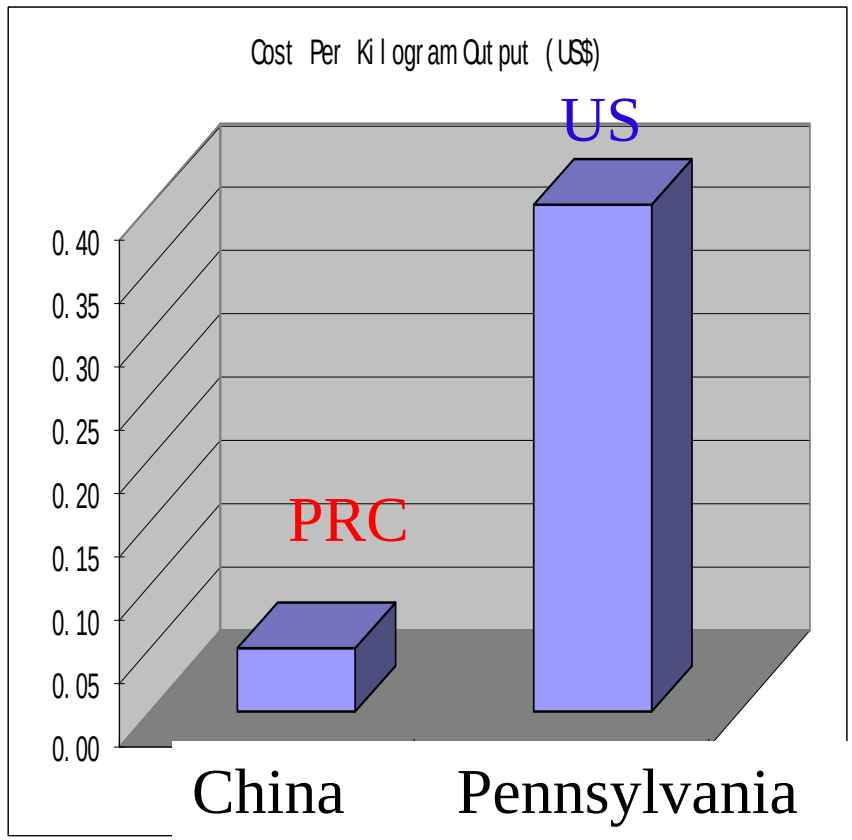
Cost of Production of *Fresh Tomatoes* in China & US, 2000 ($1=8.3 RMB)

Costs	China	US
Seeds	119	245
Fertilizer	502	210
Chemicals	284	326
Irrigation	72	304
Machinery Costs	44	3983
Labor Costs	1186	6254
Overhead & Management	77	17
Other Variable Costs	412	734
Fixed Cost	52	30
Total Costs Per Hectare	2748	12103
Per kilogram cost ($/kg)	**0.05**	**0.4**
% of labor cost in total	**43%**	**52%**
% of machinery cost in total	**4%**	**33%**

Cost of Production of *Fresh Tomatoes*

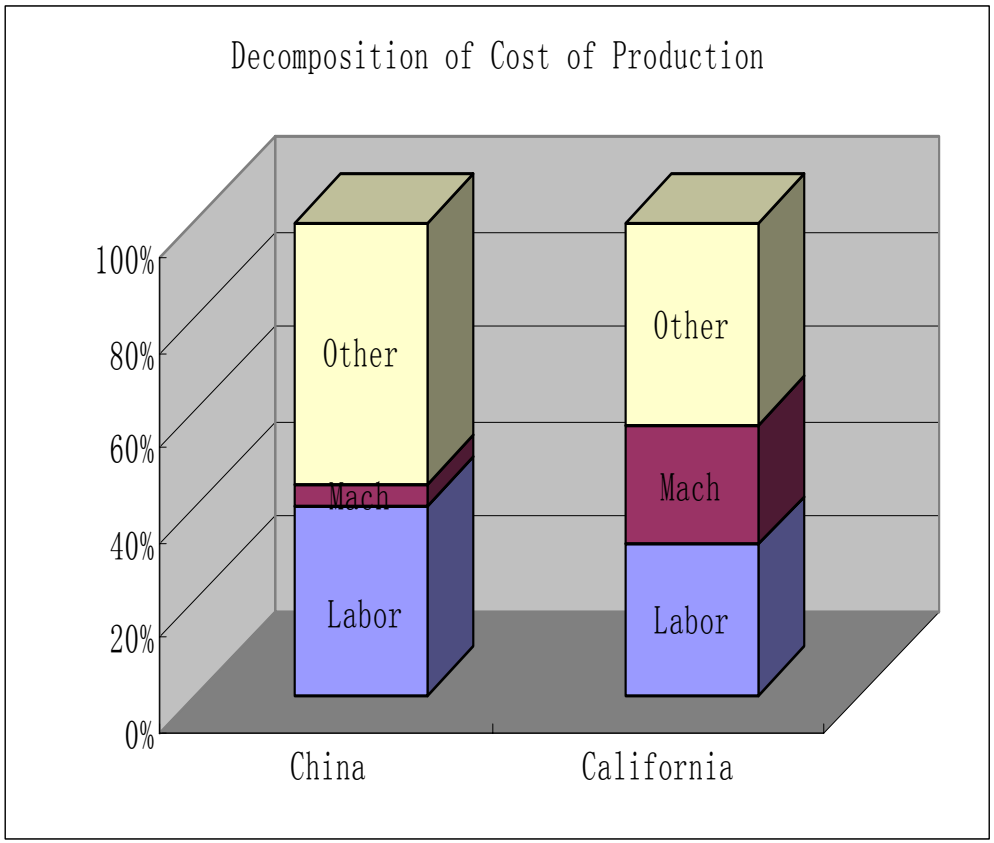
China and US

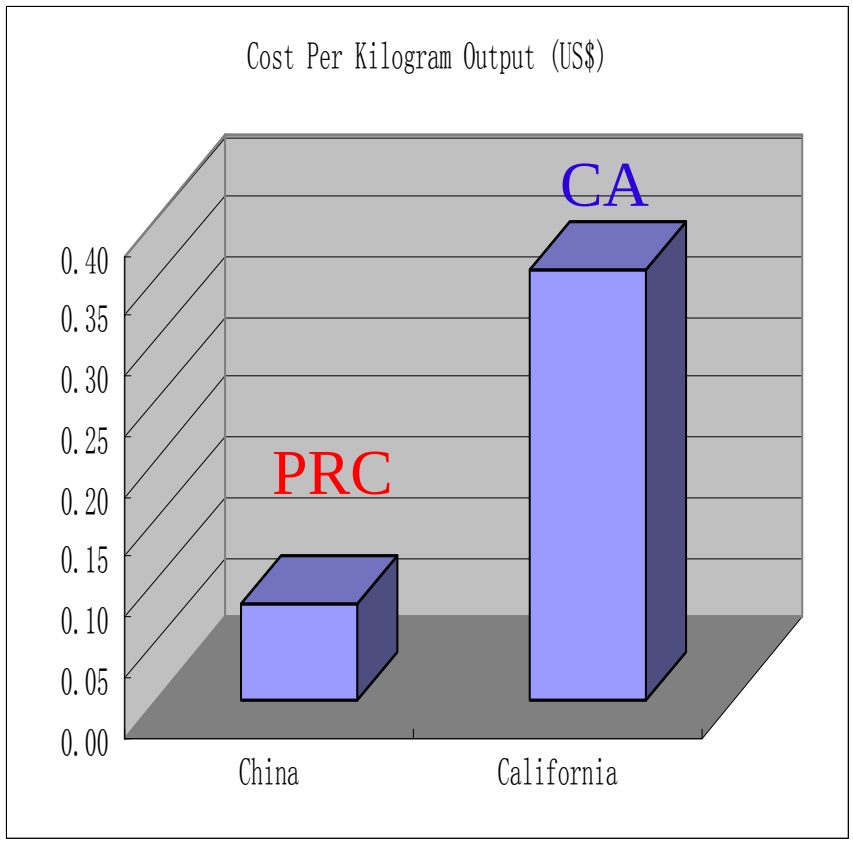




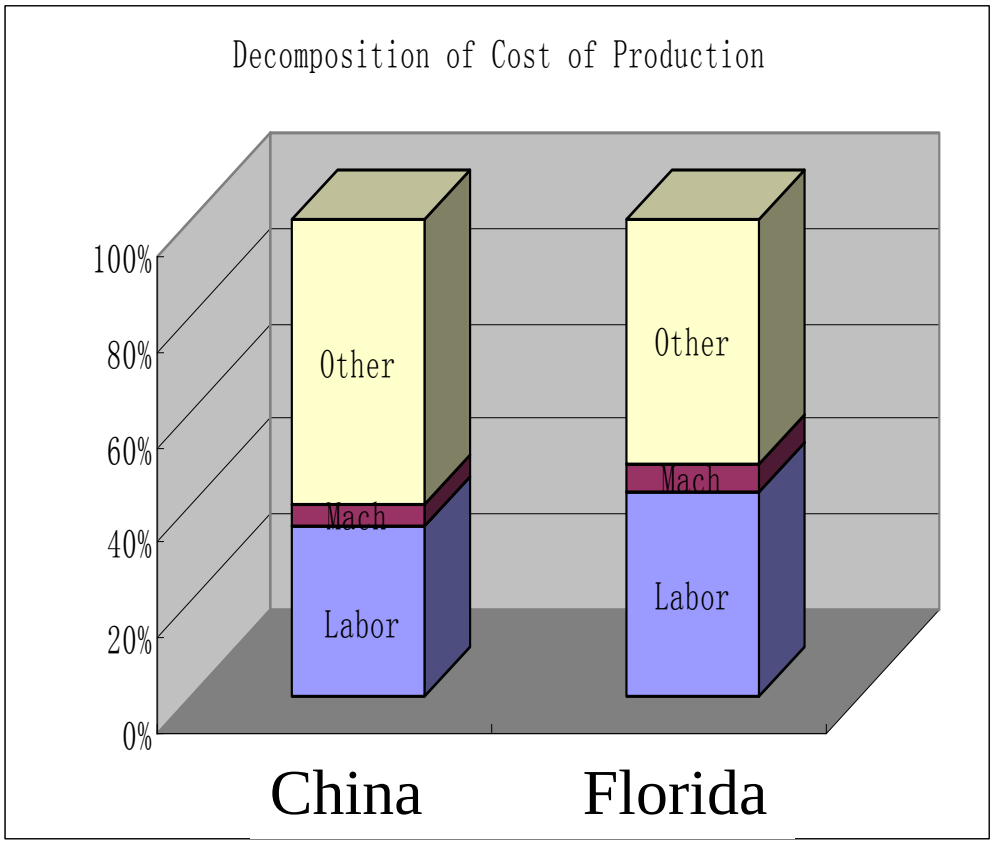
Cost of Production of *Peppers*

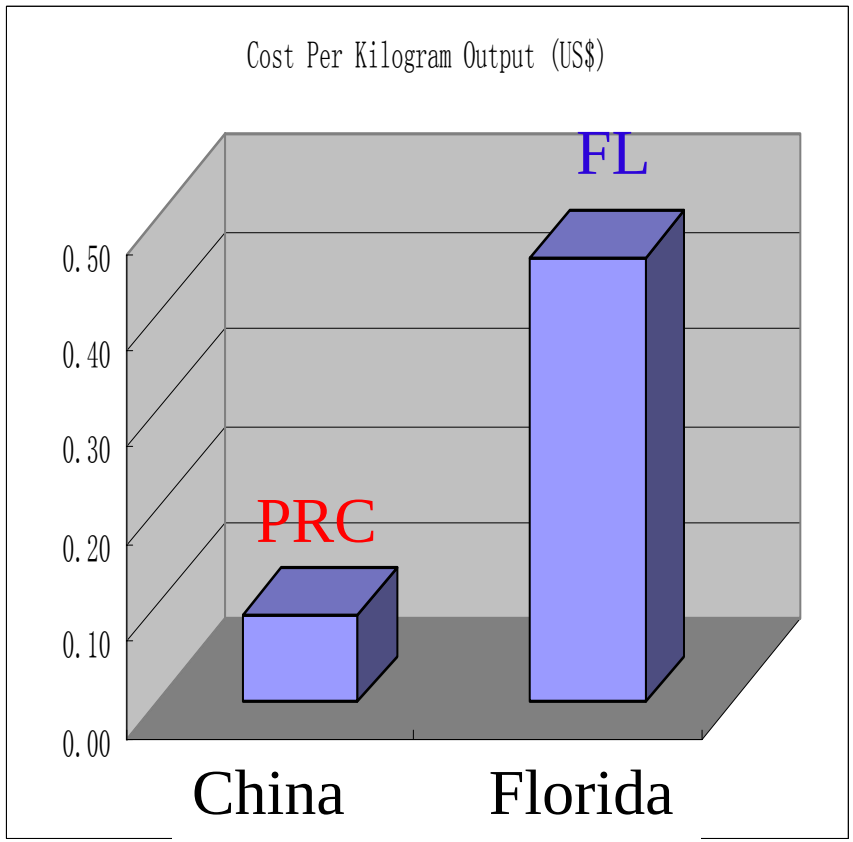
China and California





Cost of Production of *Oranges (Navels and Valencias):* China and US



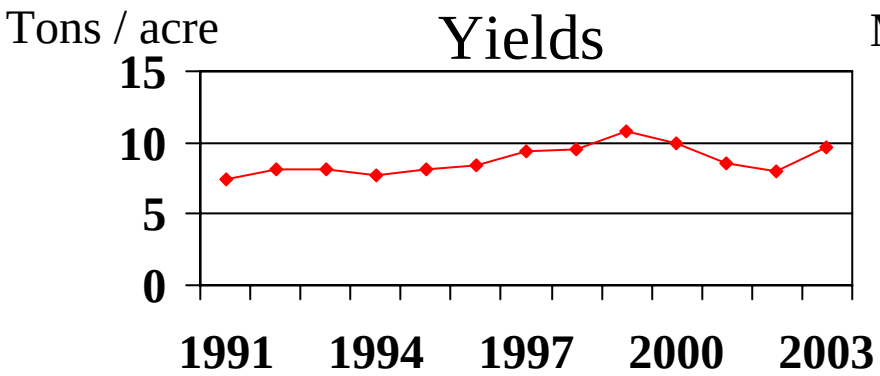


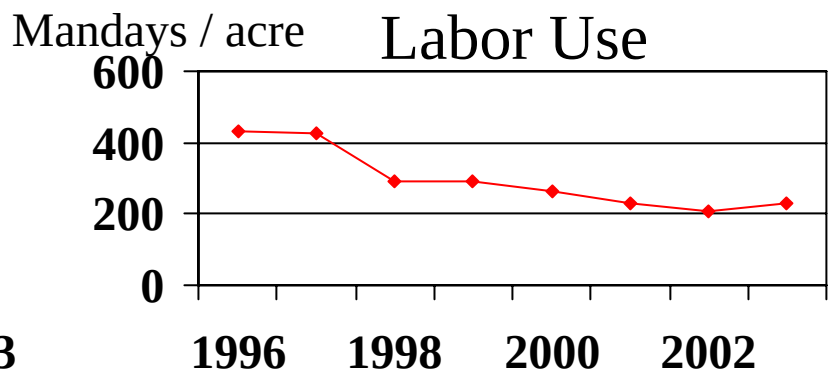
Summary: Patterns of Fruit and Vegetable Production in China

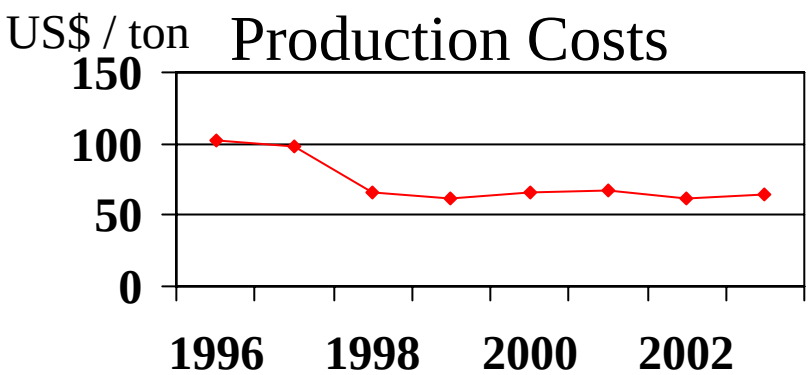
- Significant percentage of ag. land used in horticultural products (more than US and more than California)
- Rising sown area and production in many (most?) of horticultural products grown in the US (including apples)
- One of reasons: China is a low cost producer (period)

[remember this is the bad news part of the presentation]

Changes in apple production efficiency in China, 1990s to 2003





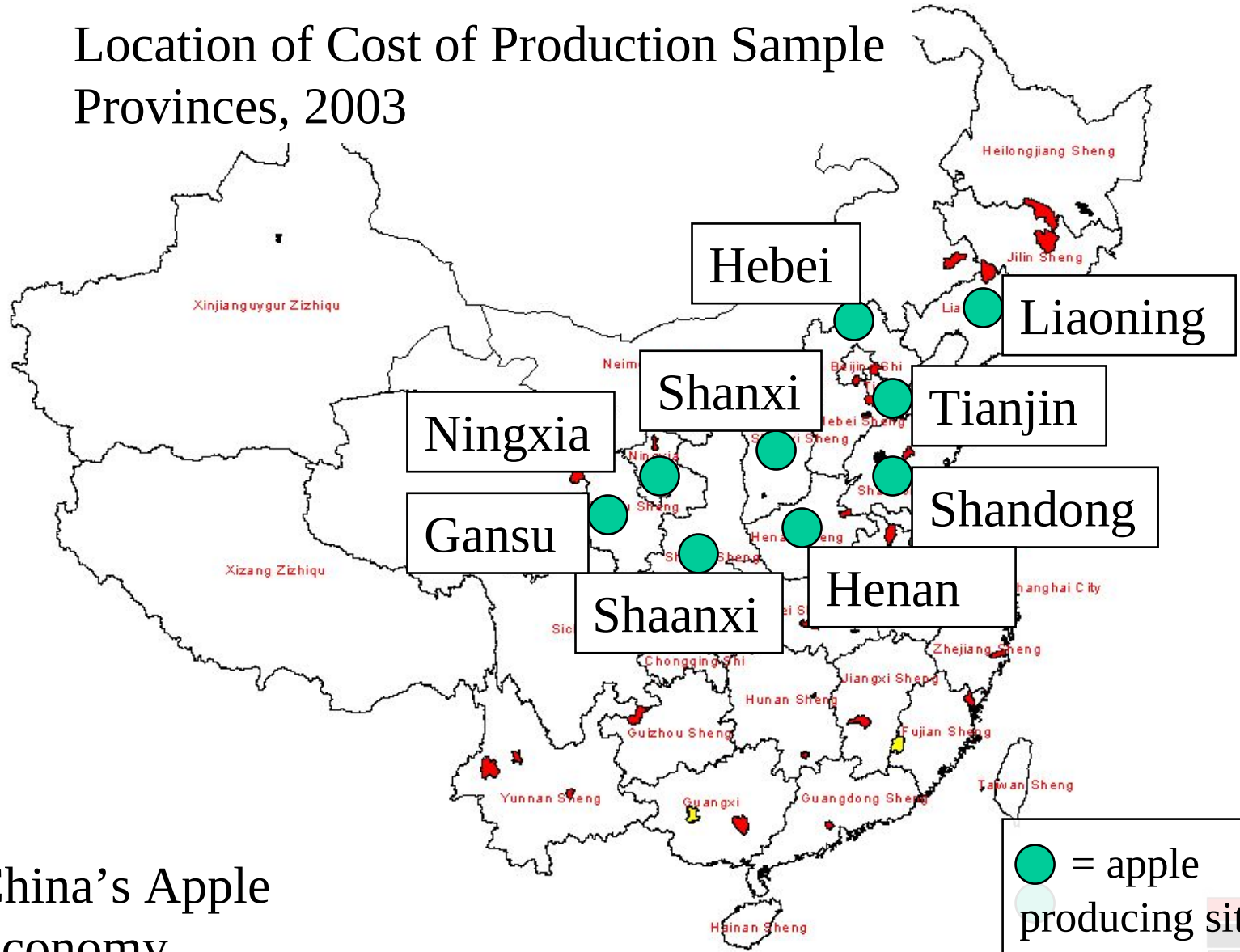


About the same farmgate cost per unit of output as Oranges, Tomatoes and Peppers:

($0.05 / kilogram)

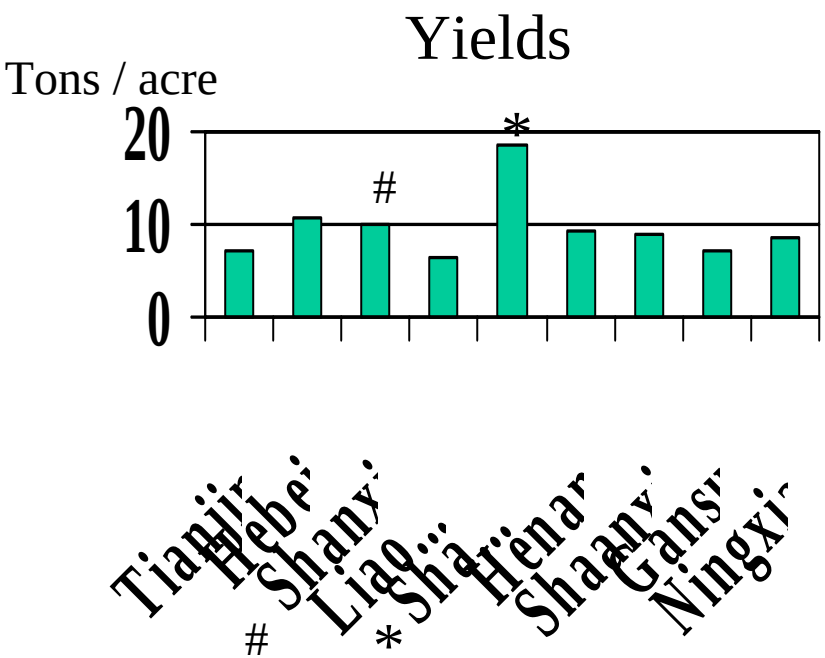
National Cost of Production Data, NDPC

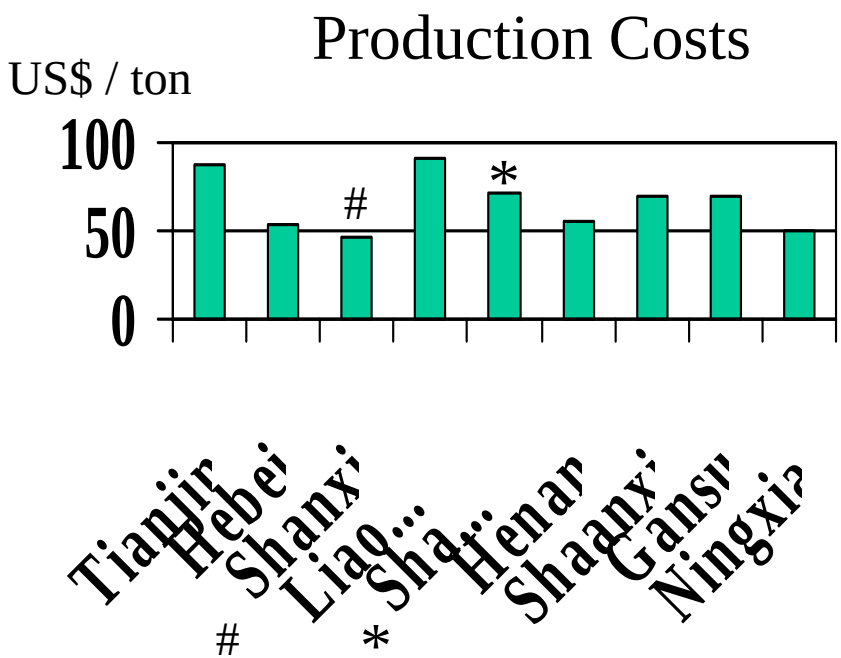
Location of Cost of Production Sample Provinces, 2003



China's Apple Economy

Regional Differences in Production Costs (range from $46/ton to $87/ton)





National Cost of Production Data – NDPC, 2004

All of this has BIG implications for the US apple industry

- As seen:
  - Largest area under apples in the world
  - Rising production and rising quality
  - Rising exports
    - Already in juice concentrate
    - Emerging exports of fresh apples

Conclusions

- China's agriculture has been transforming at an incredible rate … more open; more towards comparative advantage; more efficient
- China has potential to continue growing in this direction
- Biggest advantage in low production costs of labor intensive commodities

Remaining Questions?

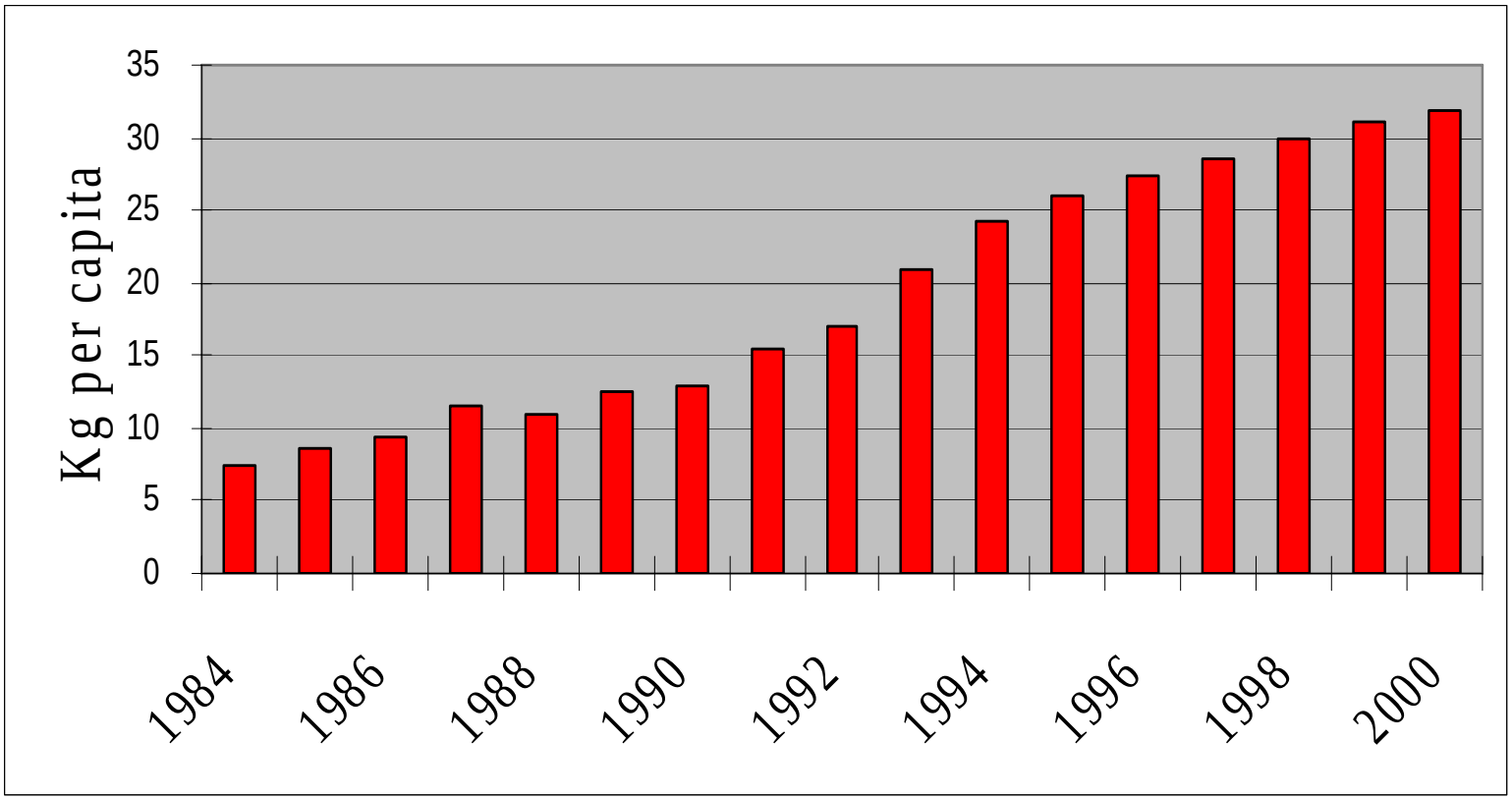
#1: What drivers will shape the future of the apple industry in China?

4 FORCES:

- Rising demand?
- Rise of supermarkets?
- Rise of supply and marketing cooperatives?
- Food security and the impetus to push grain production?

FORCE 1:

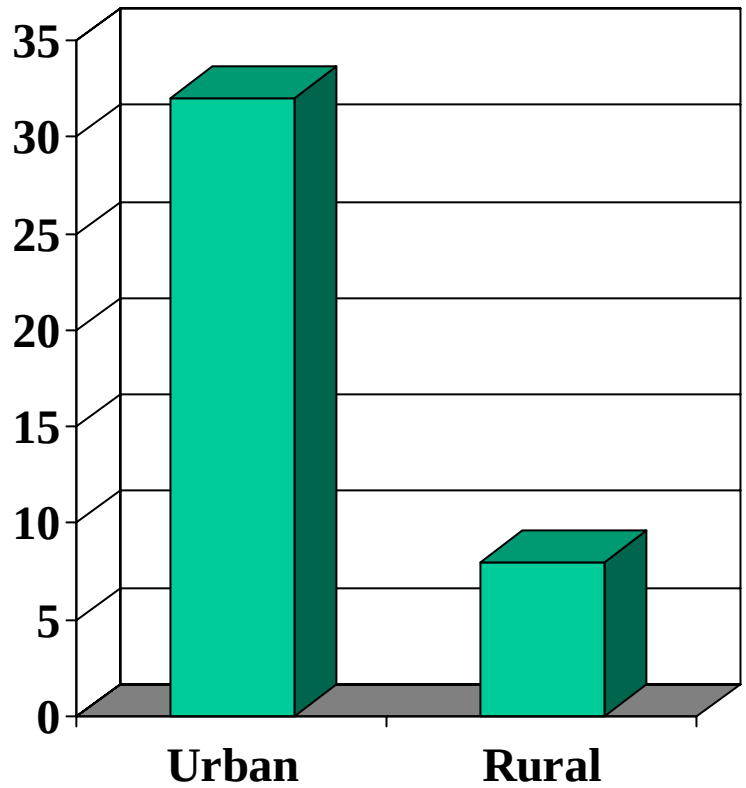
Domestic Fruit Consumption in China



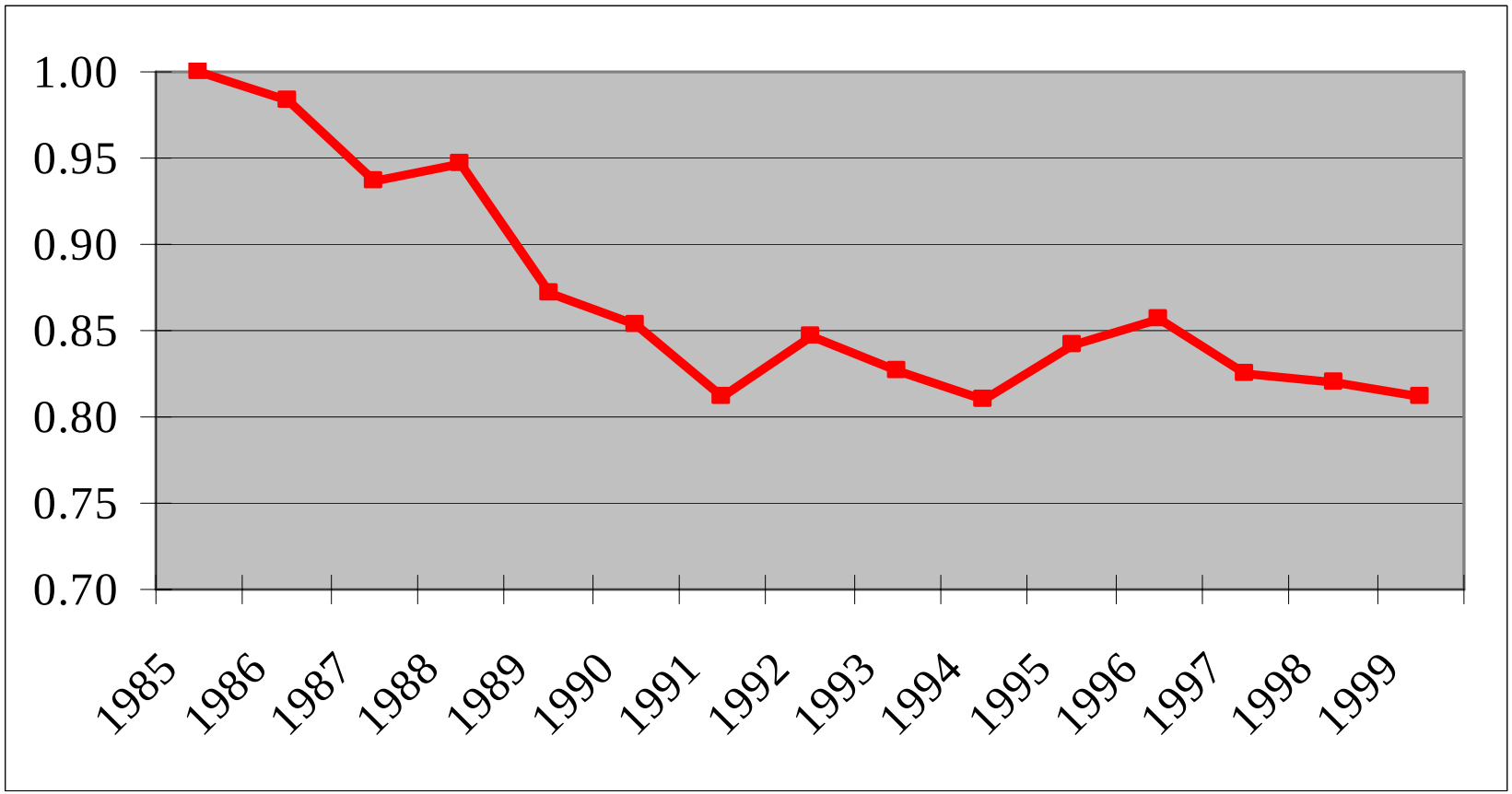
Urban Consumption of Fruit -- CNBS

Fruit Consumption: Difference in Rural vs. Urban

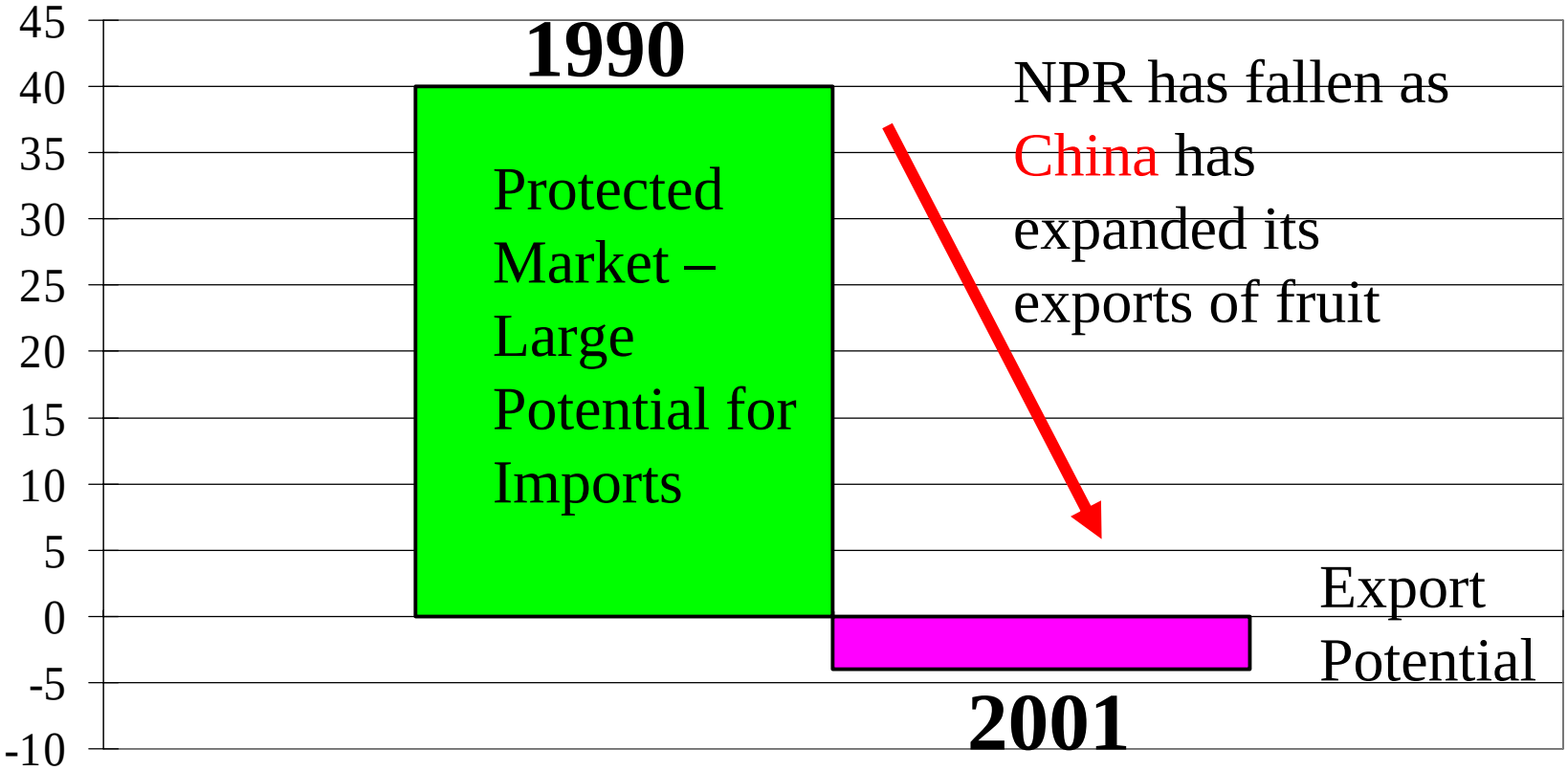
- Biggest consumption push will come over the next 10 to 20 to 30 years when hundreds of millions of rural residents migrate to the city …
- … and then consume like them!



Price of Fruit Relative to All Other Prices, China



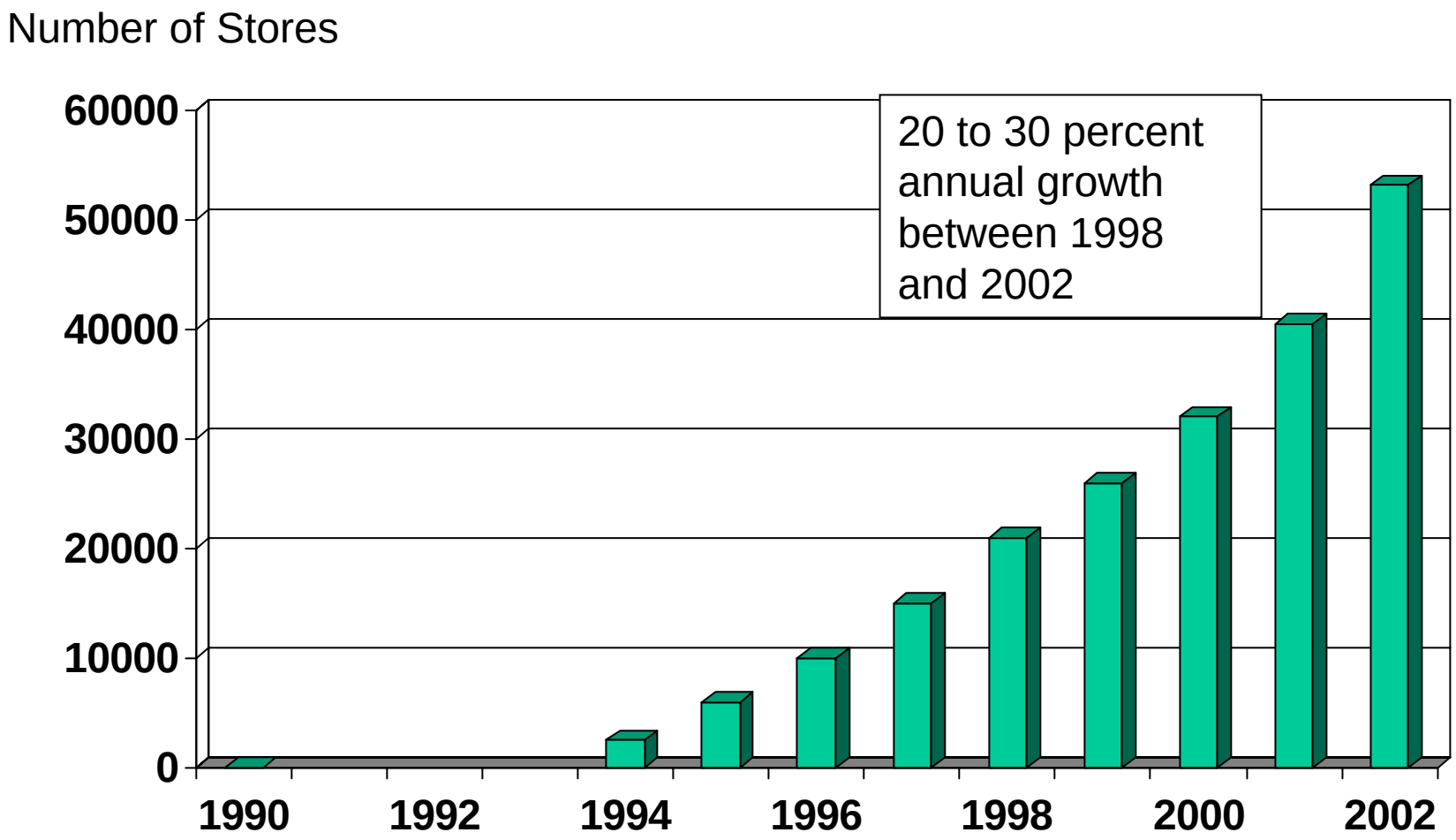
Rates of Protection (%)
Fruit in China



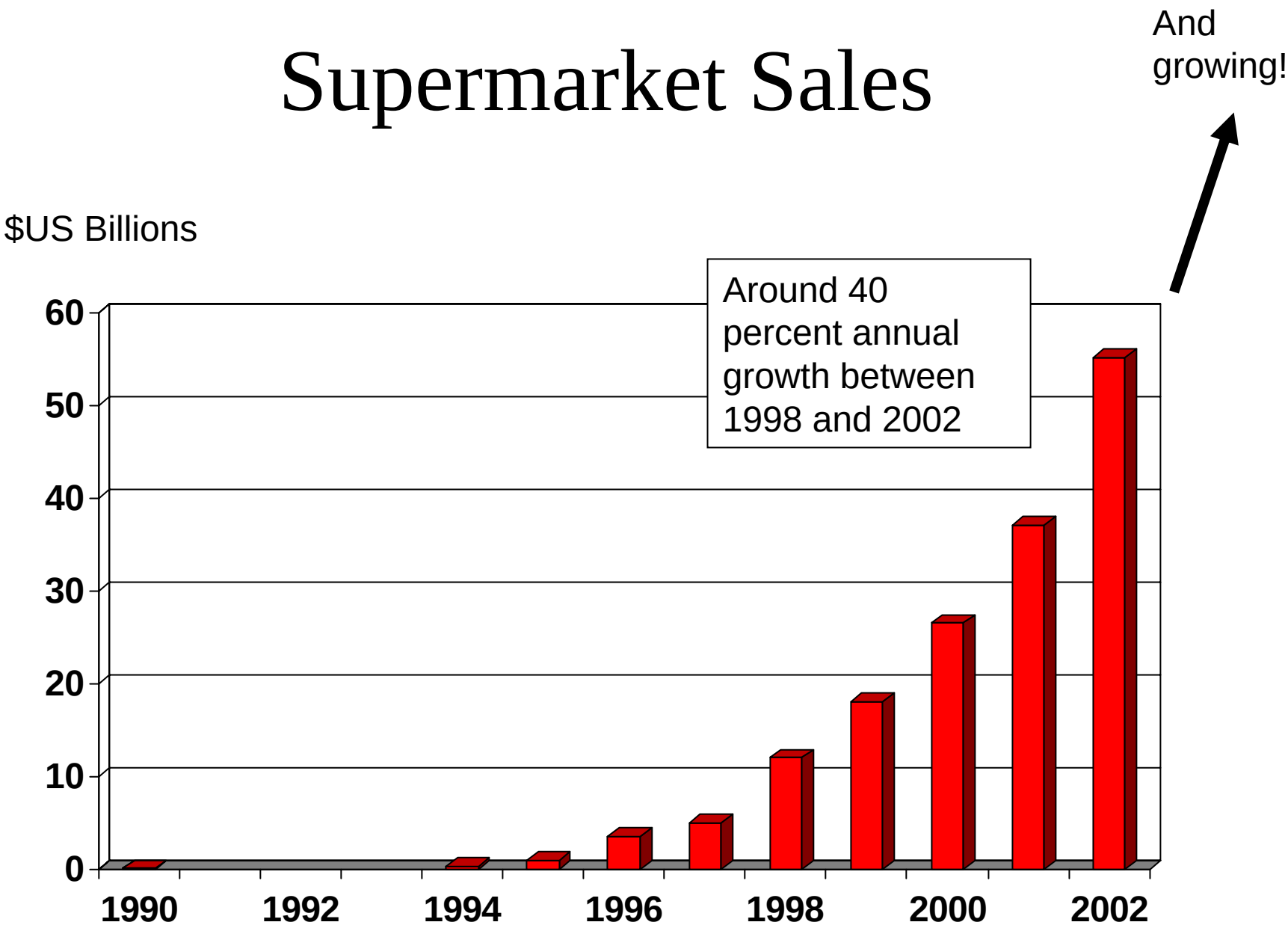
So far: supply growth > demand … but in future?

FORCE 2:

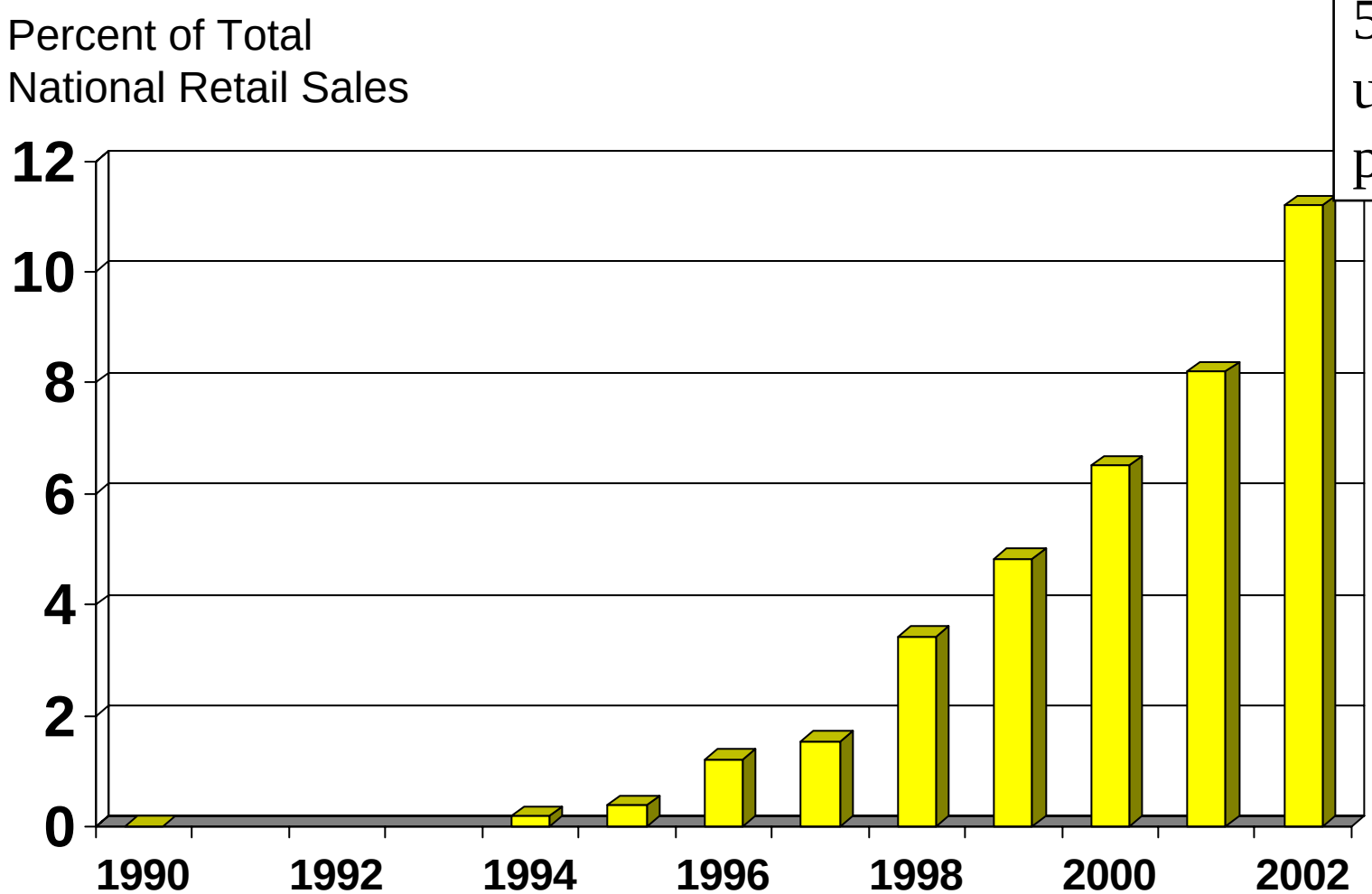
Rise of Supermarkets: Increasing Store Units



Supermarket Sales



Share in National Retail



Nearly 50% of urban food purchases

World Bank: “Retail Olympics”

What does this mean?

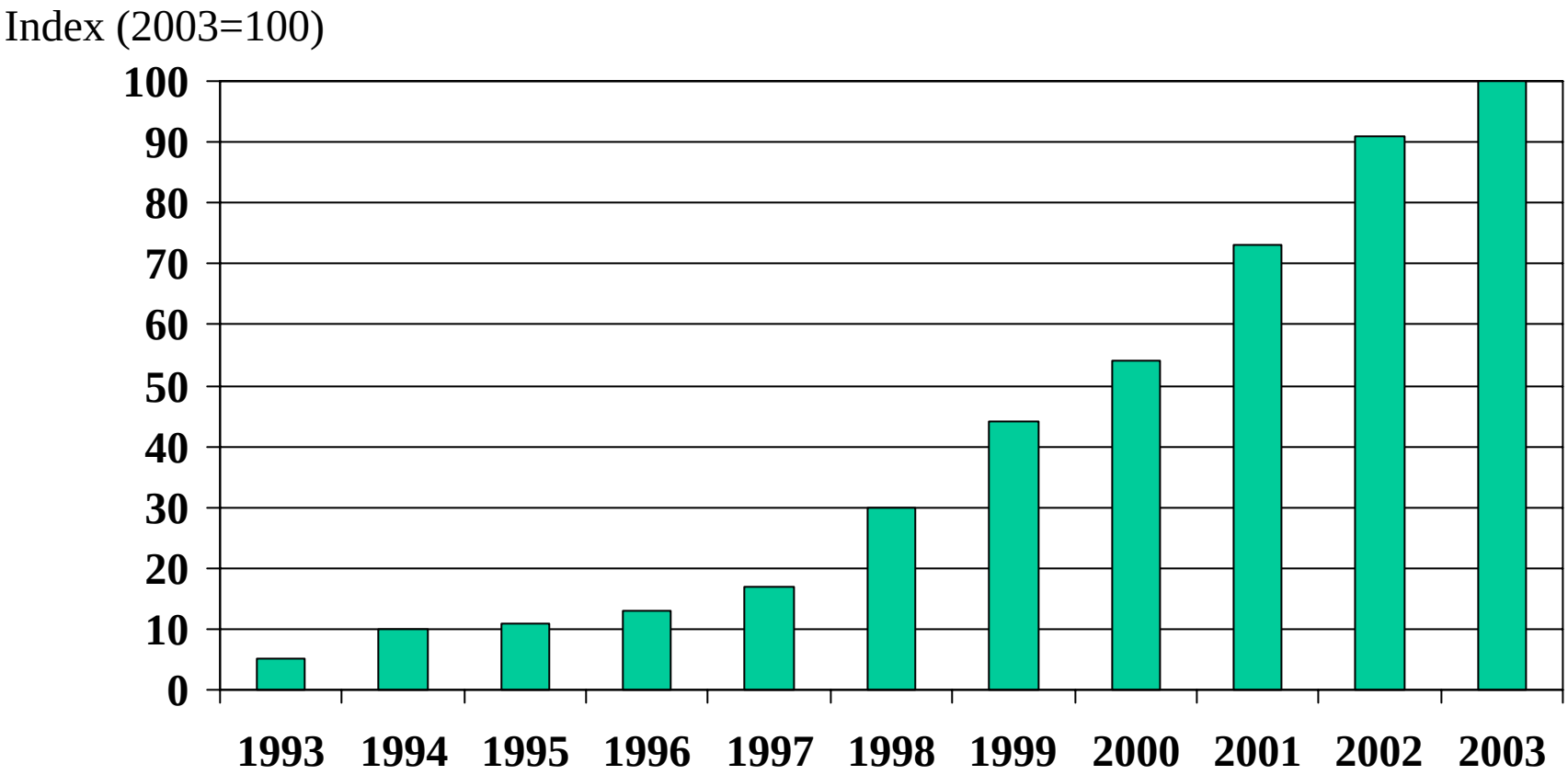
- Theory: supermarkets will go to those that will produce a standard, safe produce with a great deal of reliability (at a reasonable price) …
  - Response worldwide: work increasingly with large, well-managed growers … often larger, well-educated producers …

- Can China's small, poor farmers do this?

[If not, who will? An alternative: US apple industry]

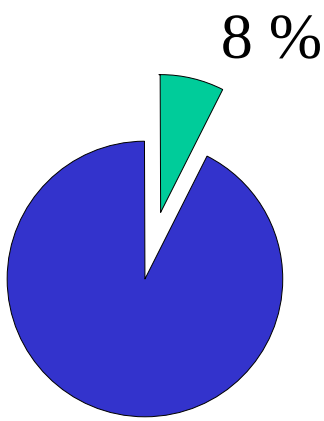
FORCE 3:

Growth of Cooperatives and Farmer Associations – Targeted mostly at provision of technology and inputs and marketing

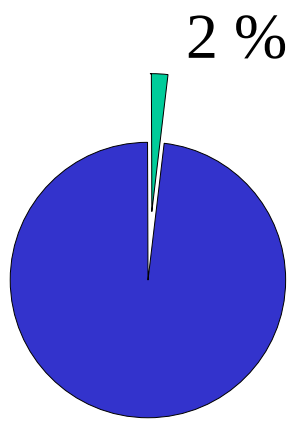


The rise of coops are especially important for small farmers to be able to interact in a modern, more-sophisticated, marketing-oriented world

But, cooperative movement still small

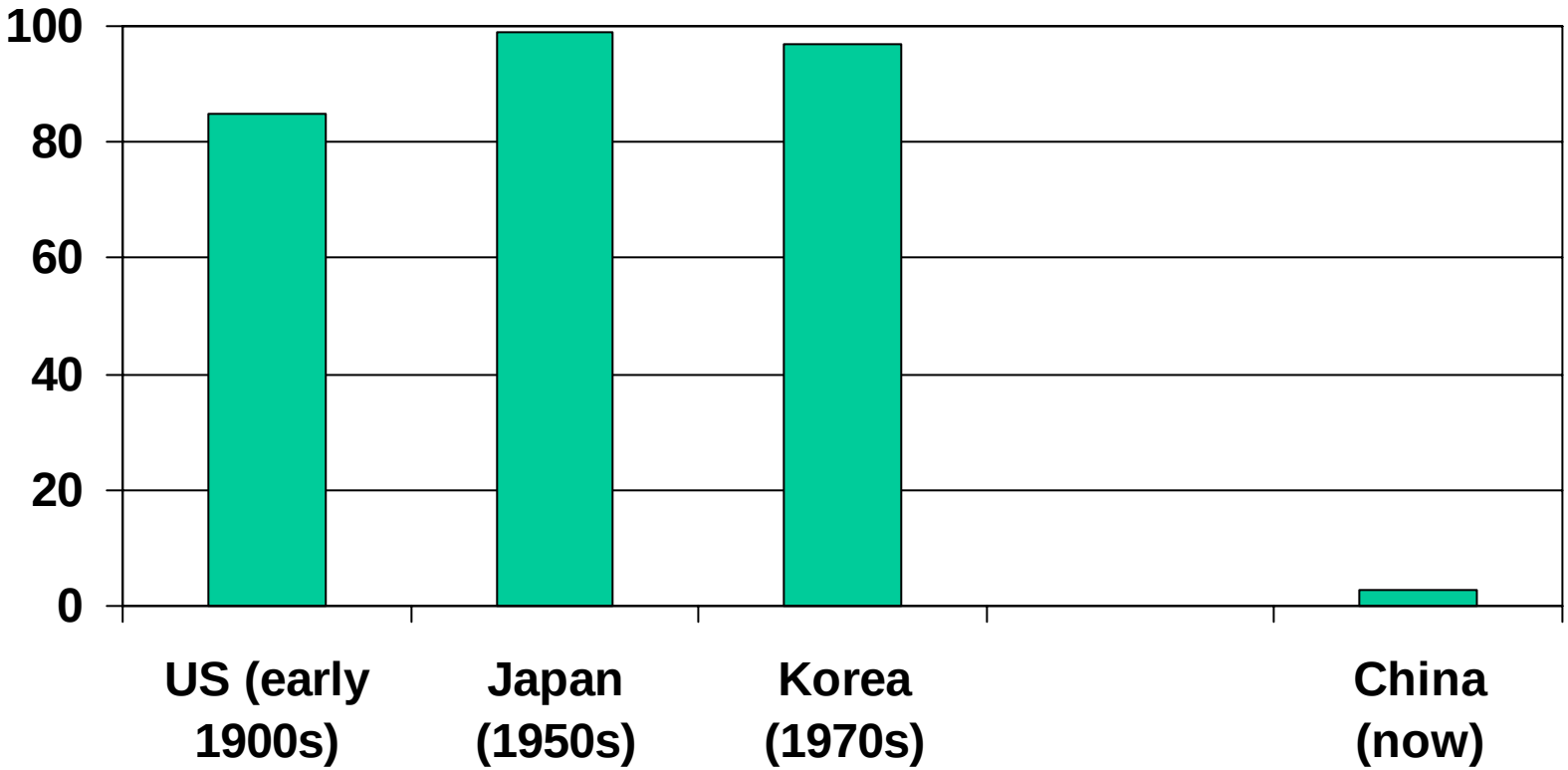


Percent of villages with Cooperatives / FAs



Percent of households that belong to Cooperatives / FAs

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



FORCE 4:

New Subsidy Policies in 2004

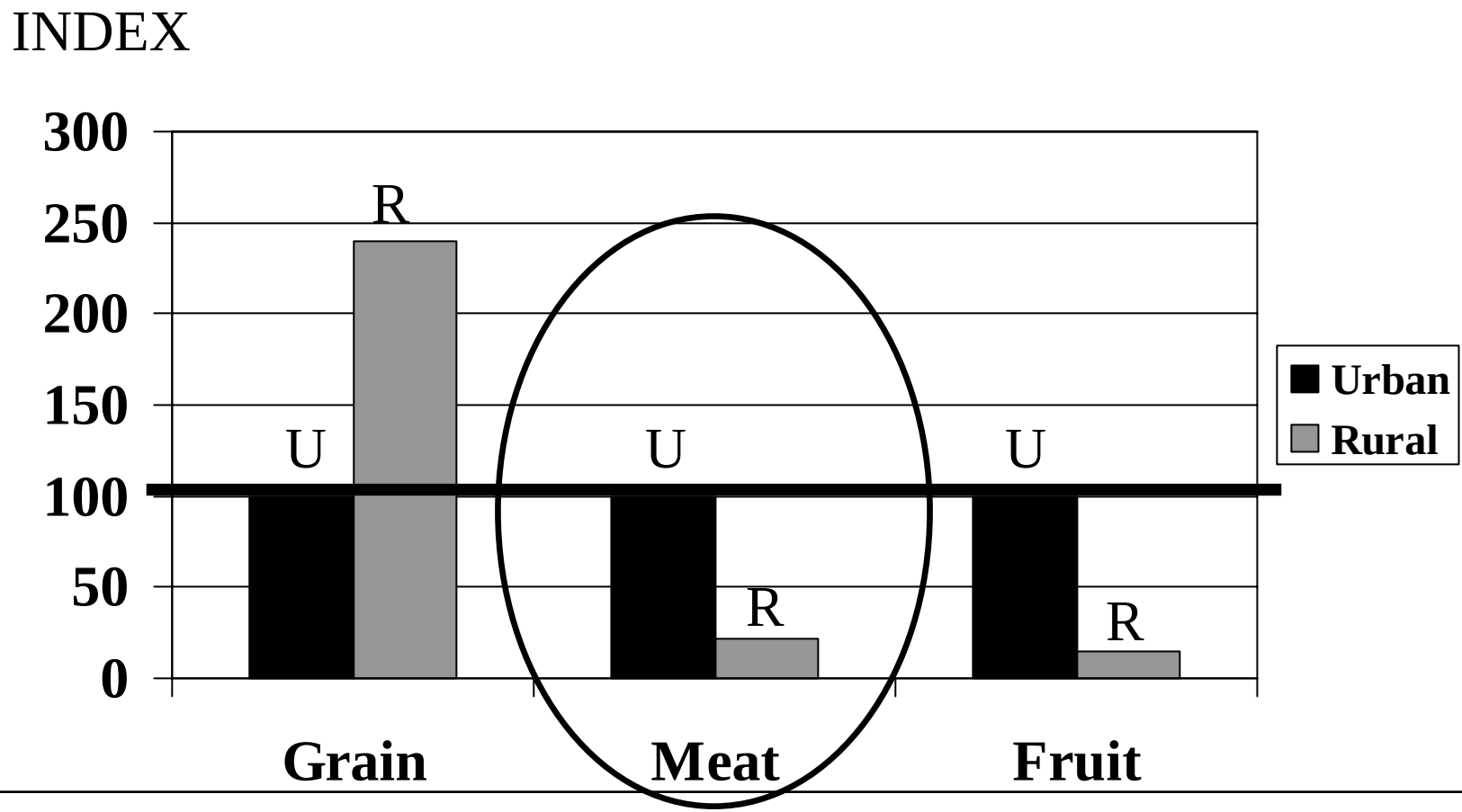
Policies	Estimated Cost
Direct Subsidies to Farmers	***$1.4 billion***
Agricultural Tax Reduction	***$5 billion***
Input Subsidies	***$200 mil.***

Data source: USDA, ERS

But, Direct Subsidies Are Not Very Big [yet]

- **$7 per acre**
- **$1 per rural household member**
- **1% of rural household income**
- **$2 to $6 per ton**
- **Below 2 percent gross value of production**

Consumption Consequences of Migration: less grain/more meat & fruit



There is a going to be a surge in the demand for feed grains … produce in China or outside of China … China wants to produce inside China, but can't do it all …

Remaining Questions
[given the forces that are driving the economy]

#2: So who is responsible for the emergence of China's apple economy?

#3: What are the implications of the future of the sector?

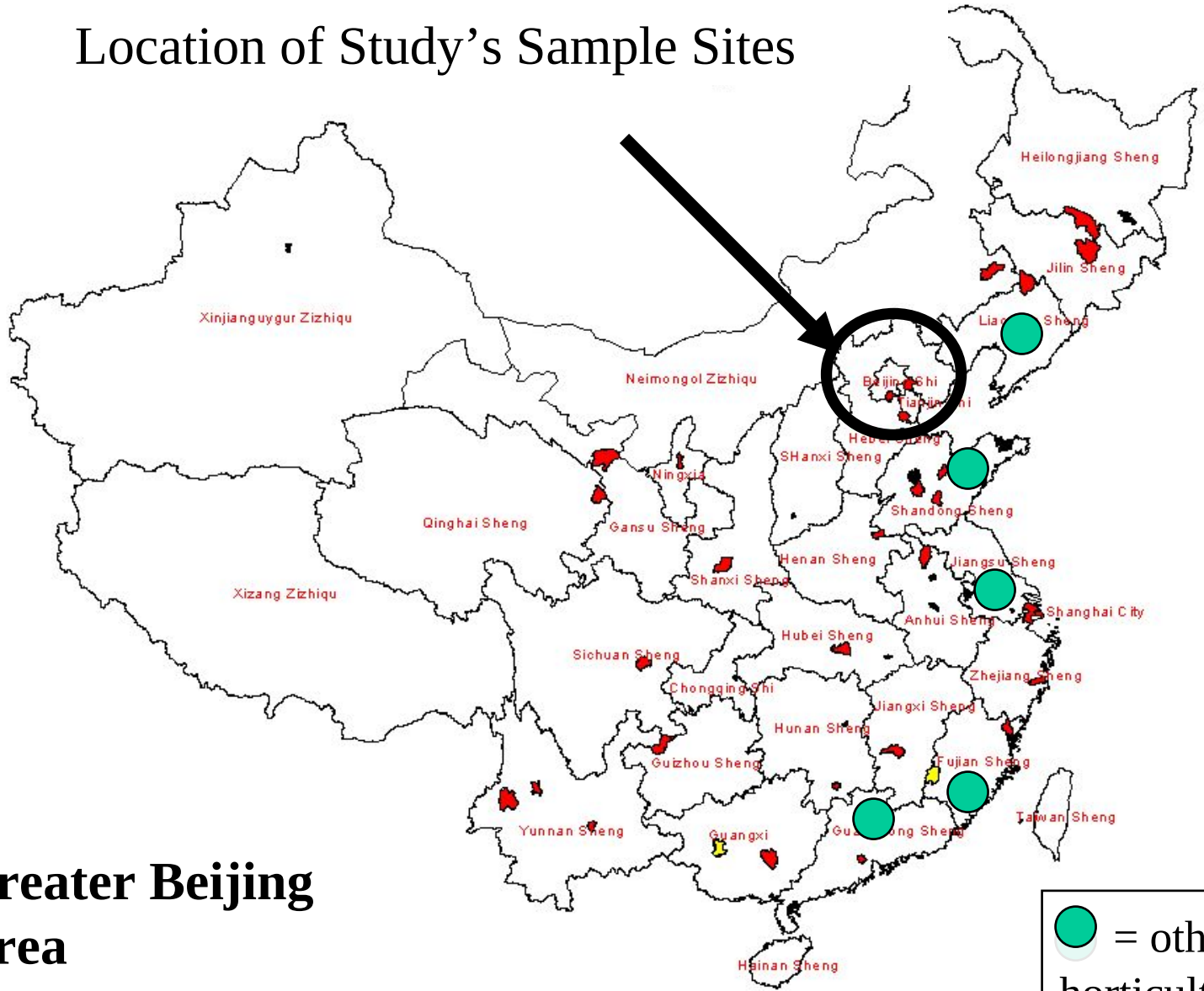
To provide some answers

- Need to get the data right

- Profile of Producers
- Profile of Traders / Truckers
- Role of the Government

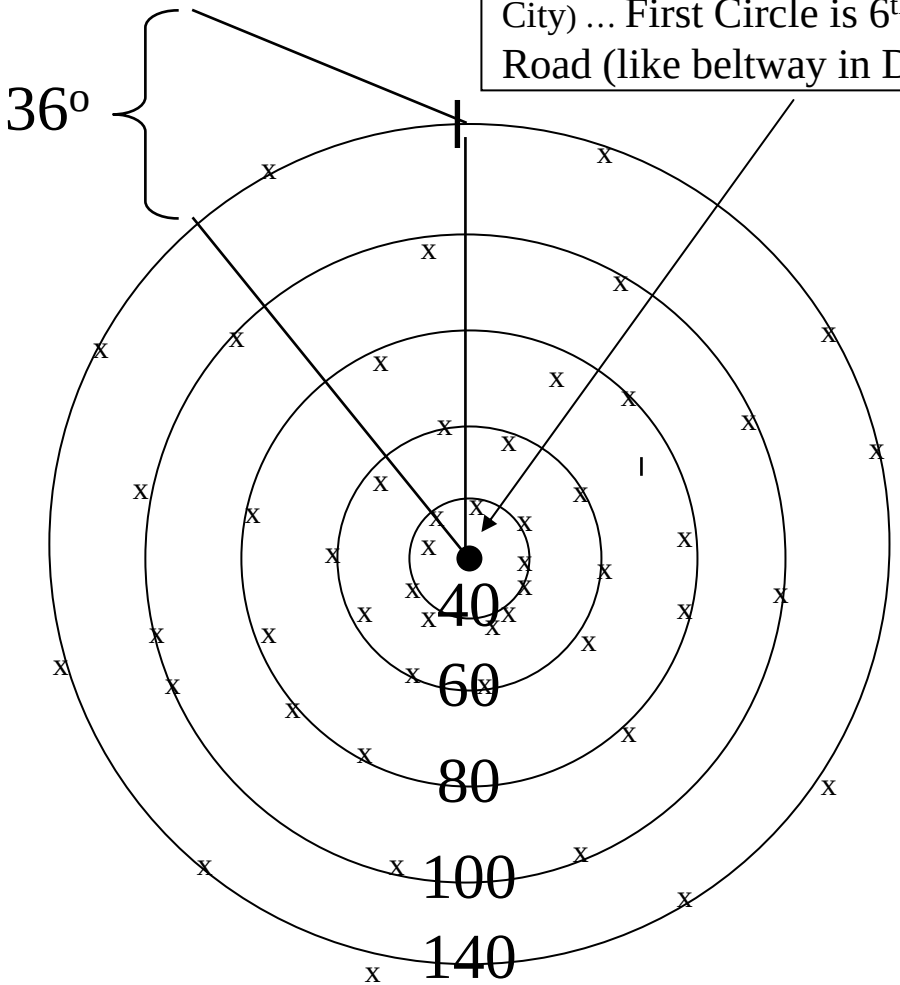
- Some FINAL thoughts on what China does right and where its weaknesses are …

Location of Study's Sample Sites



Greater Beijing Area

= other major horticulture sites



City Center … Beijing (Forbidden City) … First Circle is 6th Ring Road (like beltway in DC)

All towns, villages and farmers randomly selected … interviewed farmers / village leaders

Distance from one side of largest circle to the other is about 170 miles (from Sacramento to Fresno / Half Moon Bay to Turlock)

5 circles x

10 towns per circle x

4 villages per town =

200 villages

The Sample: Geographical Layout of Sampling Approach for China Horticulture Survey (kilometers)

The Survey

- Standard household survey PLUS:
- Horticulture growing history (2000-2004)
- Marketing channels
- Technology shifts

[interested in understanding are marketing channel shifts leading to technological change?]

The typical fruit growing household in China, 2005

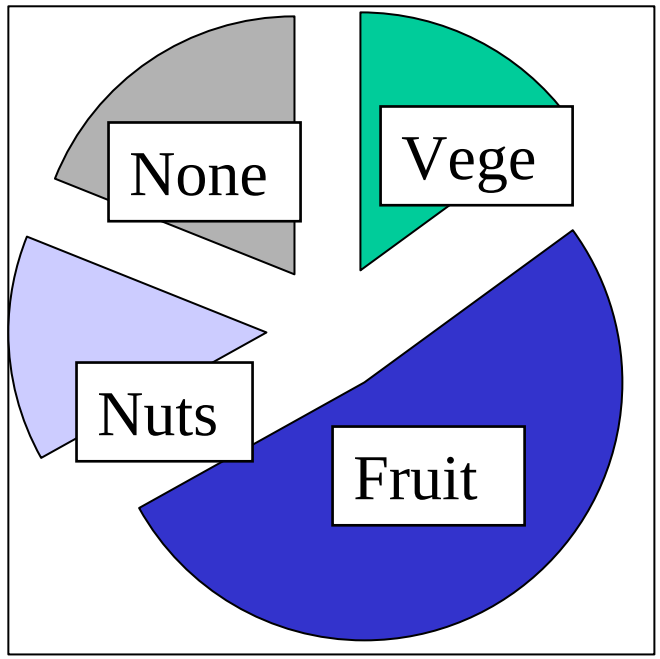
Household characteristics		
HH size	(person)	4.4
Age of HH head	(year)	42 (male)
Education and training		
Education of HH head	(year)	7
Share of HH head with ag extension training	(%)	50
Off-farm job	(%)	
Share of HH head who has off-farm jobs (in factory)	(%)	20
Share of household head who has off-farm jobs (self employed)	(%)	25
Assets: Farm equipment	(US$)	402
Housing	(US$)	7882

The typical fruit growing farm in China, 2005

Farm Characteristic		
Farm size	(acre)	1 acre
Distinct Plots	(number)	5 plots
Number of crops (diversification)	(number)	3 crops
Ownership and Control		
Contracted from “collective”	(%)	96
Rented from other farmer	(%)	4
Share of area decided by farmer	(%)	94.2
Labor		
Own Labor Days / Acre	(mandays)	312
Hired Day / Acre	(mandays)	42
Wage	(US$/day)	3.2

Distribution of Fruit, Nuts and Vegetables in greater Beijing area

- More than 80 percent of sample area villages have households that specialize in horticulture crops
  - Fruit 52%
  - Nuts 14%
  - Vegetables 15%
  - None 19%



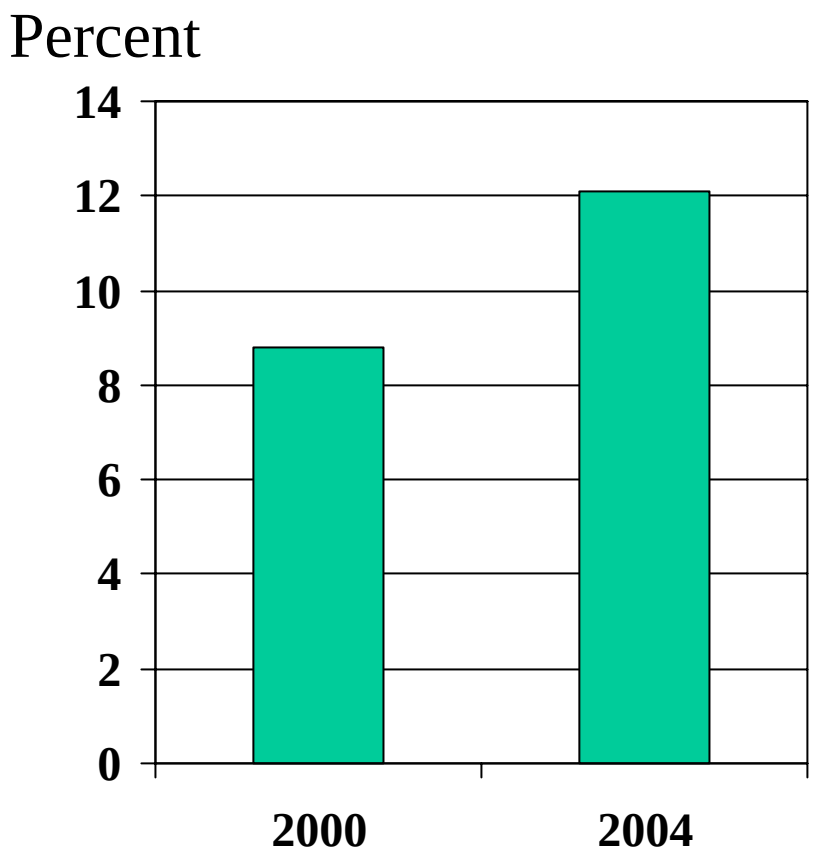
Most commonly observed crops

Crop	Number out of 200 villages	Crop	Number out of 200 villages
Grapes	13	Watermelon	8
Peaches	13	Bell peppers	7
Apricots*	11/8	Tomatoes	6
Apples	10	Pears	6
Persimmons	10	Strawberry	3
Chestnuts	9	Cherries	3
Walnuts	8	Cucumbers	3

120 / 163 (75%)

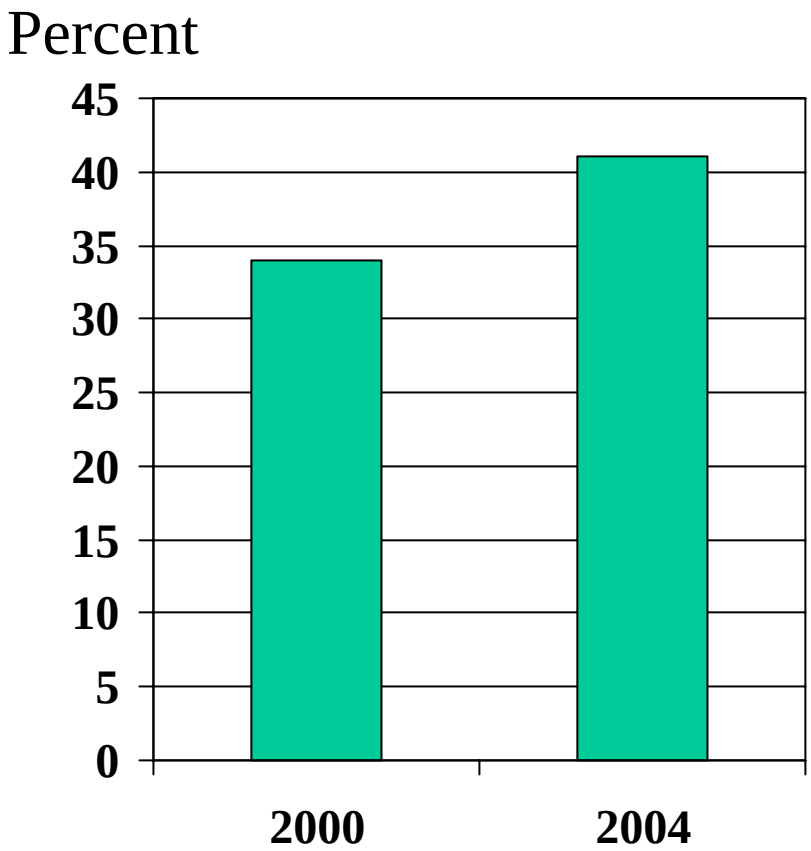
Rise over time – Vegetables (greater Beijing area)

- Share of “cultivated area” (not including orchard area) sown to vegetable crops
- About 1/3 of this area is in greenhouses …
- Data source: authors’ survey data



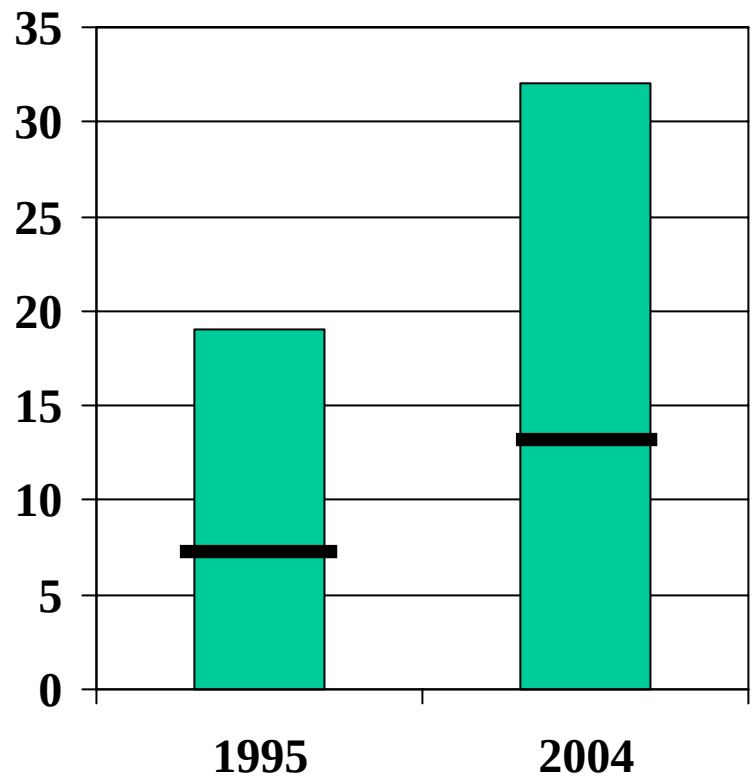
Rise over time – Fruit (greater Beijing area)

- Share of “cultivated area” plus “orchard area” planted to fruit orchards
- Does *not* include nuts
- Data source: authors’ survey data



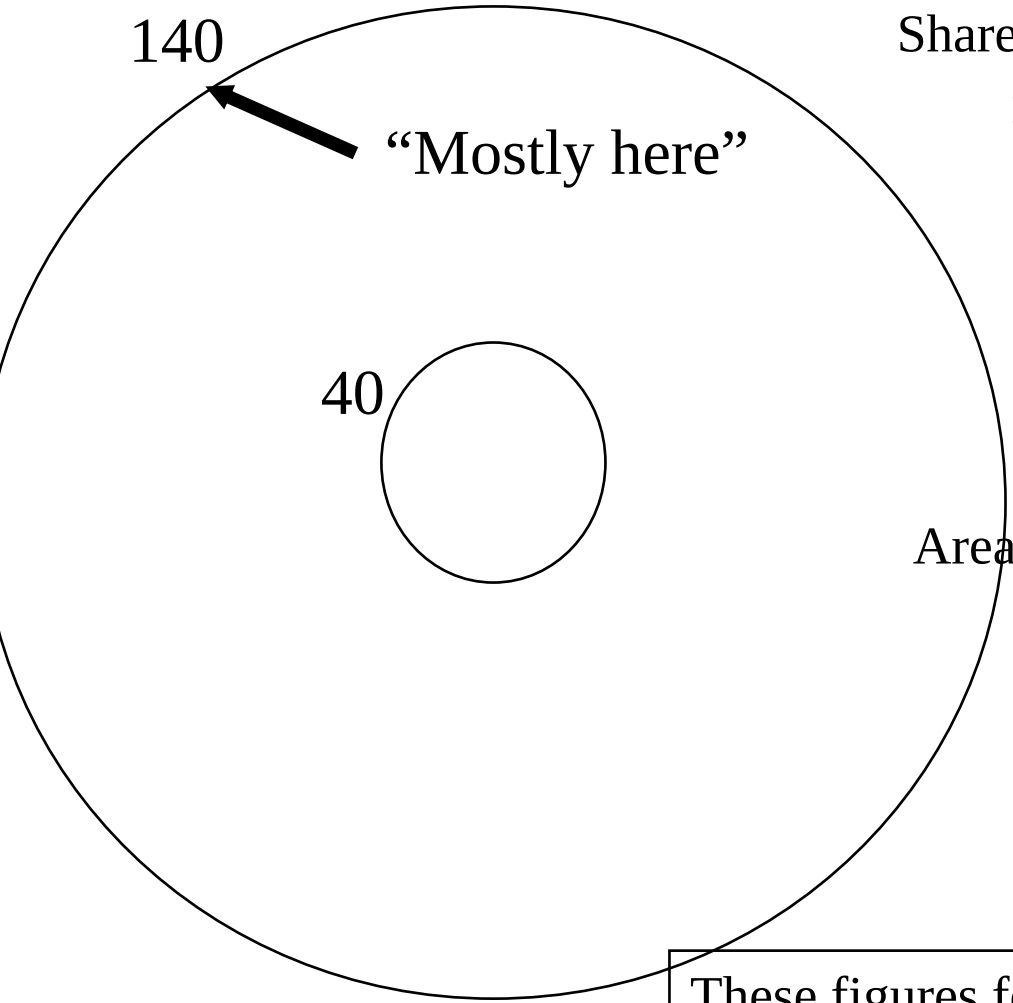
Rise of specialization (entire nation)

- In a recent survey of 650 communities in China, we asked the leaders:
  - Do farmers in your village specialize in the production of a field crop, tree crop or livestock commodity?

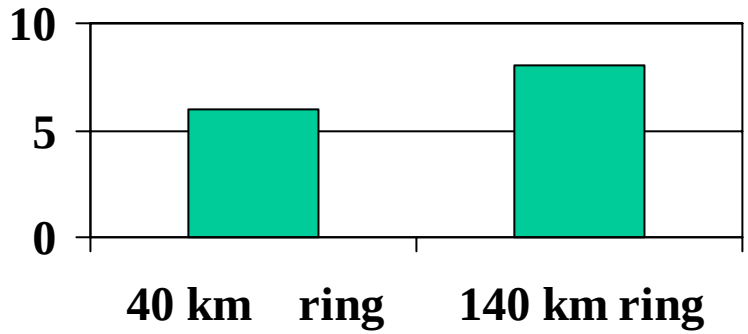


Data source: China National Rural Economy Survey (CCAP)

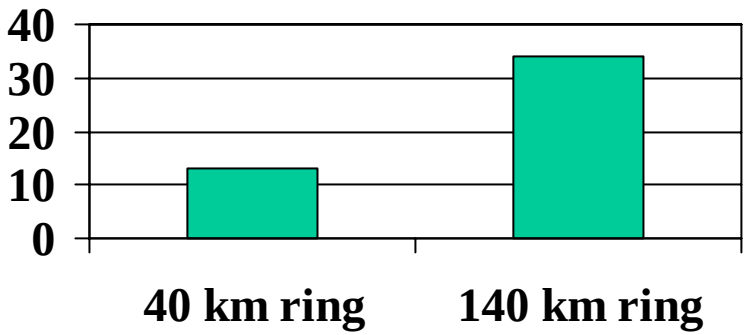
Where are they being grown?
Inside Ring / Outside Ring



Share of Cultivate Area



Area / Village (acres)



These figures for vegetables in 2000 / same for F&N's

Who are growing them? Rich or Poor?

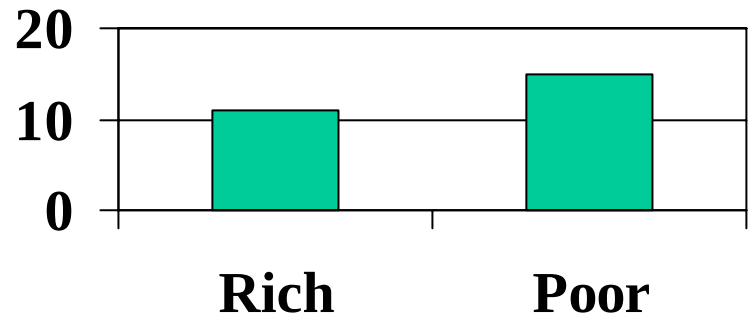
- Per capita income:

"Rich" -- $7.28/day

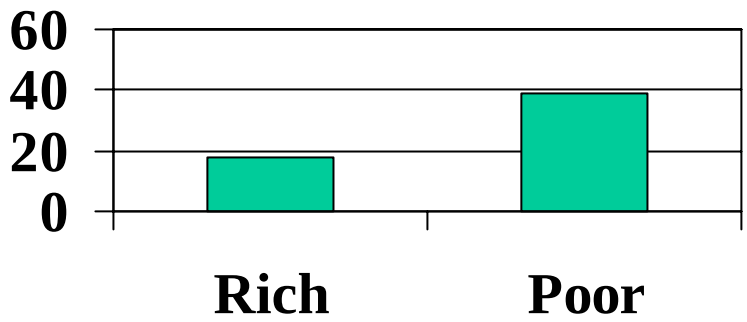
Poor -- $1.25/day

"They do"

Share of Cultivate Area



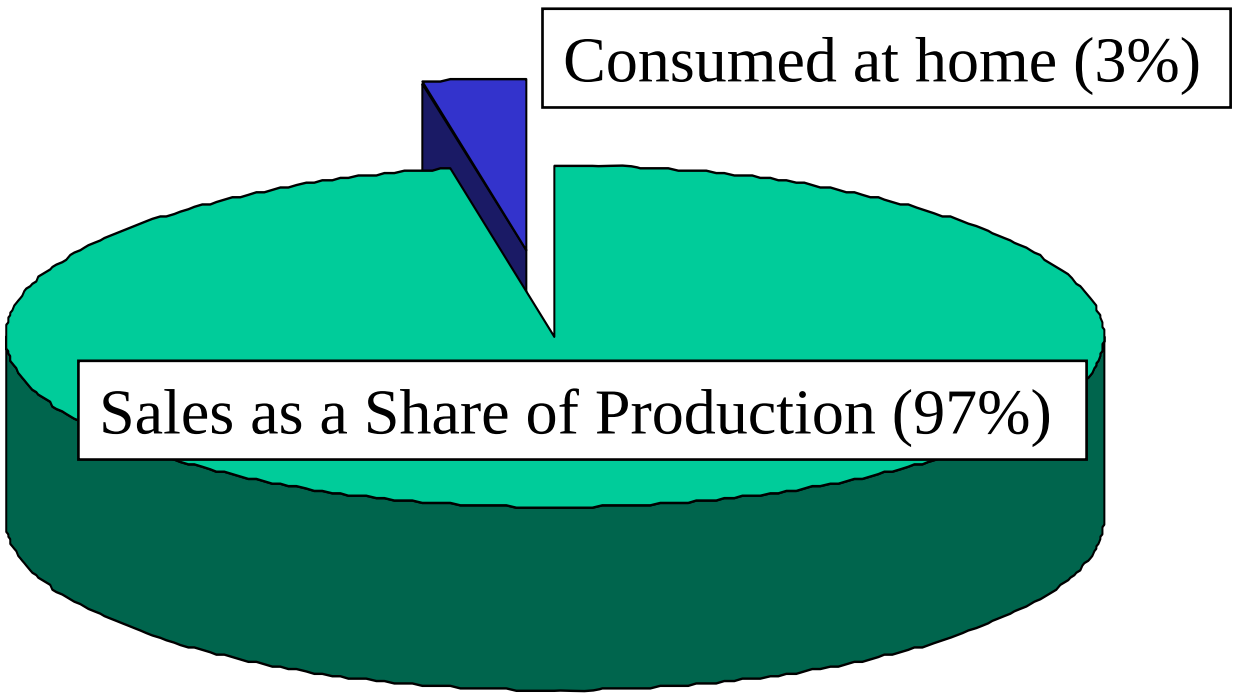
Area / Village (acres)



Fruits / Nuts / Vegetables are being increasing grown by poor farmers in relatively remotes communities!

These figures for vegetables in 2000/ same for F&N's

Degree of Commercialization of Fruit, Nut and Vegetable Farmers in Greater Beijing Area, 2004



Data Source: authors' survey

The Buying Landscape: Who might be out procuring the crop?

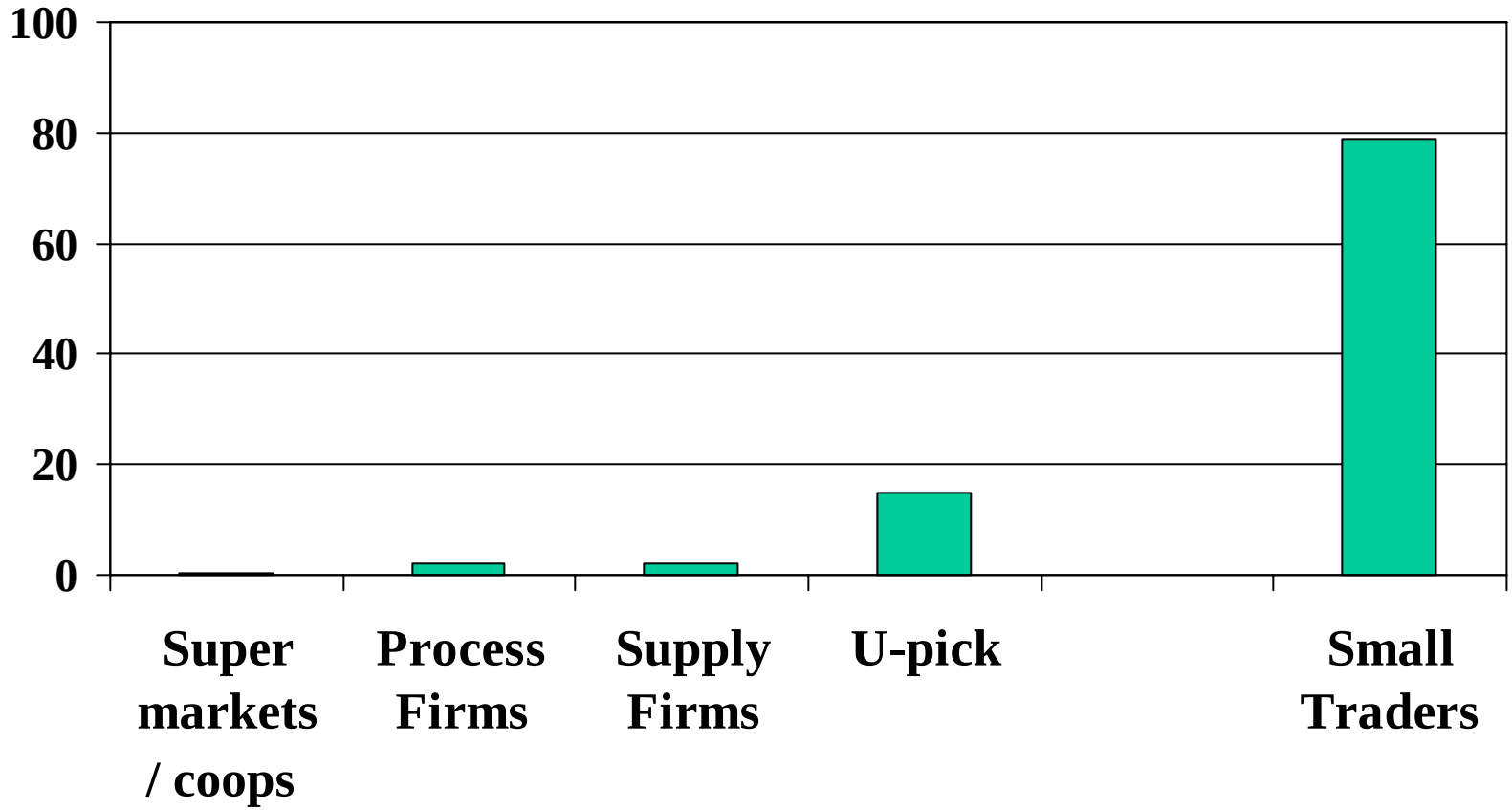
- Supermarkets / Coops
- Processing Firms (e.g., apple juice crushers)
- Professional Supply Firms (on contract to exporters /supermarkets / hotels / restaurants)
- Consumers ("u pick 'em" / bought by companies for distribution to their employees)

- Small traders

  [2 to 6 people working together / No warehouse; no office; no license; often no transport / Pay cash on the spot / From Henan; Hubei; Anhui / Poor (will work for $2-3/day)]

Small Trader-dominated System (2004)

Percent of all purchases

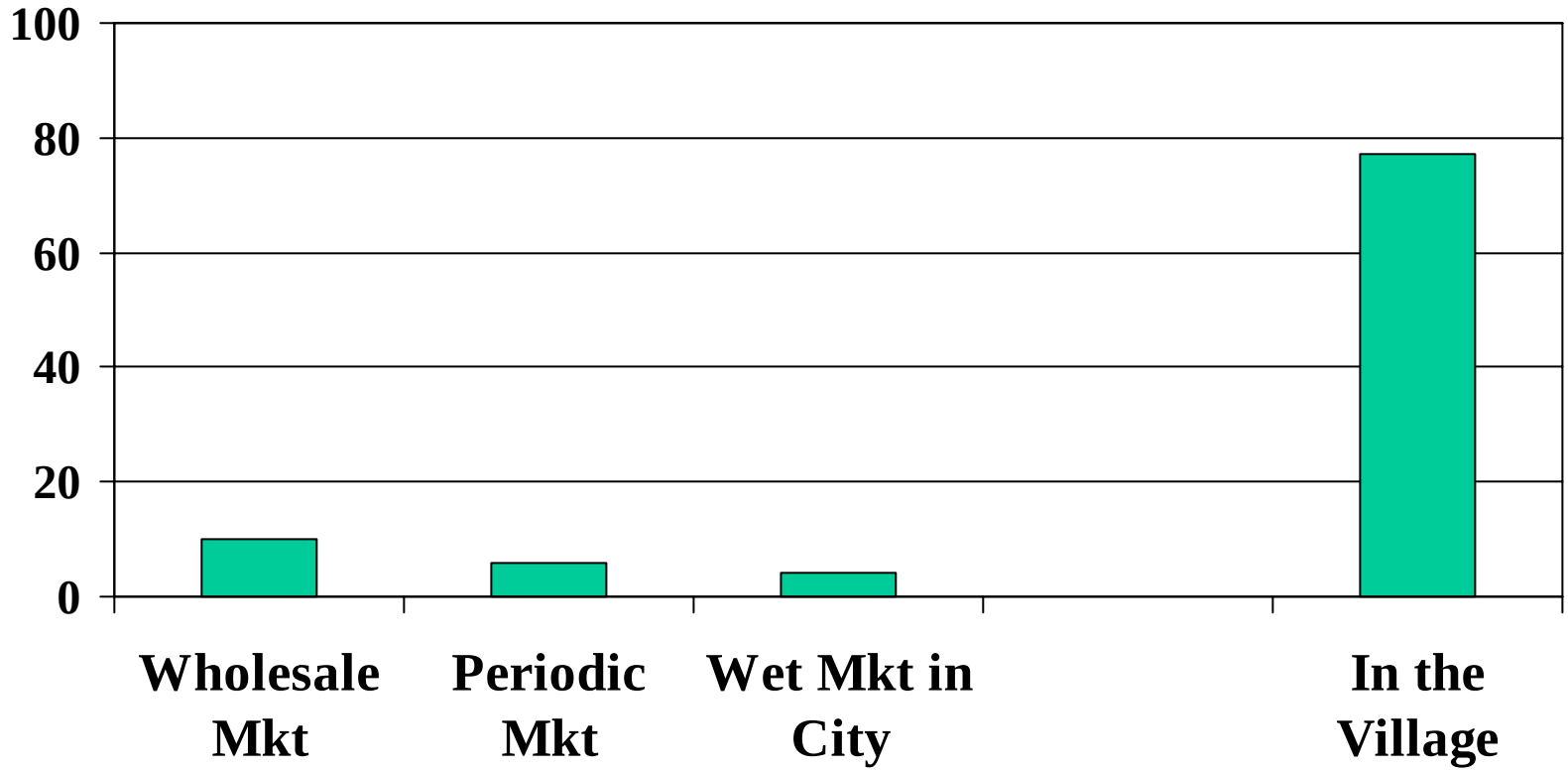


Note; -- Supermarkets did not procure in any villages (ZERO)

-- Zero procured by coop

“In-home Service” (2004)

Percent of all purchases

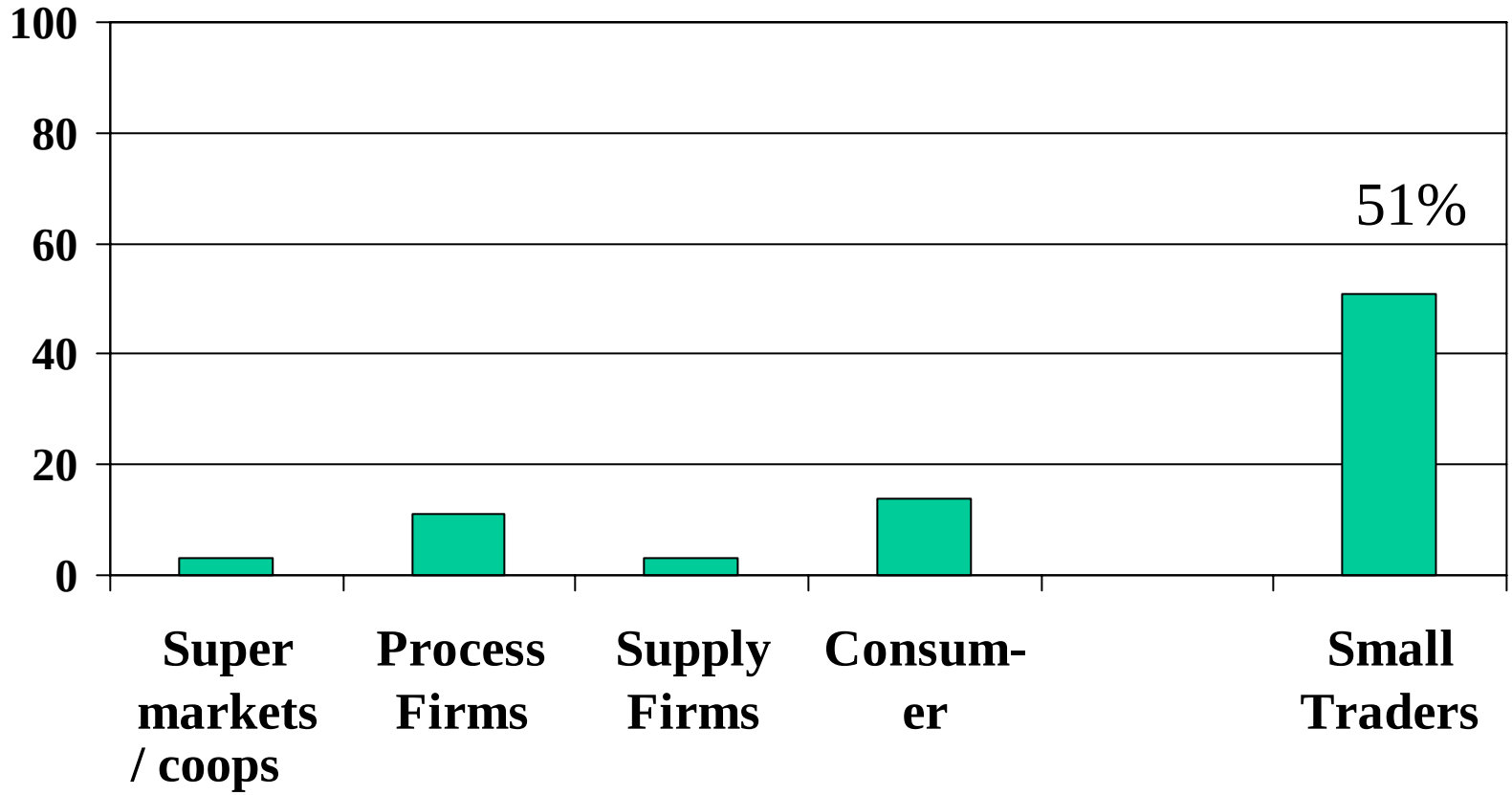


Note; -- “In the village” = Off the tree + From Home + Road-side

-- Share sold in wet markets in cities down over time

Second Buyer in the Wholesale Chain Still Small Trader-dominated (2004)

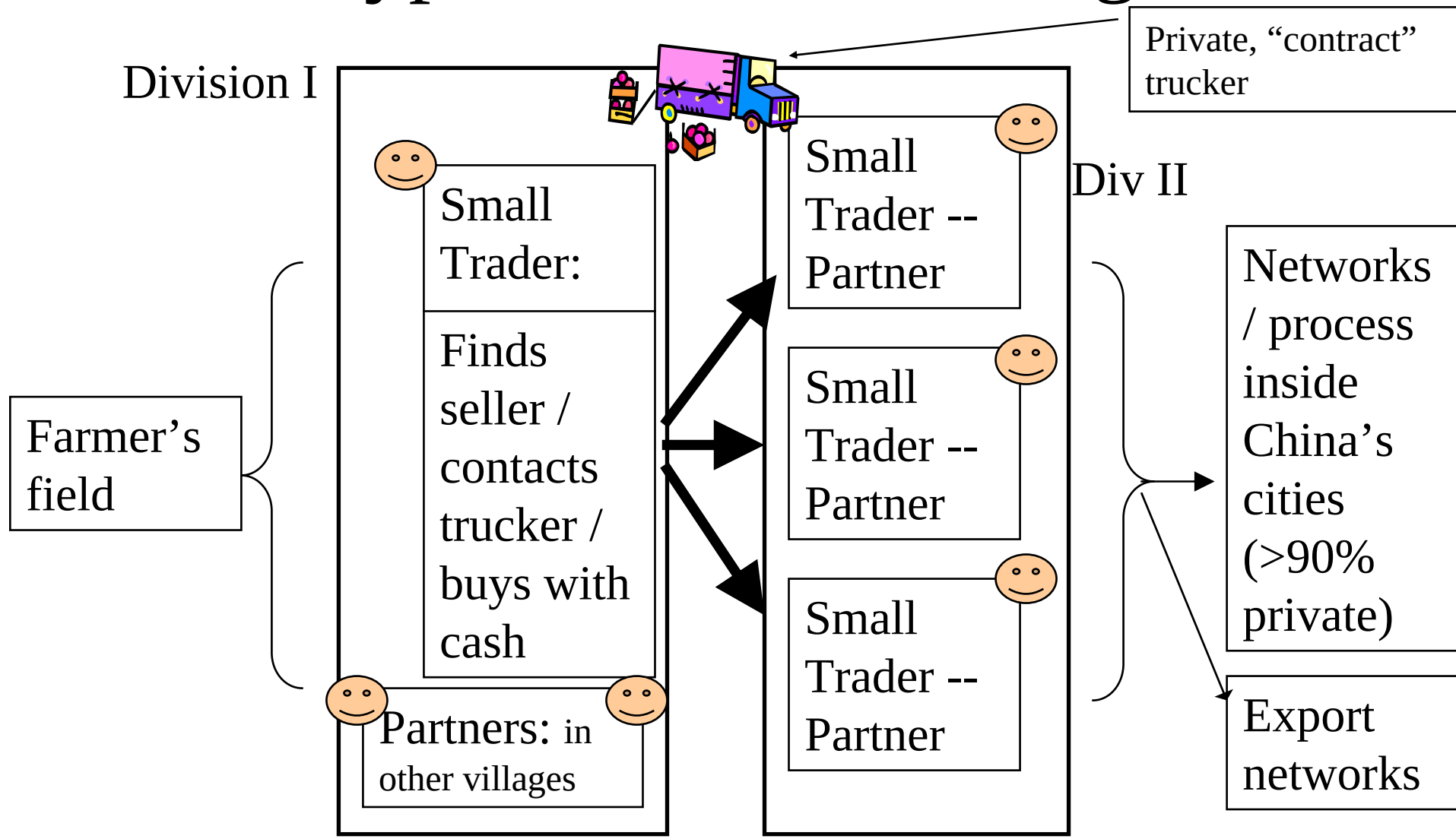
Percent of all purchases



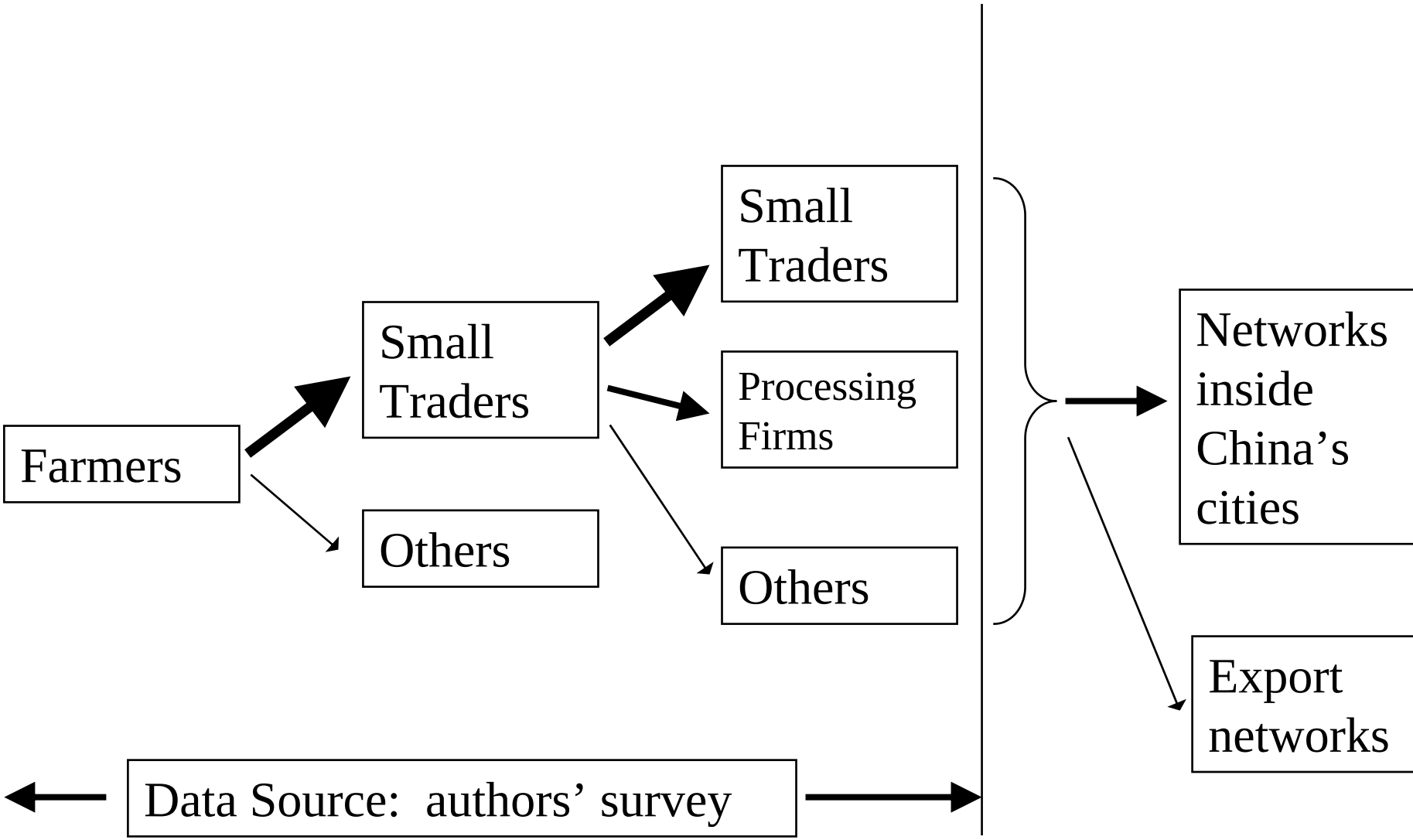
Note; -- Supermarkets only directly involved in 3% of “second trades”

-- Share sold to processing firms rising over time

Profile: Typical 6-man Trading "Firm"



First 2 links of the FN&V marketing chain



Summary: Participants in China's Fruit, Nut and Vegetable Markets

Farmer	Private 97% own decisions	$2/day
Small Trader	Private	$3/day
Trucker	Private	$2.5/day
Second buyer	>90% private [of 75% of respondents that responded]	

Export business?

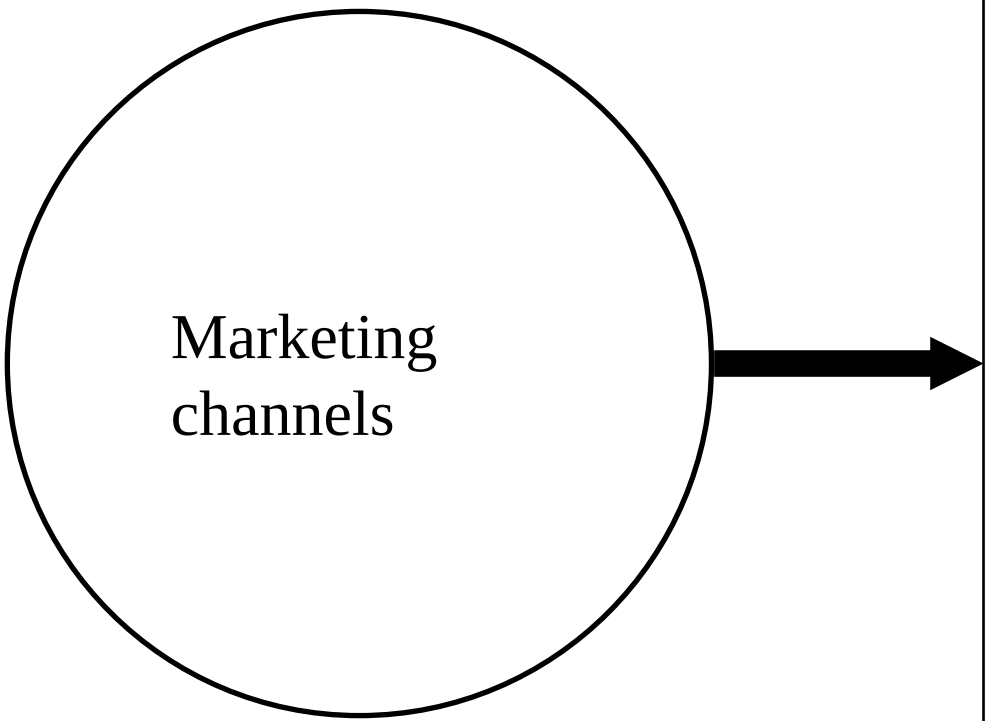
Potential Influence of Government

- On-farm (nearly unregulated: projects / low-interest rate loans / extension – very little … especially recently)
- Trading (nearly unregulated: pay fee for stall space in city-run markets / FN&V are untaxed)
- Trucking (nearly unregulated: one-time (high) fees and taxes … gasoline bought at US-like market rates)

- Processing (research needed: certainly some firms have subsidized loans and government grants / access to cheap land … but, not much in most industries [exceptions: e.g., tomato paste])
- Export (research needed: few, if any, rebates / government may run export information center / low interest loans for exporters—don't know)

- *The case of apples, in particular (research needed!)*

Are Marketing Channels Leading Shifts in Technology in China?



Farmer's choice of technology:

- Variety (thru market signals)
- Picking/packing (not much)
- Pesticide application (technique / type / timing)
- Fertilizer application (technique / type / timing)

NO!

Why not?

- Extent of formal contracting: Almost ZERO

- When asked farmers if traders / procurement agents were able to dictate their application of fertilizers and pesticides, the most common answer was:

  - A laugh / a pause (as if they did not understand the question) … and then: “of course not … how could they?”
  - Main reason? almost certainly a big reason is that contracting costs are too high / the monitoring and coordination effort of doing so for millions of farmers with 1/2 acre orchards are almost inconceivable

Implications?

- Small farmers / small traders
  - Market signals pass directly to farmers (fast)
  - Unable to implement or enforce standards
  - Without cooperatives … but, with rise of supermarkets (and higher demand by the consumer / exporter) … there may be a break down …
- Key question: will China respond? If not, there is huge opportunity in China's markets (evenn inside China, domestically … and in export markets)

Conclusions

- US is due for tough competition for many crops …
- Competition: first, in third markets (Japan; Hong Kong; Korea; Taiwan) … later, directly in US (?)
- Extent of competition will depend on:

  -- rate of improvement of quality and marketing (but this is improving fast!)

  -- growth of China's domestic demand

  -- how US and other competitors or collaborators perform

What can US producers do?

- Strategy ONE: "Ignore what is going on"

  [but can only adopt this strategy if buy into 1 or more of several assumptions]

China is not a threat

-- today's presentation should be evidence this is not so

on its own, China is developing VERY FAST … but there is time

-- China also has several important regulatory advantages (but US has other advantages)

China will implode:

-- there are severe water problems

-- infrastructure is so poor, can not compete

What can US do?

- Strategy TWO: "Raise Protection"

  Because China is entering WTO as a "non-market economy," it is easy to file and win dumping cases …

  garlic

  honey

But, these are almost surely a function of the way the laws are written (mostly) … China is probably NOT dumping … in longer run, politics and WTO appeals will *probably* limit effectiveness of this strategy

What can US do?

- Strategy THREE: "Compete"

  -- Research

  -- Promote and Differentiate US's
  Products
  [Potential to work with China's supermarket]

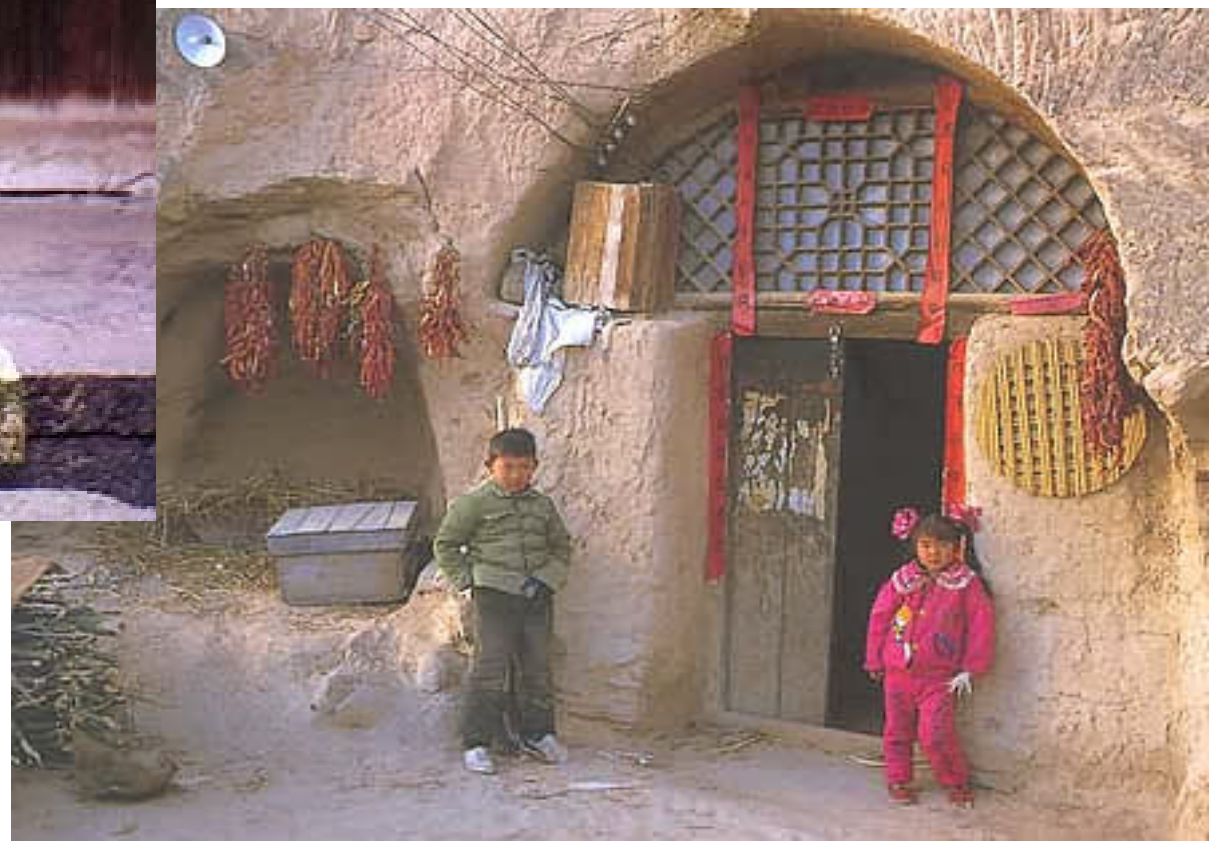
  -- Invest and Become Partners

China and the Economic Forces that are Driving the Evolution of Its Wine Economy

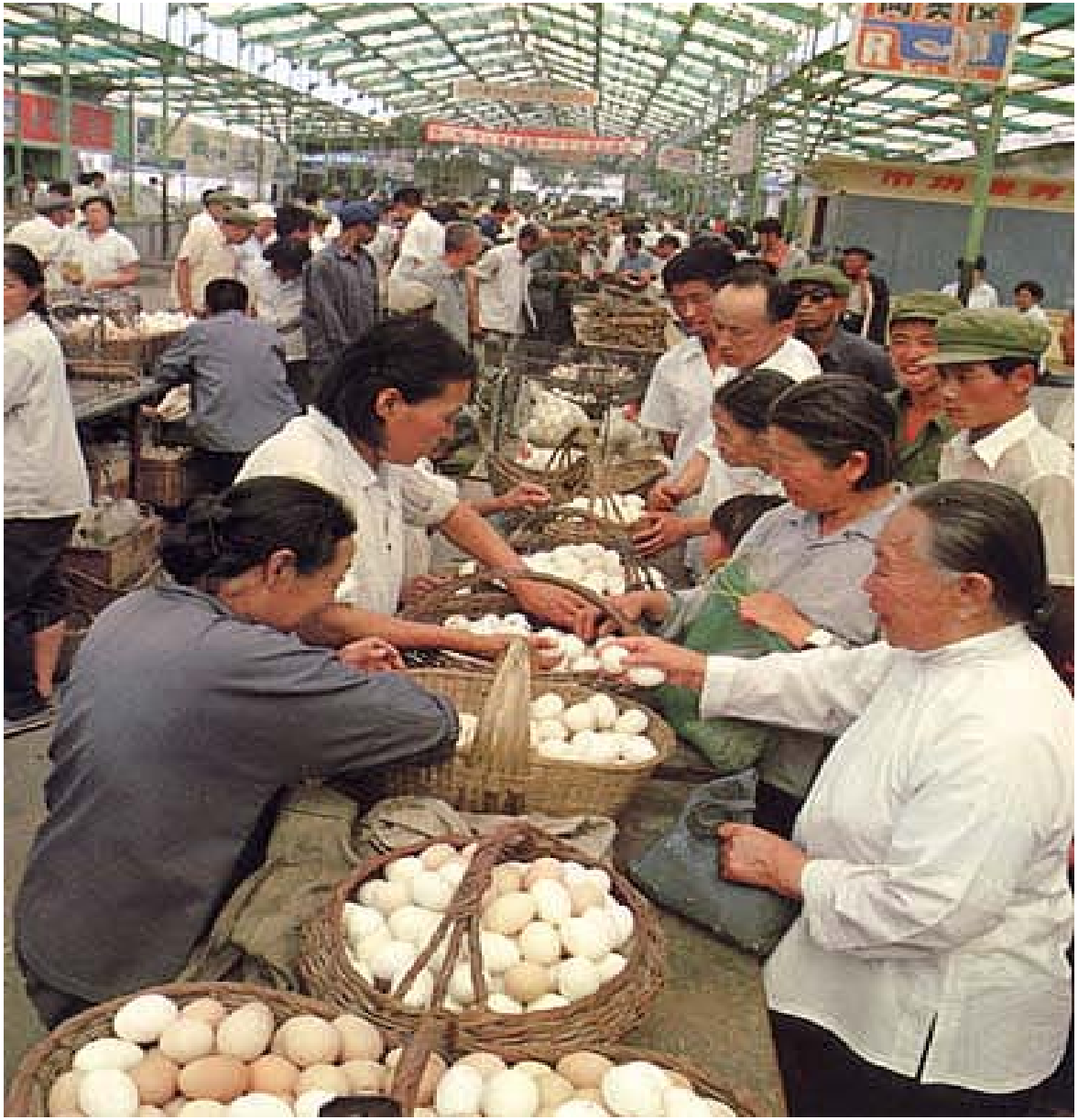
Scott Rozelle and Dan Sumner
Department of Agricultural and Resource Economics
University of California, Davis

Jikun Huang and Xiang Bi
Center for Chinese Agricultural Poicy
Chinese Academy of Sciences

Rapidly Shifting Nature of China's Food Economy … almost defies description



Marketizing



More Open

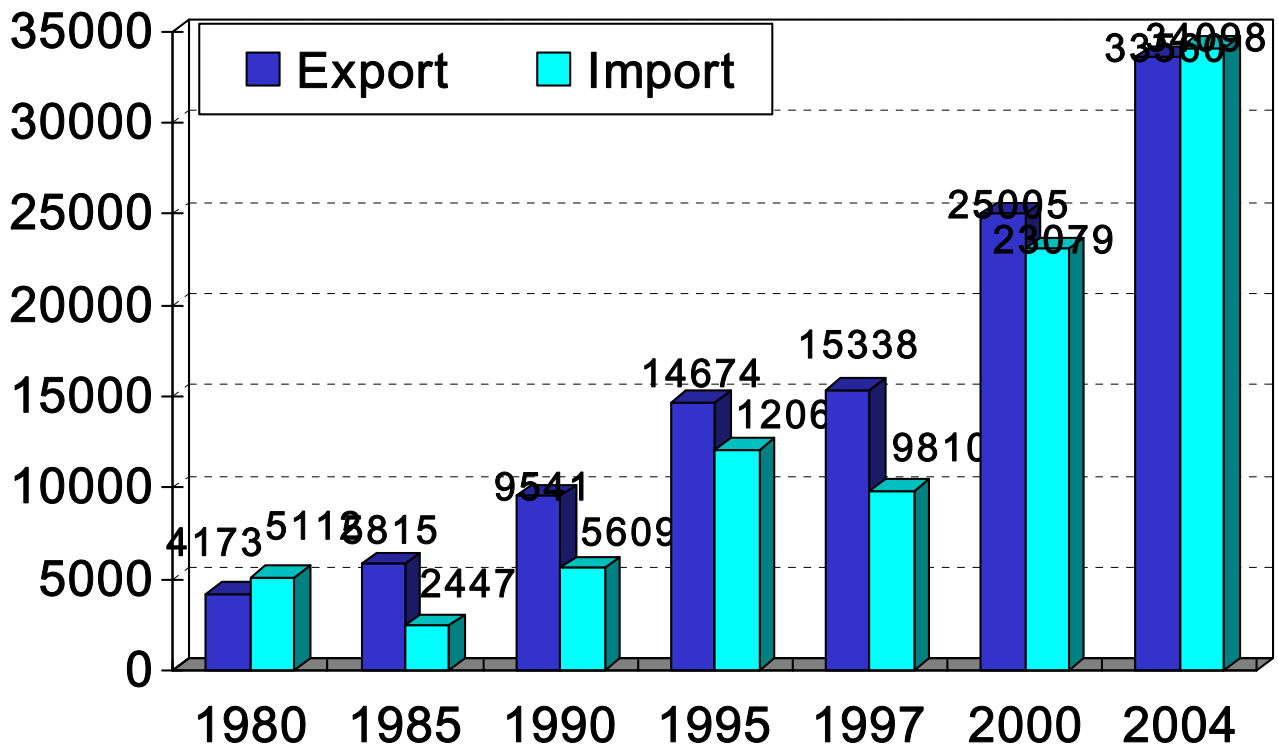
[Shenzhen in 1980 and 2000]

Industrializing

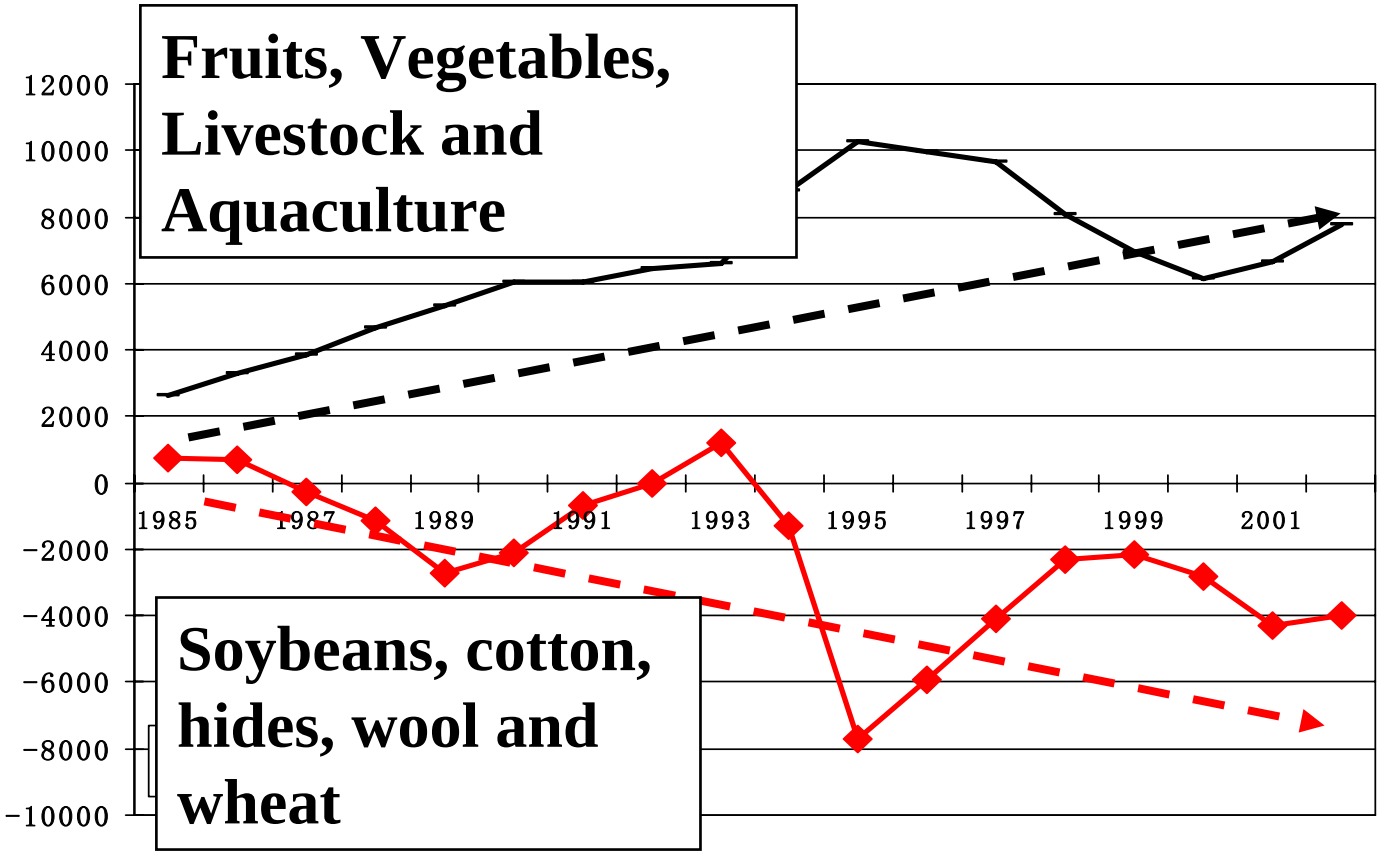
Urbanizing

Westernizing

Agricultural Trade (million US$)



International Trade



Rising EXPORTS from China

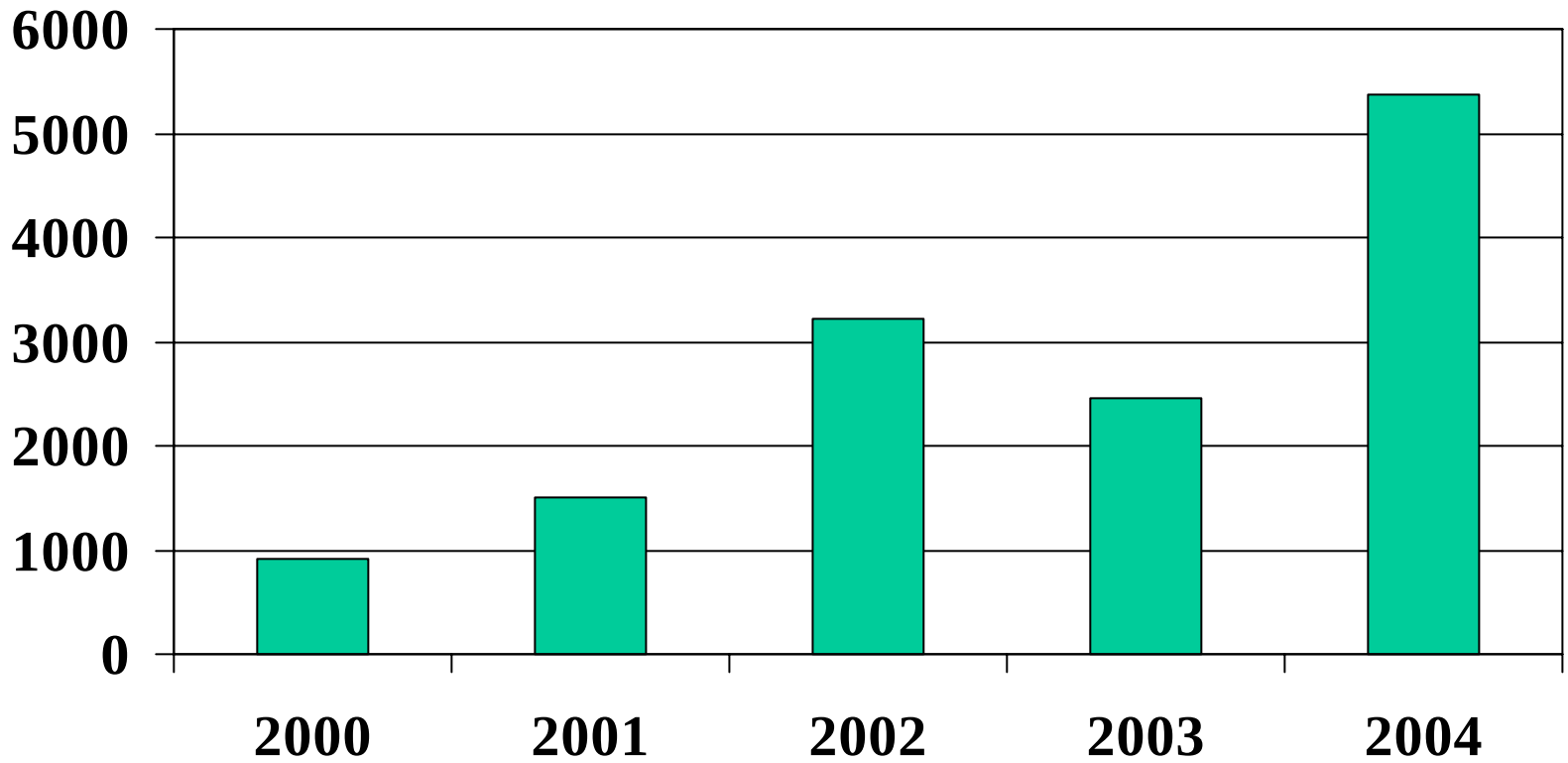
Rising IMPORTS into China

Agricultural Trade Balance by Crop Type, 1984 to 2002 (mil US$) …. So what accounts for this pattern?

What does this mean for imports of high valued, branded products, such as wine from California?

Exports of US wines (mostly California) to China, 2000 to 2004

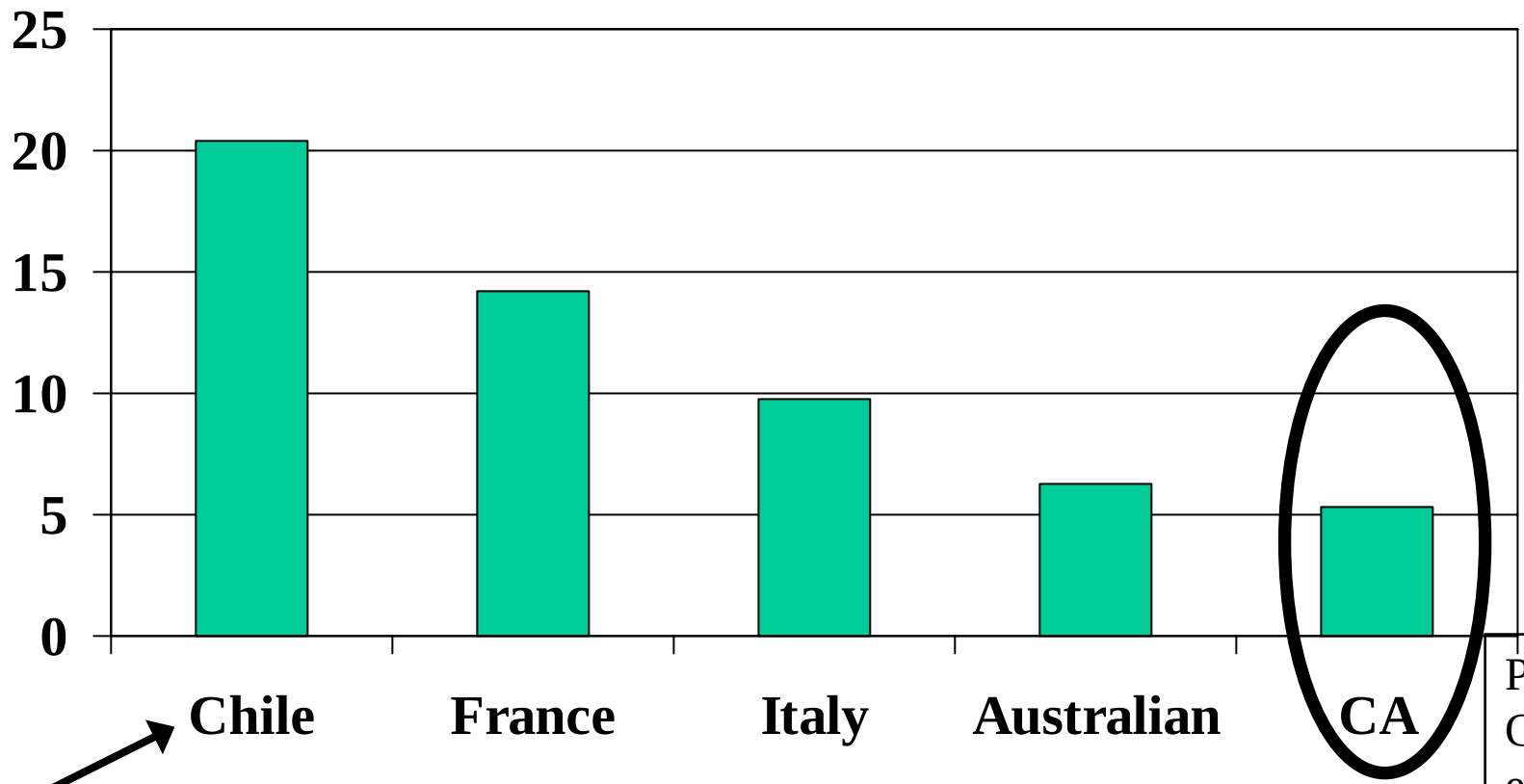
Value in Thousands US dollars



Mostly bottled … bulk wine exports actually fell

Data source: FAS trade data

Imports of foreign wines into China by country, 2004



Mostly in bulk and mixed and sold as Chinese wine

Plus, CA exports are very small

Main Questions

- What has caused rise in exports in recent years?
- What are the prospects for the future?

- Why hasn’t California wine featured more prominently in recent years?
- What can California do?

Outline of Presentation

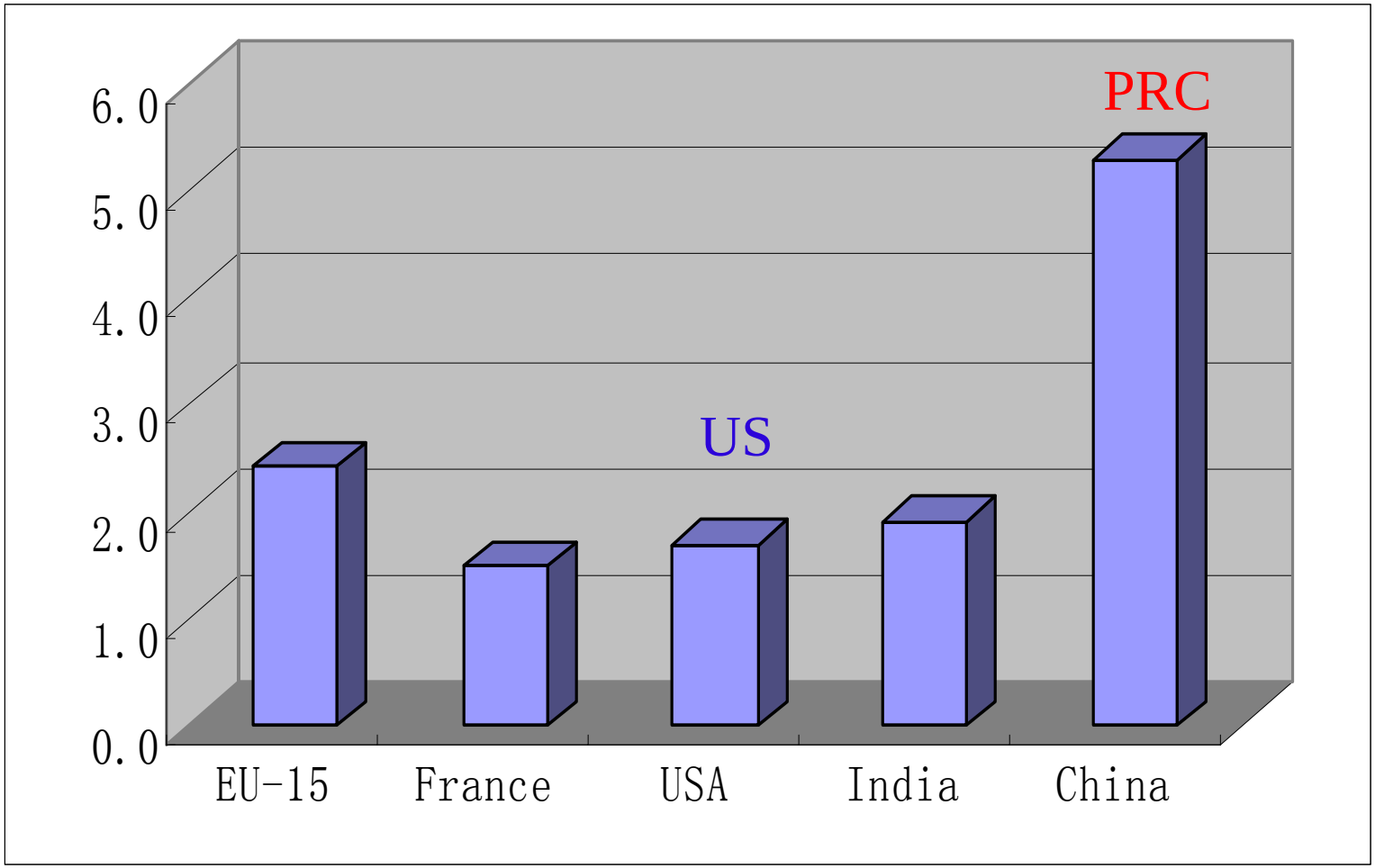
- Goal: Answer some of these questions

- Horticulture Facts:
  - Supply (bad news)
    - Competitiveness: US versus China
    - The Wine Industry
      - Changing efficiency
    - Economic Drivers
      - Food Security Policies
      - Getting the wine grapes from the vineyard to the winery (implications for future development of industry)
  - The consumer (potential good news)
    - Economic Drivers
    - California wine in China's supermarkets

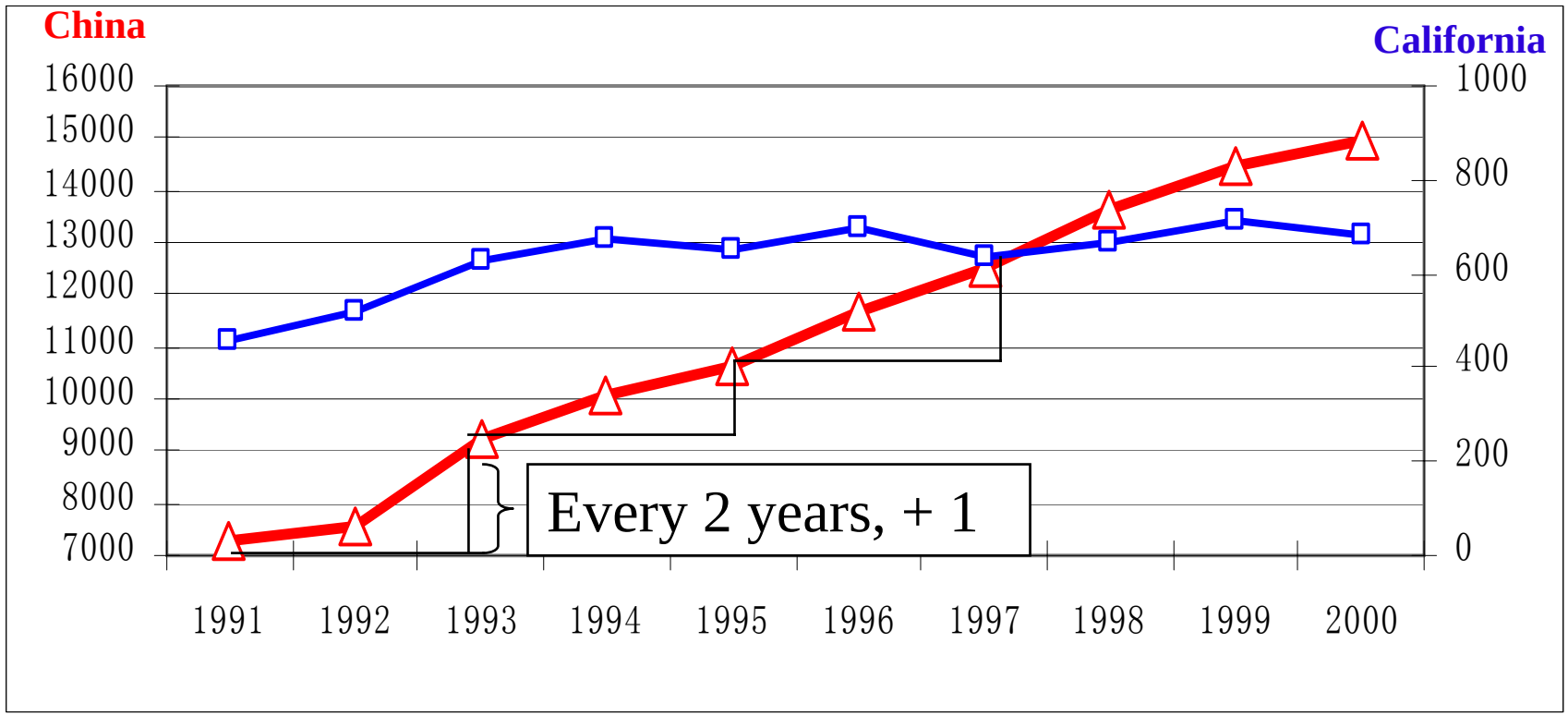
- Implications for California Wine Industry

Horticulture Facts: Supply

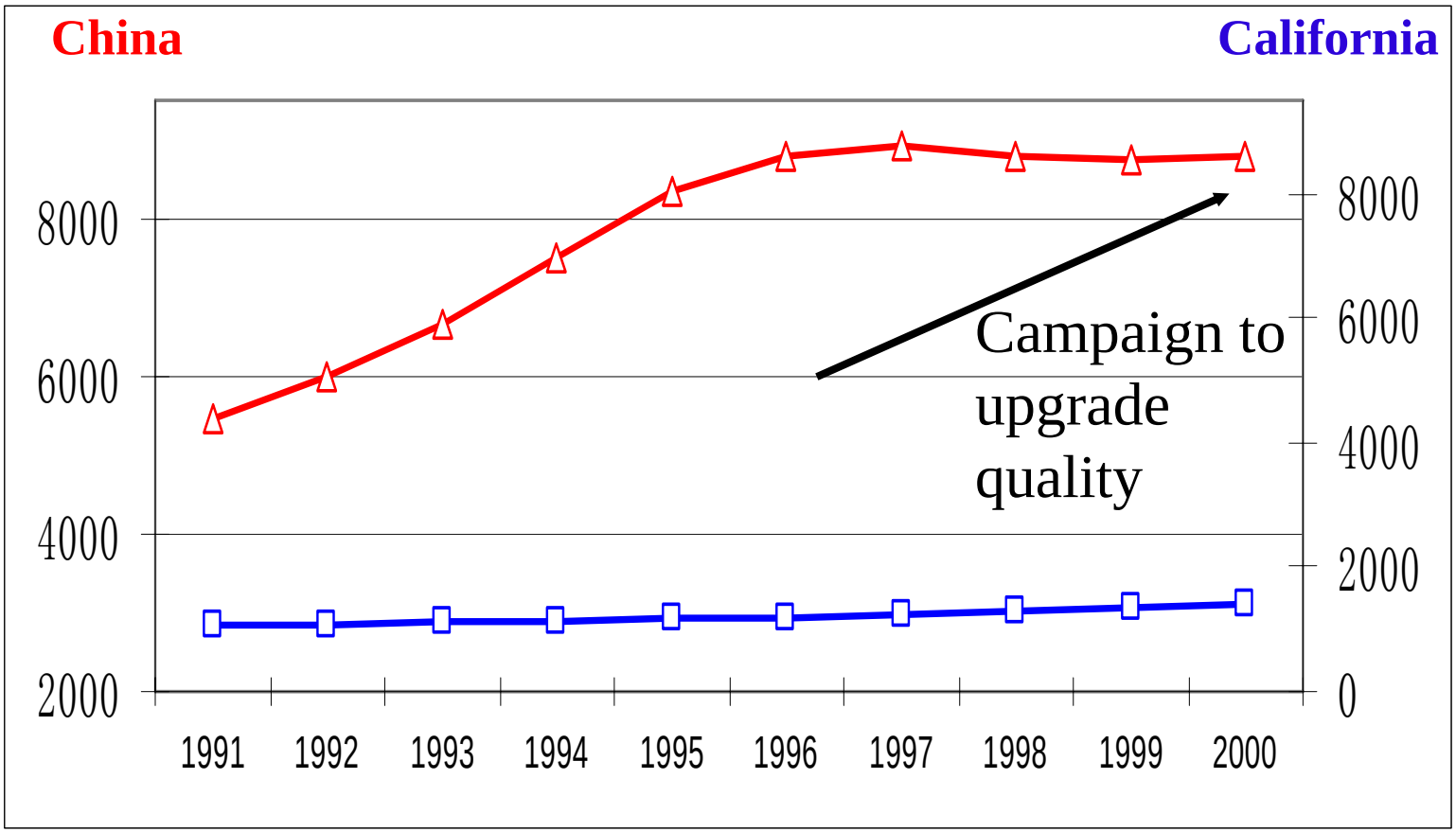
China has Higher Share of Land in Orchards and Vineyards than Most Other Countries



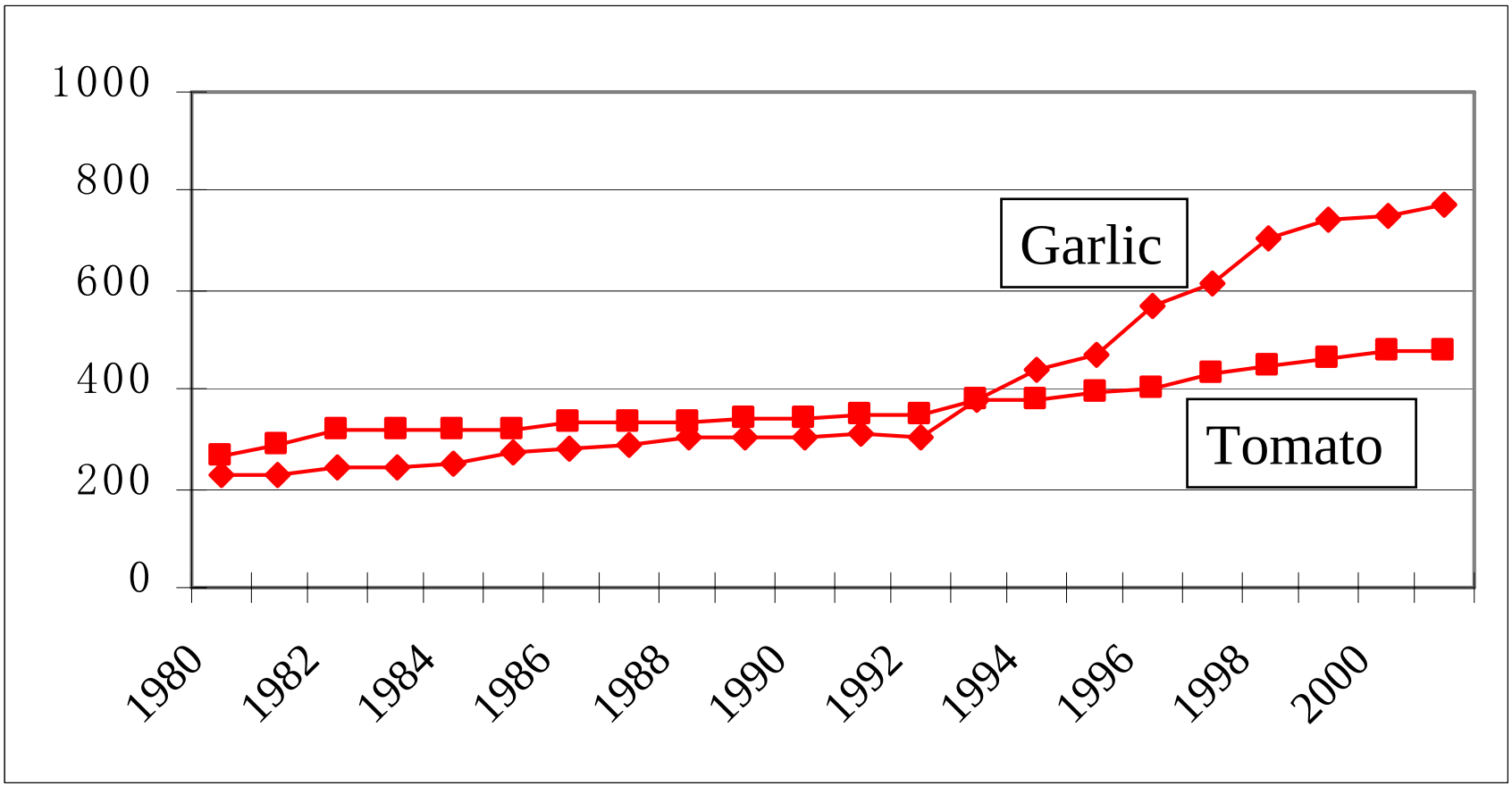
Increasing Sown Areas of Vegetables in China and California (1000 ha)



Trends of Cultivated Areas of Fruits and Nuts in China and California (1000 ha)



Tomatoes and Garlic – China Area Trends, 1985-00 (1000 ha)



Walnut and Peaches --

China Area Trends, 1985-00 (1000 ha)

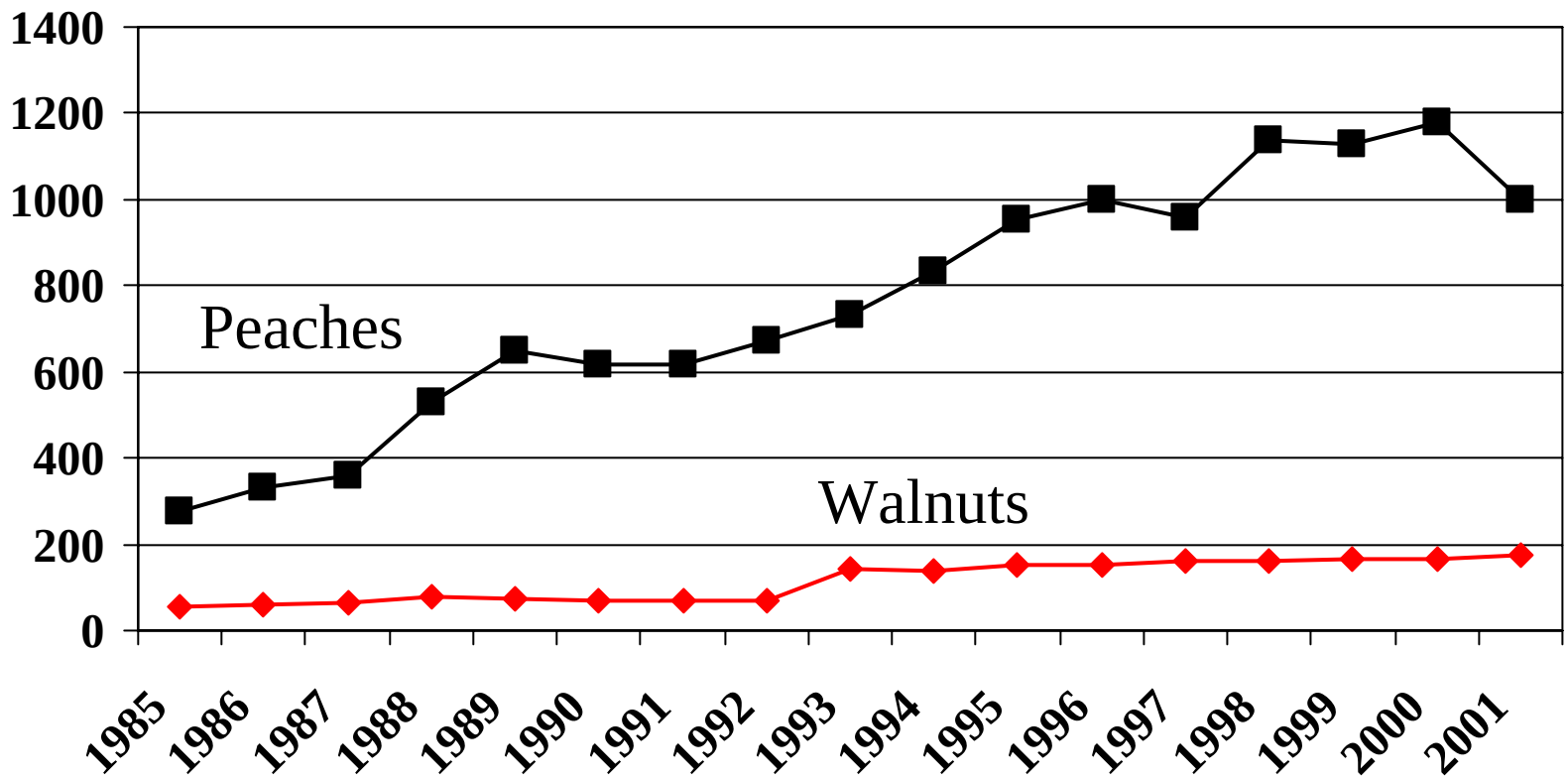
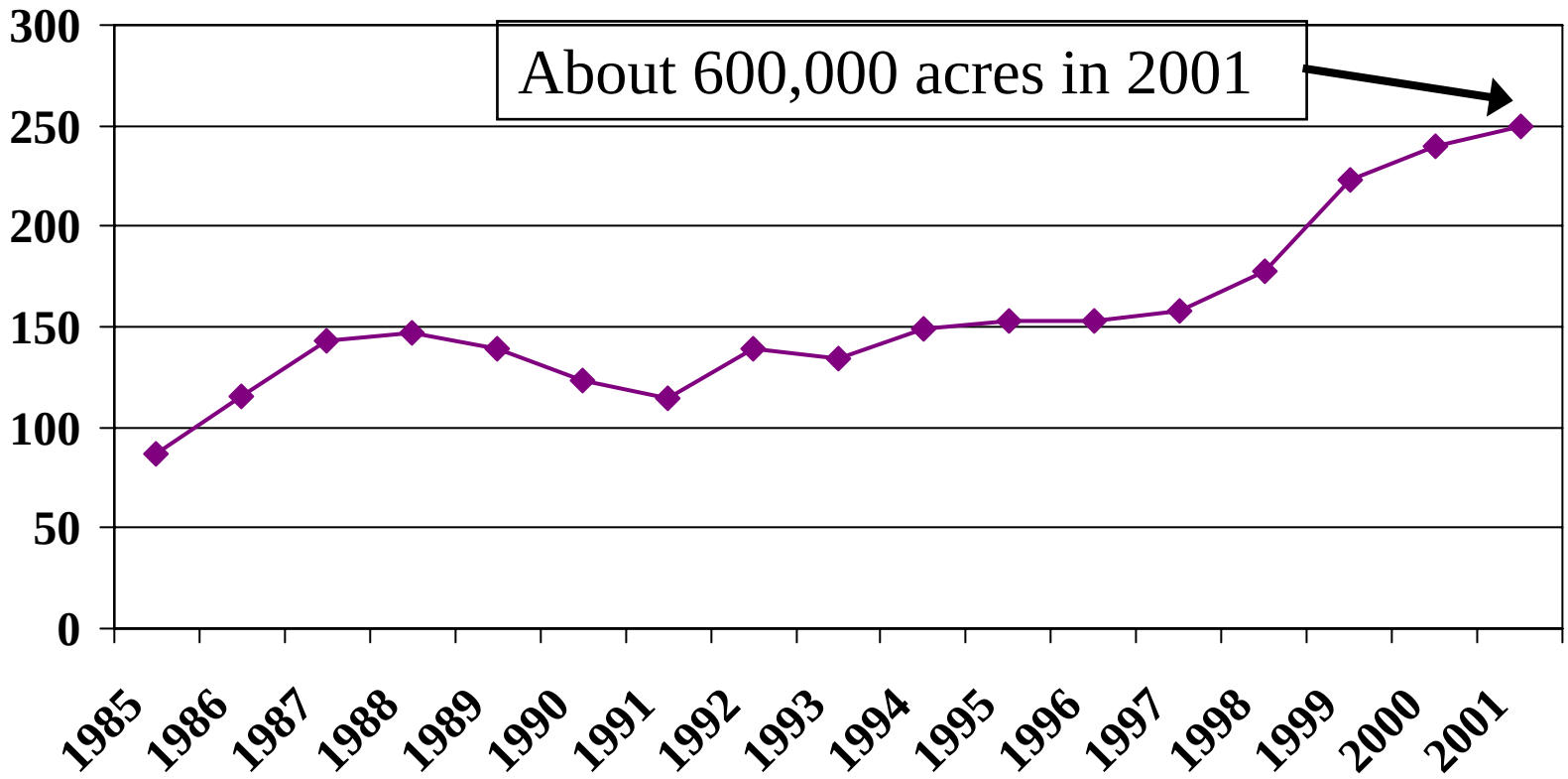


Table and Wine Grapes --

China Area Trends, 1985-00 (1000 ha)



Relative Competitiveness: China versus US/California

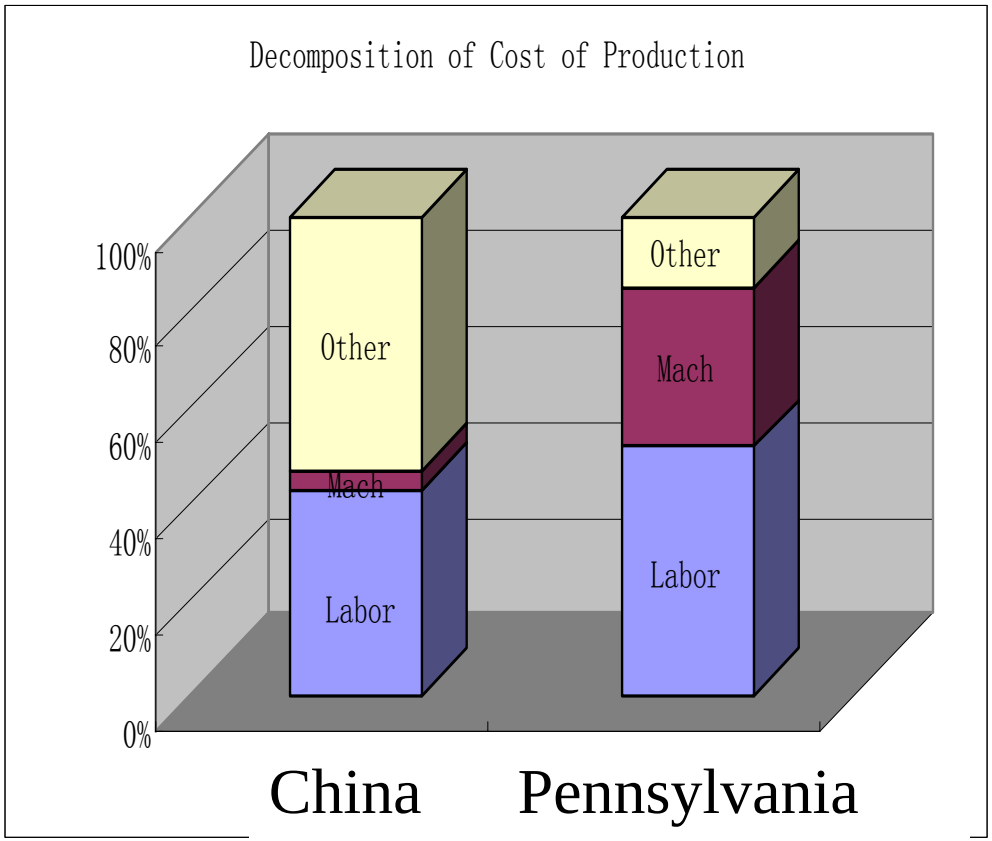
- Comparing the Level of Cost of Production of Major Agricultural Commodities in China and US/CA

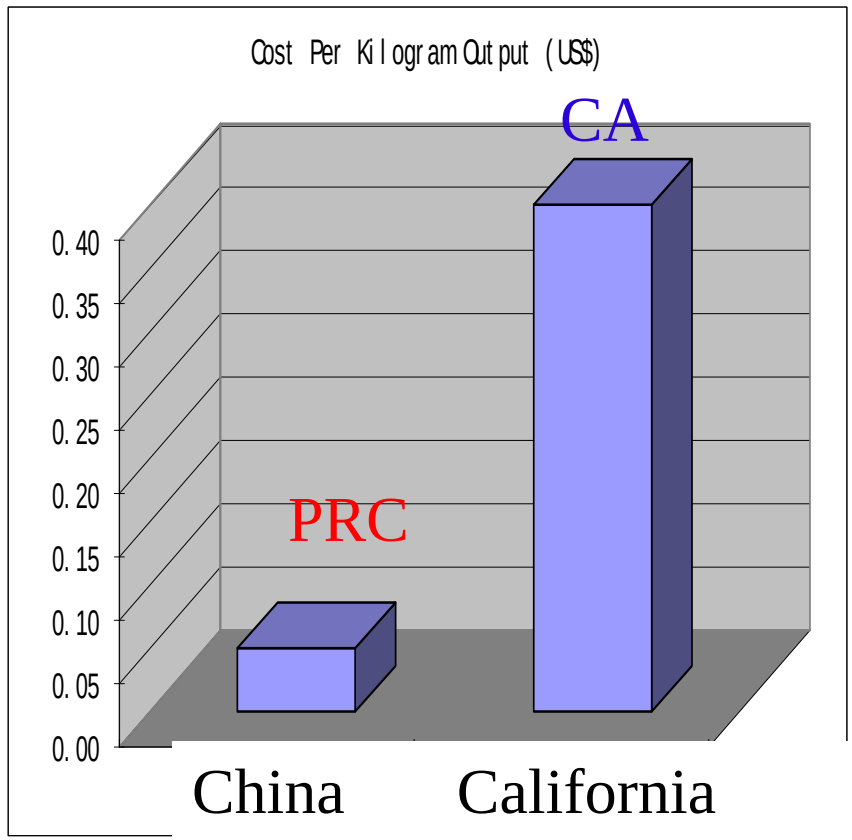
Cost of Production of *Fresh Tomatoes* in China & CA, 2000 ($1=8.3 RMB)

Costs	China	CA
Seeds	119	245
Fertilizer	502	210
Chemicals	284	326
Irrigation	72	304
Machinery Costs	44	3983
Labor Costs	1186	6254
Overhead & Management	77	17
Other Variable Costs	412	734
Fixed Cost	52	30
Total Costs Per Hectare	2748	12103
Per kilogram cost ($/kg)	**0.05**	**0.4**
% of labor cost in total	**43%**	**52%**
% of machinery cost in total	**4%**	**33%**

Cost of Production of *Fresh Tomatoes*

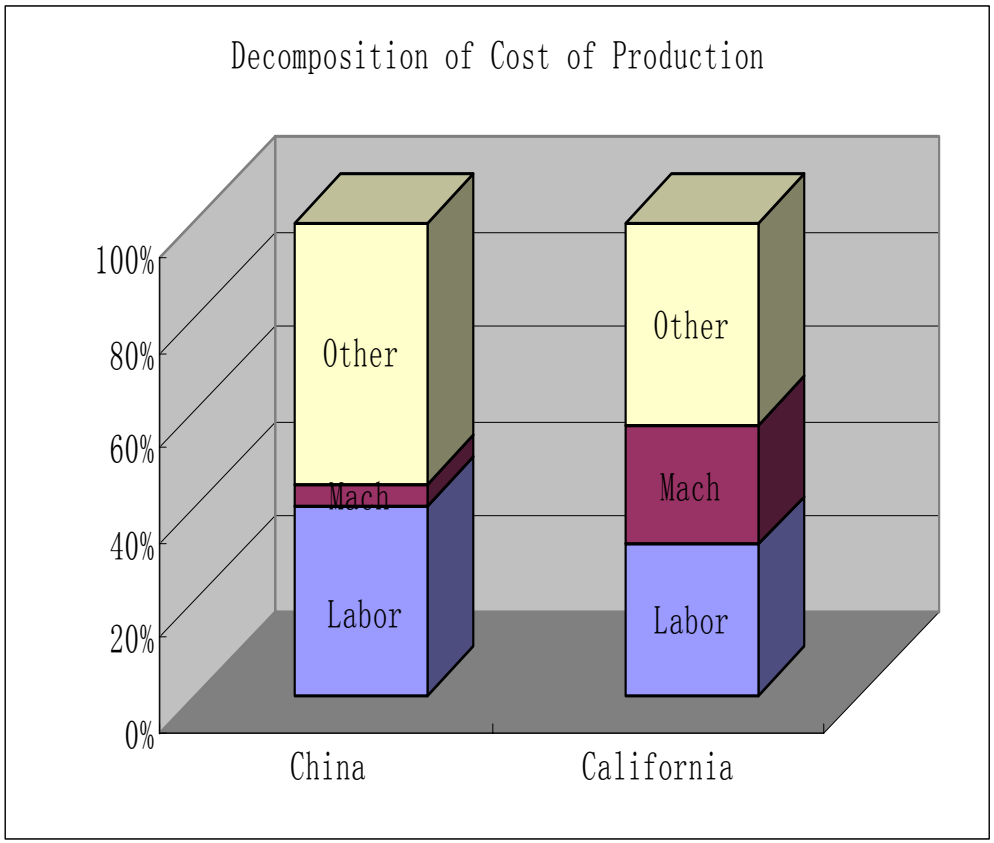
China and CA

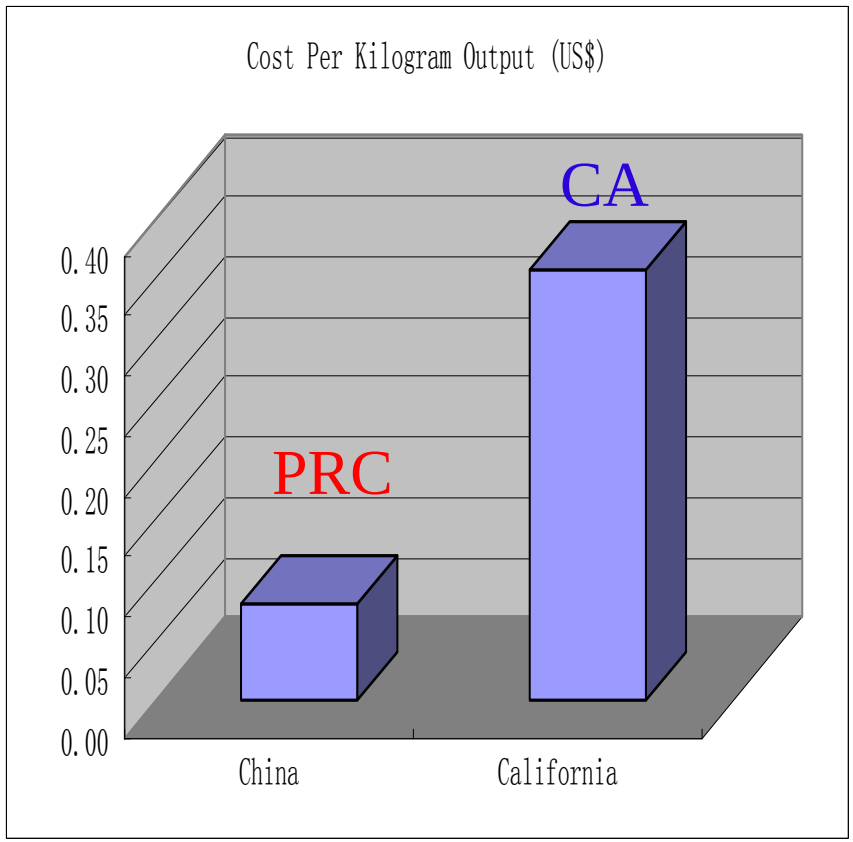




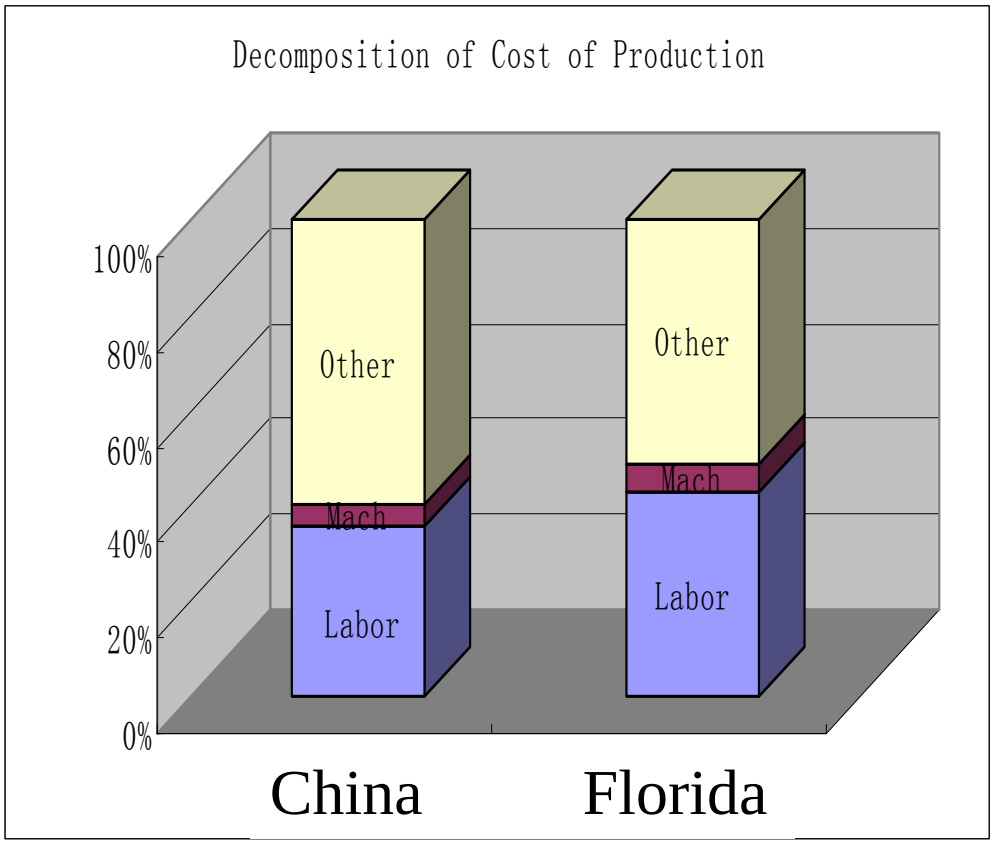
Cost of Production of *Peppers*

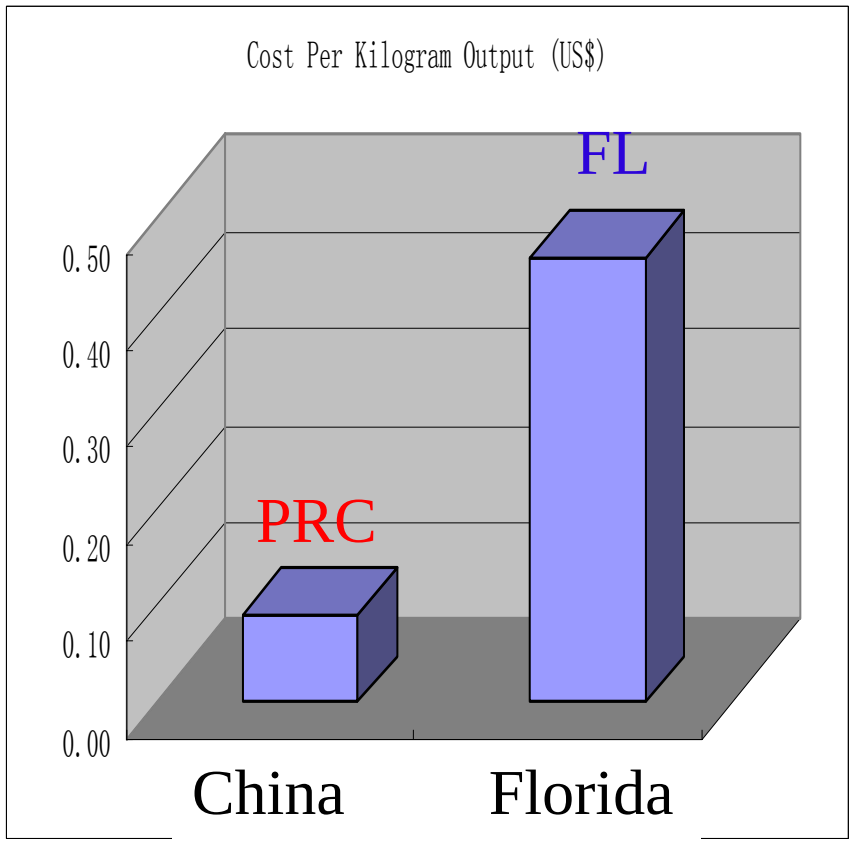
China and California



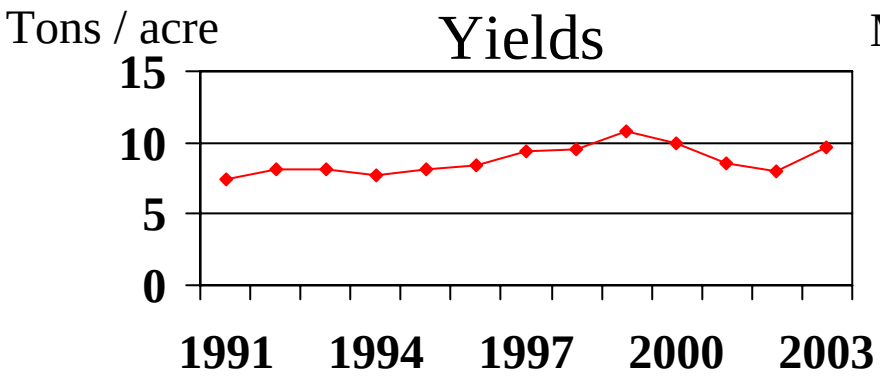


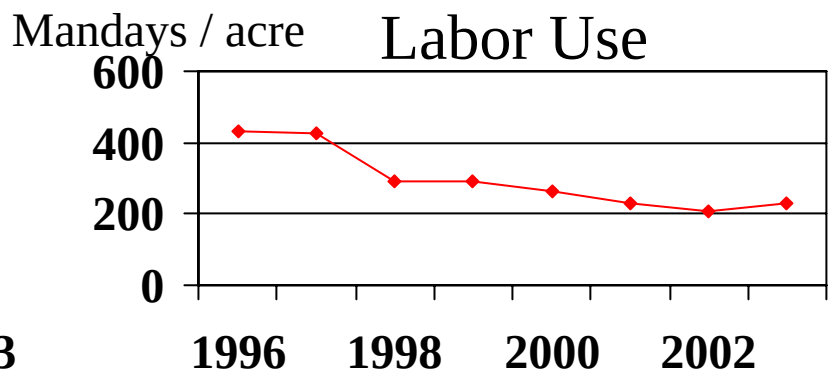
Cost of Production of *Oranges (Navels and Valencias):* China and US

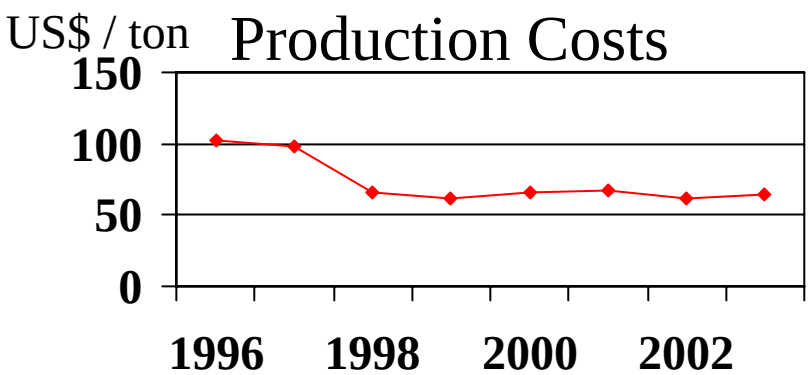




Changes in fruit production efficiency in China, 1990s to 2003







About the same farmgate cost per unit of output as Oranges, Tomatoes and Peppers:

($0.05 / kilogram)

National Cost of Production Data, NDPC

Summary: Patterns of Fruit and Vegetable Production in China

- Significant percentage of ag. land used in horticultural products (more than US and more than California)
- Rising sown area and production in many (most?) of horticultural products grown in the US and California

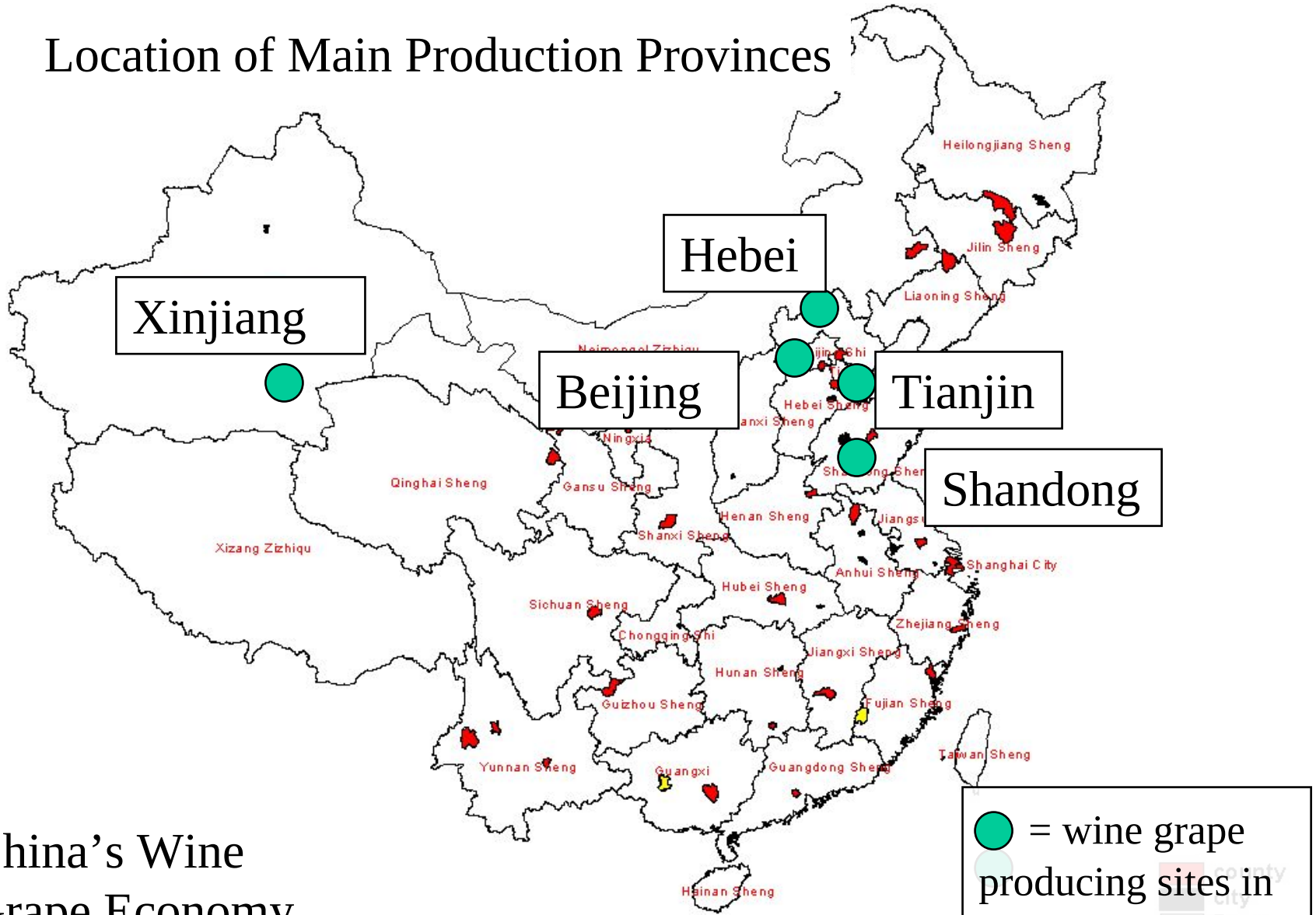
- One of reasons: China is a low cost producer (period)

- Plus: Increasingly efficient

[remember this is the bad news part of the presentation]

So where do the wine grape growers fit in?

Location of Main Production Provinces



China's Wine Grape Economy

Typical wine grape growing household in China, 2005

Household characteristics		
HH size	(person)	4.4
Age of HH head	(year)	42 (male)
Education and training		
Education of HH head	(year)	7
Share of HH head with ag extension training	(%)	50
Off-farm job	(%)	
Share of HH head who has off-farm jobs (in factory)	(%)	20
Share of household head who has off-farm jobs (self employed)	(%)	25
Assets: Farm equipment	(US$)	402
Housing	(US$)	7882

The typical wine grape growing farm in China, 2005

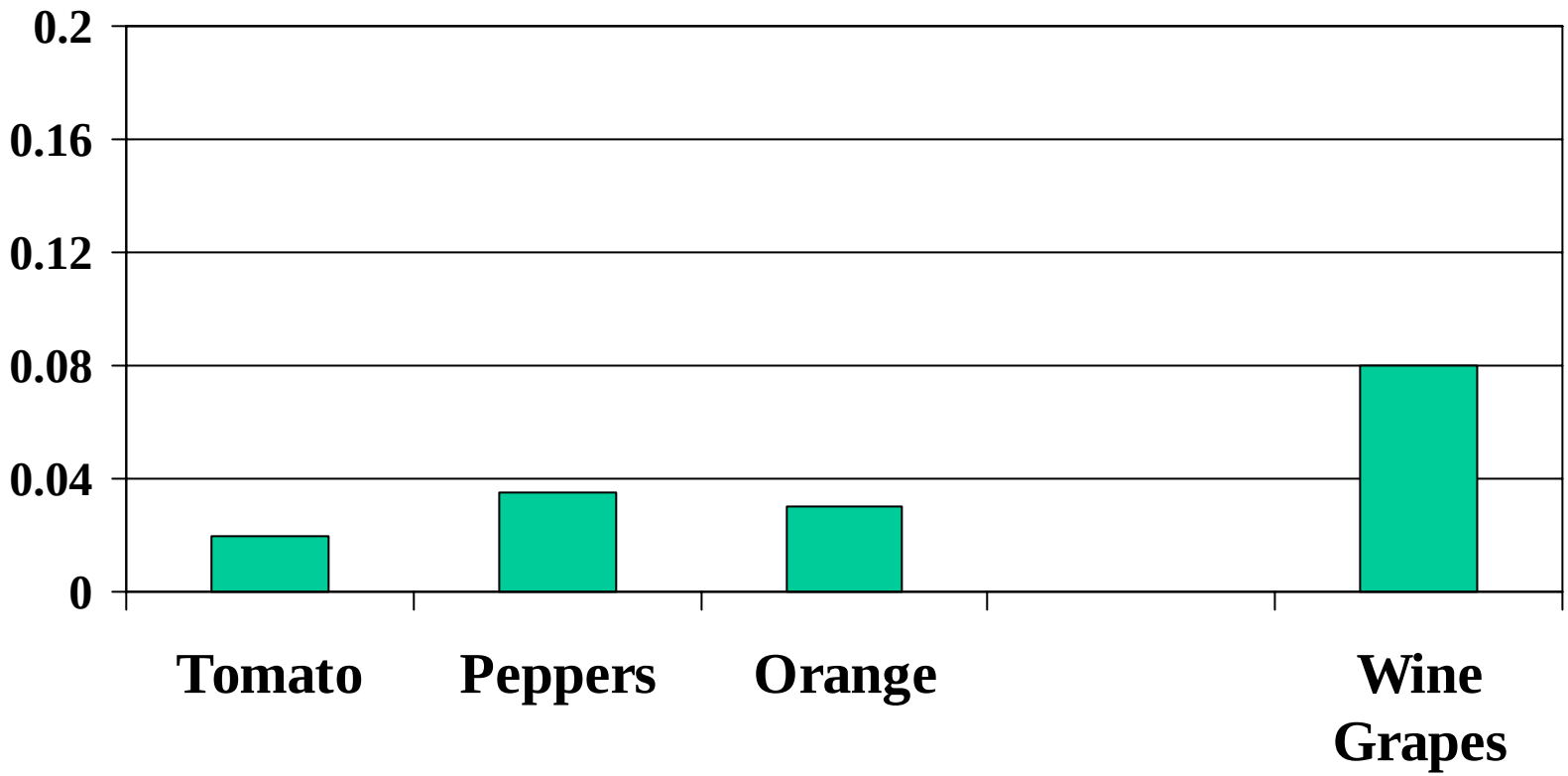
Farm Characteristic		
Farm size	(acre)	1 acre
Distinct Plots	(number)	5 plots
Number of crops (diversification)	(number)	3 crops
Ownership and Control		
Contracted from “collective”	(%)	96
Rented from other farmer	(%)	4
Share of area decided by farmer	(%)	94.2
Labor		
Own Labor Days / Acre	(mandays)	312
Hired Day / Acre	(mandays)	42
Wage	(US$/day)	3.2

Grape production cost , output and revenue ,2004

Fertilizer cost	U.S.D/acre	187.99
Organic fertilizer cost	U.S.D/acre	223.41
Chemical cost	U.S.D/acre	109.52
Hired labor cost	U.S.D/acre	63
Machine cost	U.S.D/acre	38.4
Other costs	U.S.D/acre	274.79
Own Labor	U.S.D/acre	538.00
Total Cost	U.S.D/acre	1435
Output	kg/acre	16928
Revenue	U.S D./acre	2298

Cost of Production – Wine Grapes versus Other Crops

Cents per pound



Conclusions

- China's agriculture has been transforming at an incredible rate … more open; more towards comparative advantage; more efficient
- China has potential to continue growing in this direction
- Biggest advantage in low production costs of labor intensive commodities

- Shift to horticulture production includes shift to wine grapes and wine making

- Will it continue?

Remaining Questions?

What drivers will shape the future of the wine grape supply in China?

2 FORCES for consideration:

- Food security and the impetus to push grain production?
- Getting wine grapes from the vine to markets

[-- foreign direct investment (FDI)]

SUPPLY
FORCE 1:

Food Security

"When the granaries are full, the emperor can rest"

Han Dynasty, 110 BC

"A good magistrate thinks first of feeding full the bellies of his people, all else takes second place"

Tang Dynasty, 796 AD

New Subsidy Policies in 2004

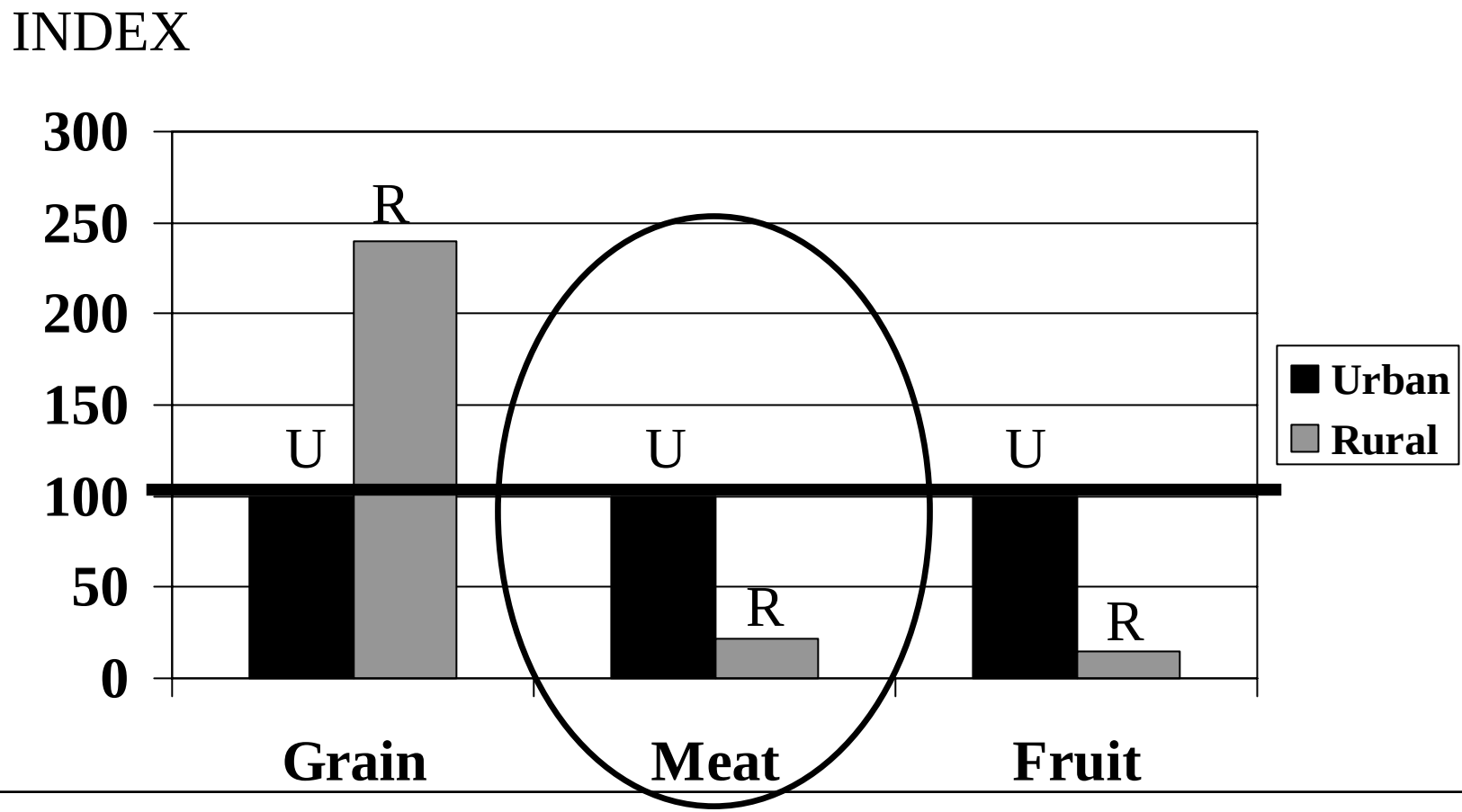
Policies	Estimated Cost
Direct Subsidies to Farmers	***$1.4 billion***
Agricultural Tax Reduction	***$5 billion***
Input Subsidies	***$200 mil.***

Data source: USDA, ERS

But, Direct Subsidies Are Not Very Big [yet]

- **$7 per acre**
- **$1 per rural household member**
- **1% of rural household income**
- **$2 to $6 per ton**
- **Below 2 percent gross value of production**

Consumption Consequences of Migration: less grain/more meat & fruit



There is a going to be a surge in the demand for feed grains … produce in China or outside of China … China wants to produce inside China, but can't do it all …

Key Question

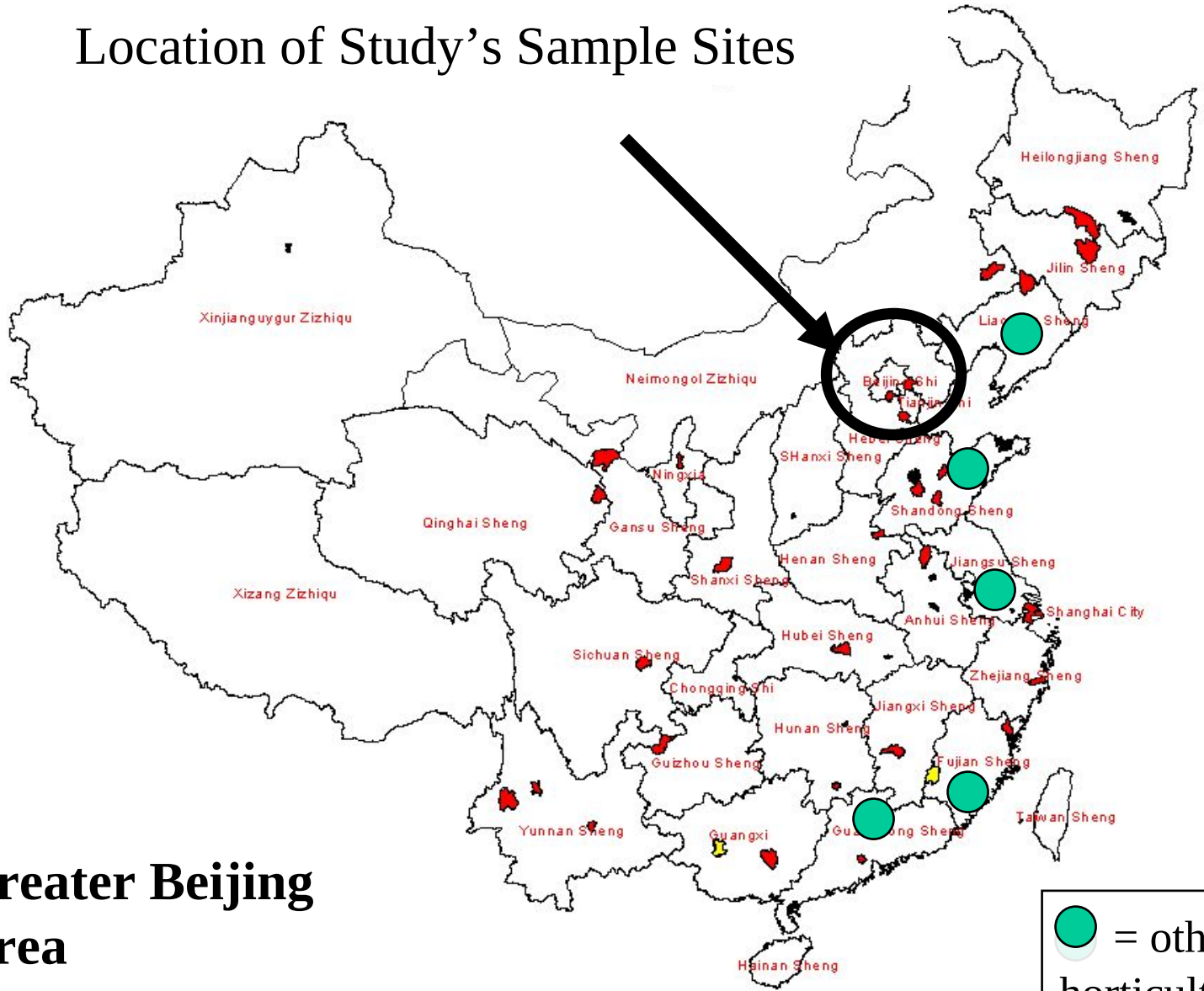
- China can not produce all of its own food?
- Will it decide to try to remain self sufficient in grains?
- Or will it further pursue the production of specialized crops?

SUPPLY
FORCE 2:

Marketing: from the vine to the winery

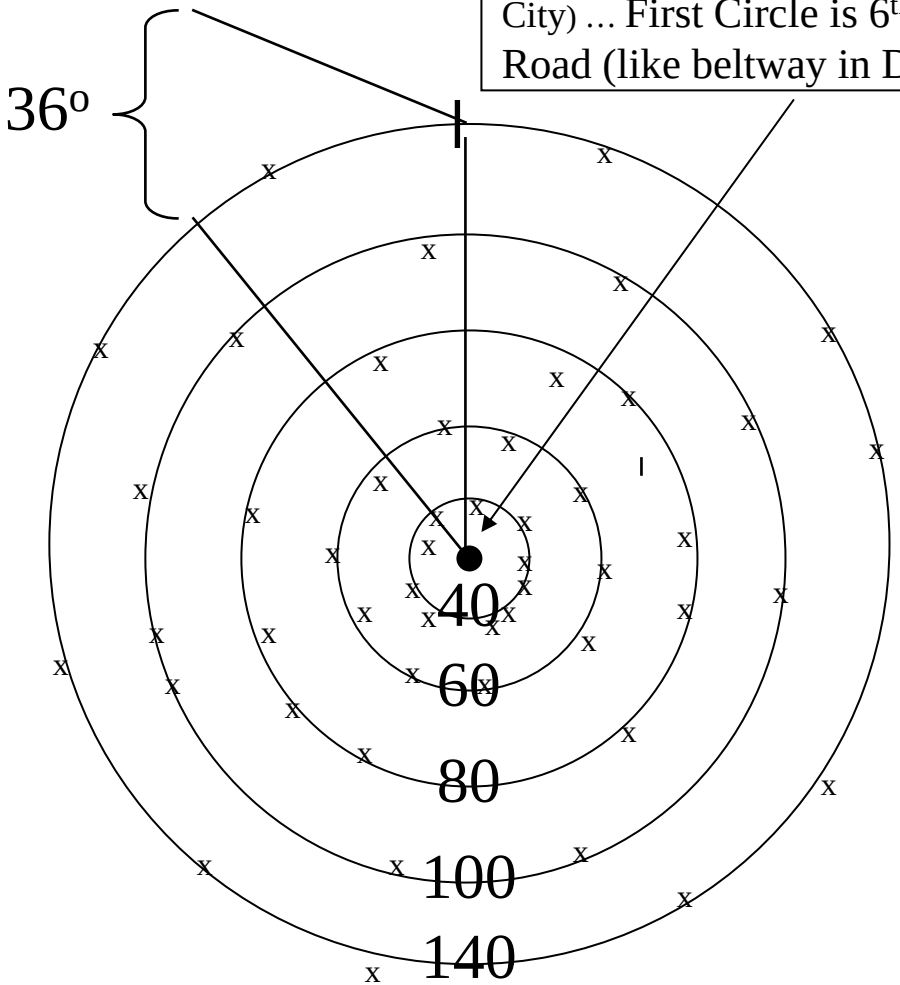
- Outline
  - The survey
  - The sellers
  - The buyers + truckers (+processors)

Location of Study's Sample Sites



Greater Beijing Area

= other major horticulture sites



City Center … Beijing (Forbidden City) … First Circle is 6th Ring Road (like beltway in DC)

All towns, villages and farmers randomly selected … interviewed farmers / village leaders

Distance from one side of largest circle to the other is about 170 miles (from Sacramento to Fresno / Half Moon Bay to Turlock)

5 circles x

10 towns per circle x

4 villages per town =

200 villages

The Sample: Geographical Layout of Sampling Approach for China Horticulture Survey (kilometers)

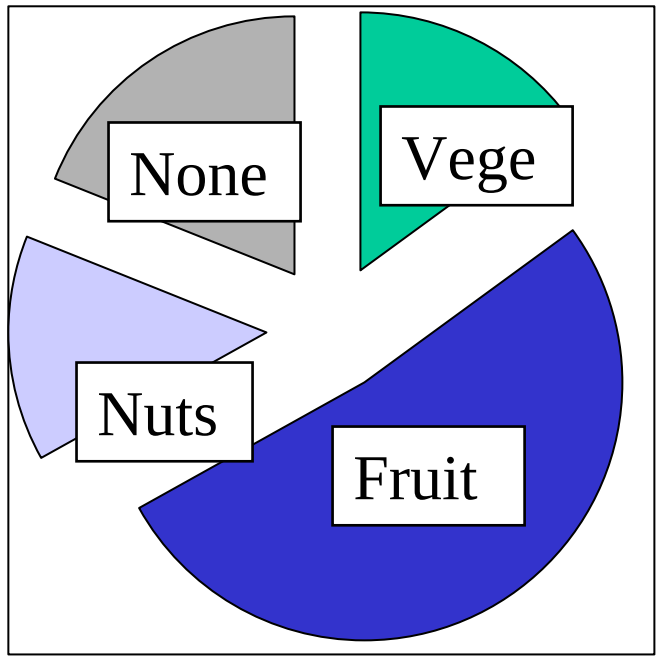
The Marketing Channel Survey

- Standard household survey PLUS:
- Horticulture growing history (2000-2004)
- Marketing channels
- Technology shifts

  [interested in understanding are marketing channel shifts leading to technological change?]

Distribution of Fruit, Nuts and Vegetables in greater Beijing area

- More than 80 percent of sample area villages have households that specialize in horticulture crops
  - Fruit 52%
  - Nuts 14%
  - Vegetables 15%
  - None 19%



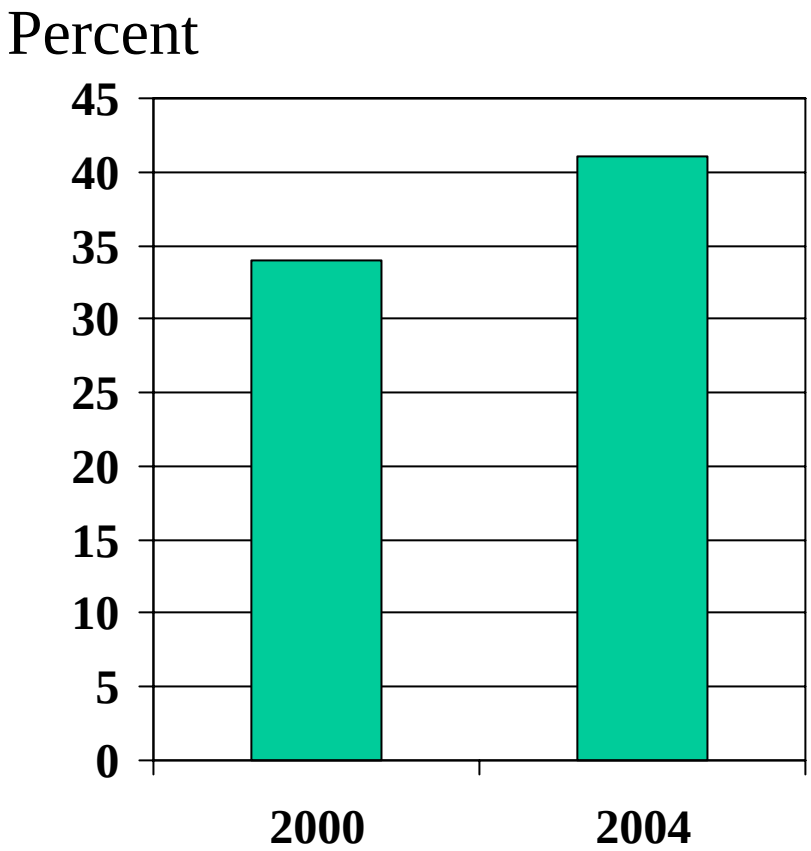
Most commonly observed crops

Crop	Number out of 200 villages	Crop	Number out of 200 villages
Grapes	13	Watermelon	8
Peaches	13	Bell peppers	7
Apricots*	11/8	Tomatoes	6
Apples	10	Pears	6
Persimmons	10	Strawberry	3
Chestnuts	9	Cherries	3
Walnuts	8	Cucumbers	3

120 / 163 (75%)

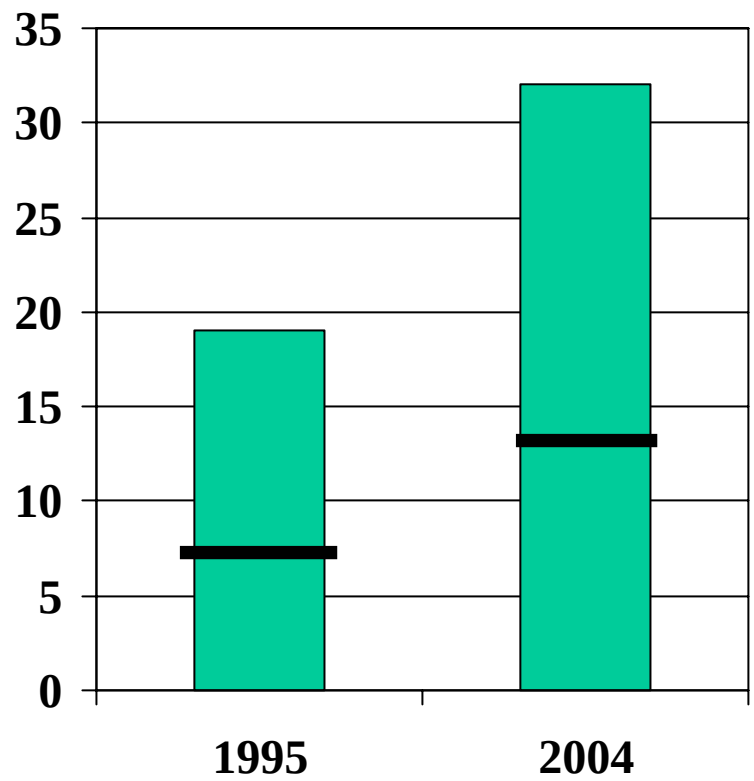
Rise over time – Fruit (greater Beijing area)

- Share of “cultivated area” plus “orchard area” planted to fruit orchards
- Does *not* include nuts
- Data source: authors’ survey data



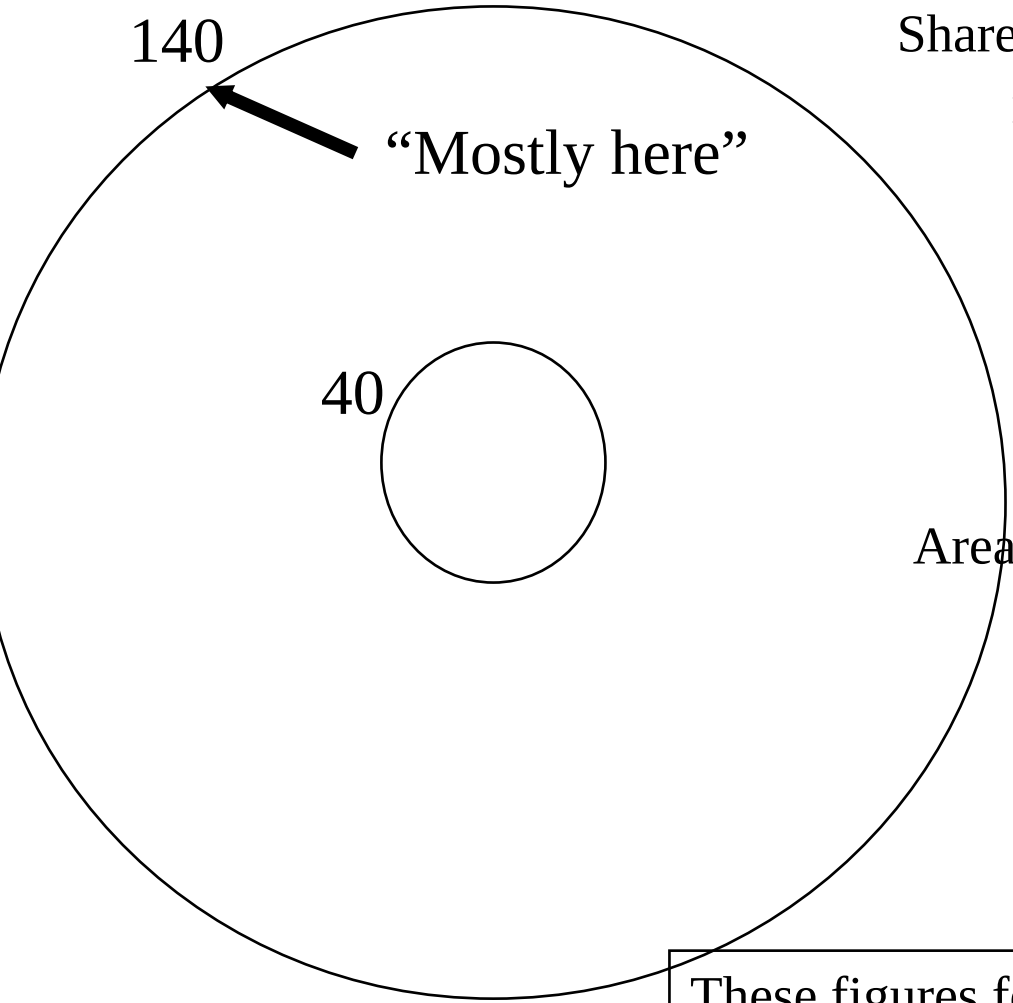
Rise of specialization (entire nation)

- In a recent survey of 650 communities in China, we asked the leaders:
  - Do farmers in your village specialize in the production of a field crop, tree crop or livestock commodity?

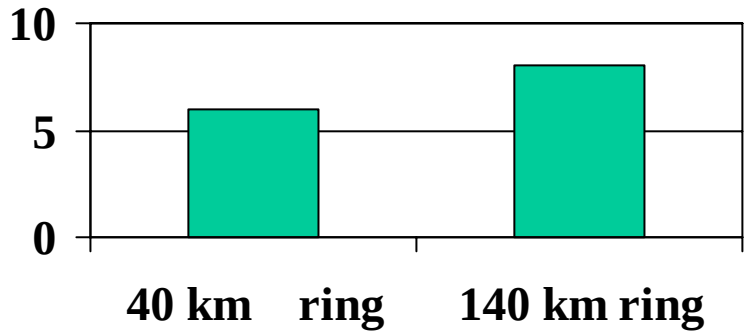


Data source: China National Rural Economy Survey (CCAP)

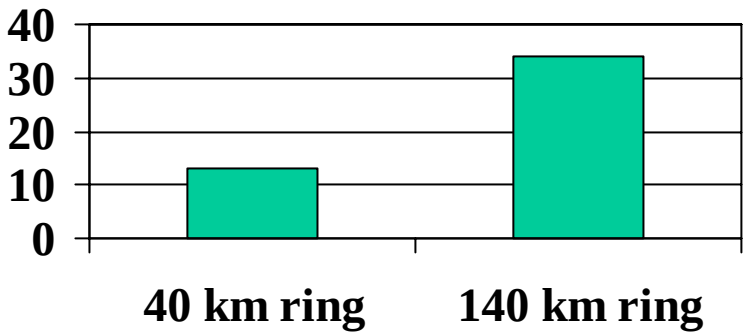
Where are they being grown?
Inside Ring / Outside Ring



Share of Cultivate Area



Area / Village (acres)



These figures for vegetables in 2000 / same for F&N's

Who are growing them? Rich or Poor?

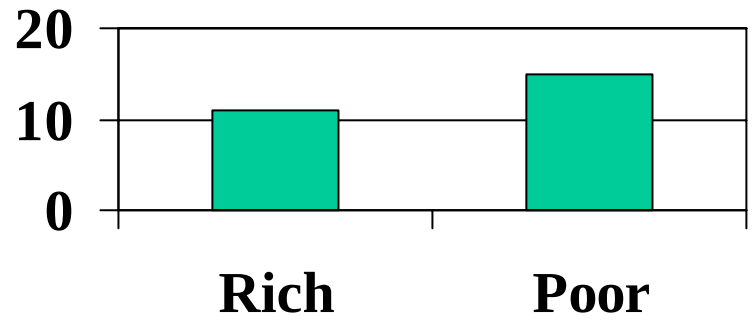
- Per capita income:

"Rich" -- $7.28/day

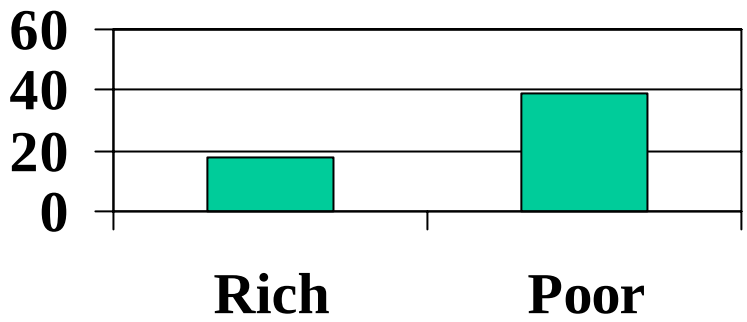
Poor -- $1.25/day

"They do"

Share of Cultivate Area



Area / Village (acres)



Fruits / Nuts / Vegetables are being increasing grown by poor farmers in relatively remotes communities!

These figures for vegetables in 2000/ same for F&N's

The Buying Landscape: Who might be out procuring the crop?

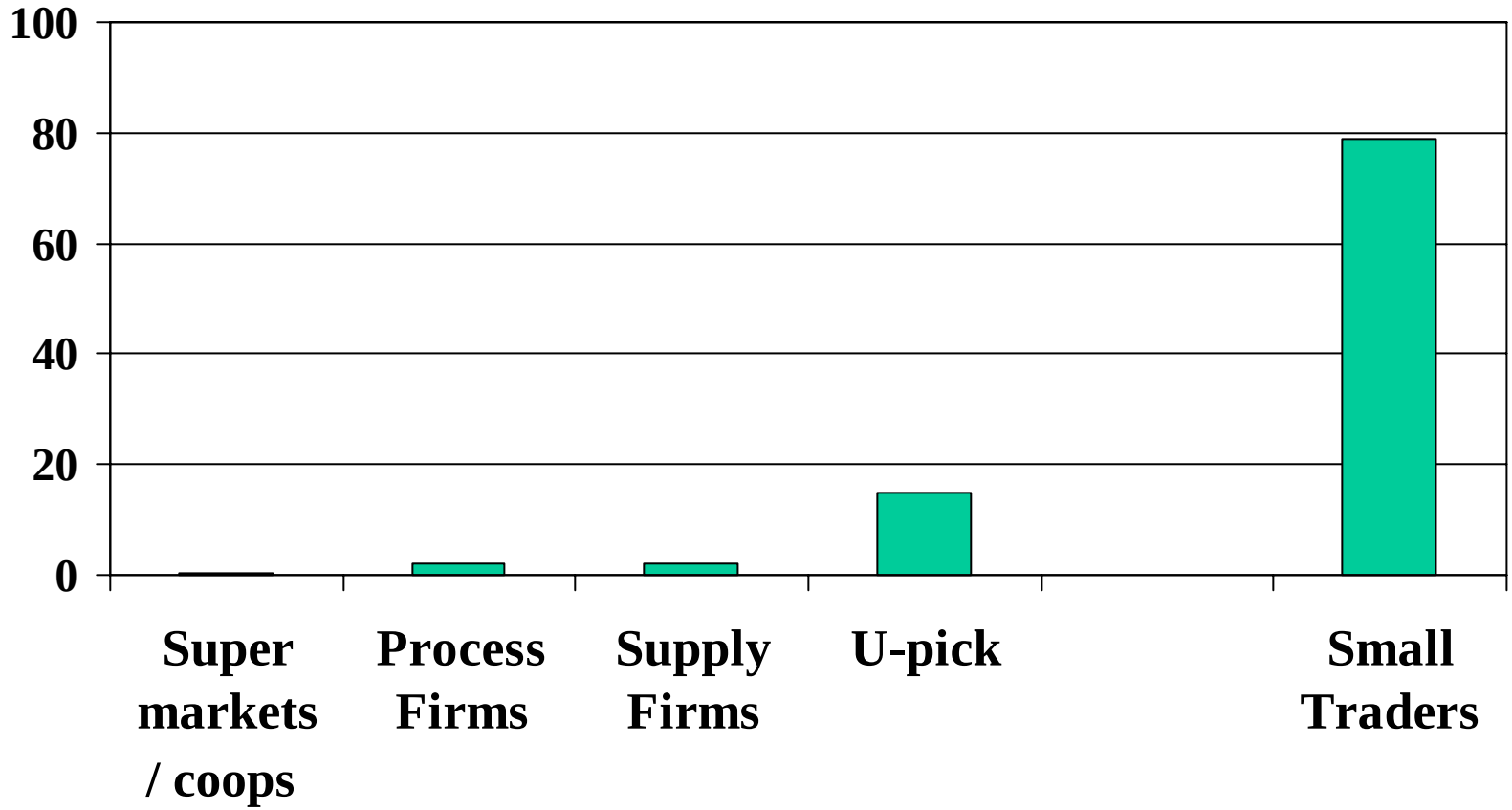
- Supermarkets / Coops
- Processing Firms (e.g., wineries)
- Professional Supply Firms (on contract to exporters /supermarkets / hotels / restaurants)
- Consumers ("u pick 'em" / bought by companies for distribution to their employees)

- Small traders

  [2 to 6 people working together / No warehouse; no office; no license; often no transport / Pay cash on the spot / From Henan; Hubei; Anhui / Poor (will work for $2-3/day)]

Small Trader-dominated System (2004)

Percent of all purchases

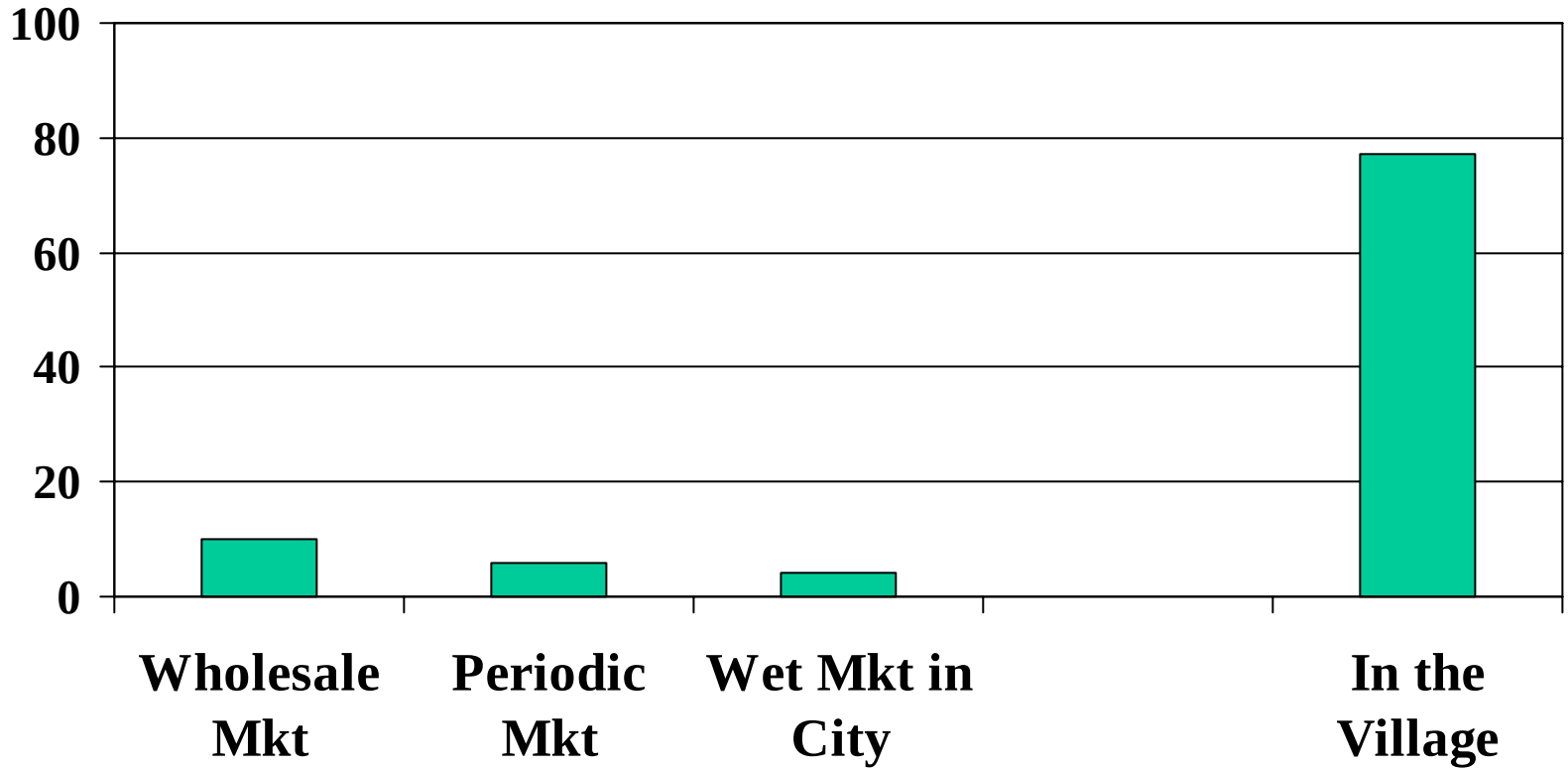


Note; -- Supermarkets did not procure in any villages (ZERO)

-- Zero procured by coop

“In-home Service” (2004)

Percent of all purchases

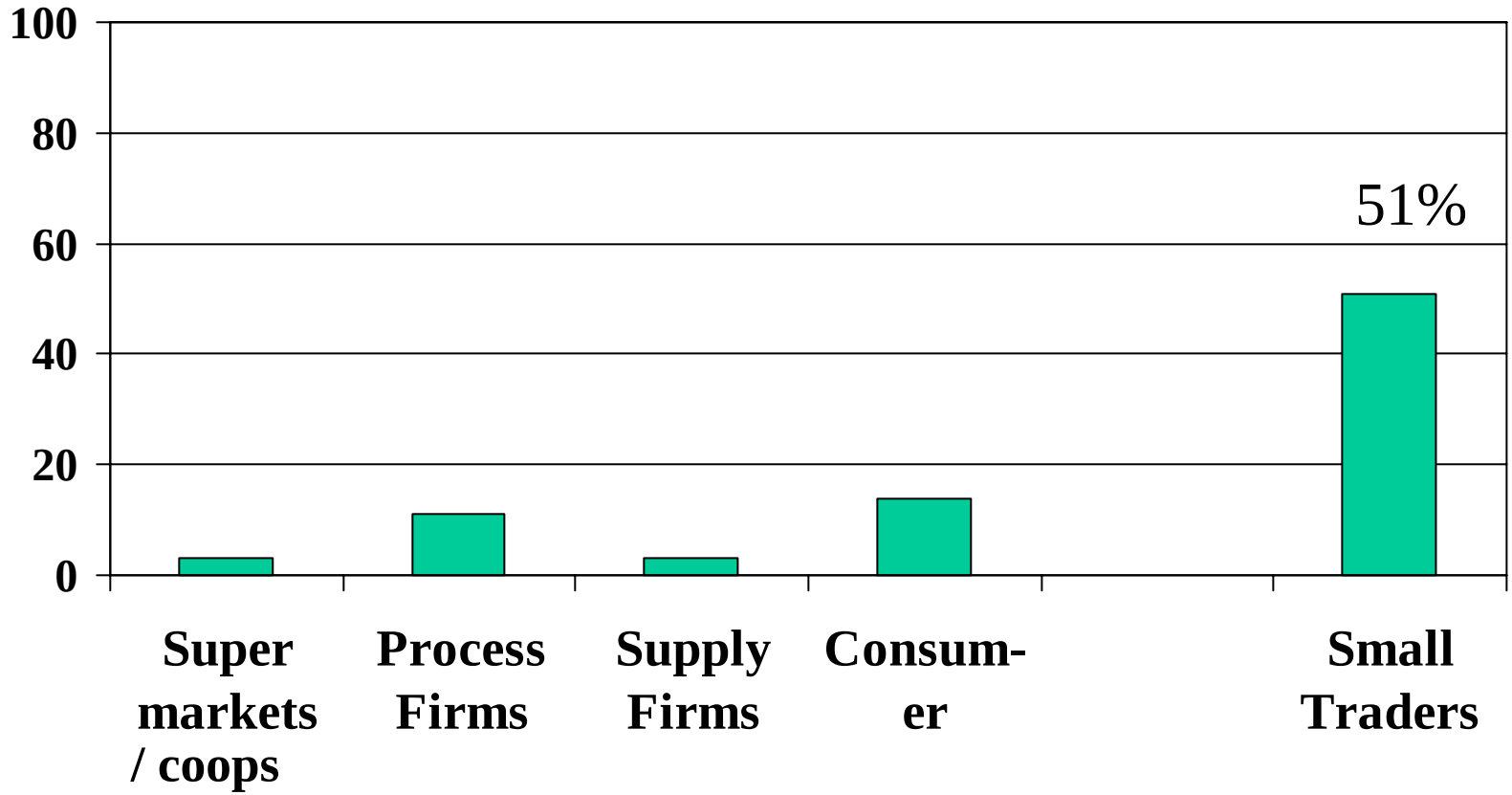


Note; -- “In the village” = Off the tree + From Home + Road-side

-- Share sold in wet markets in cities down over time

Second Buyer in the Wholesale Chain Still Small Trader-dominated (2004)

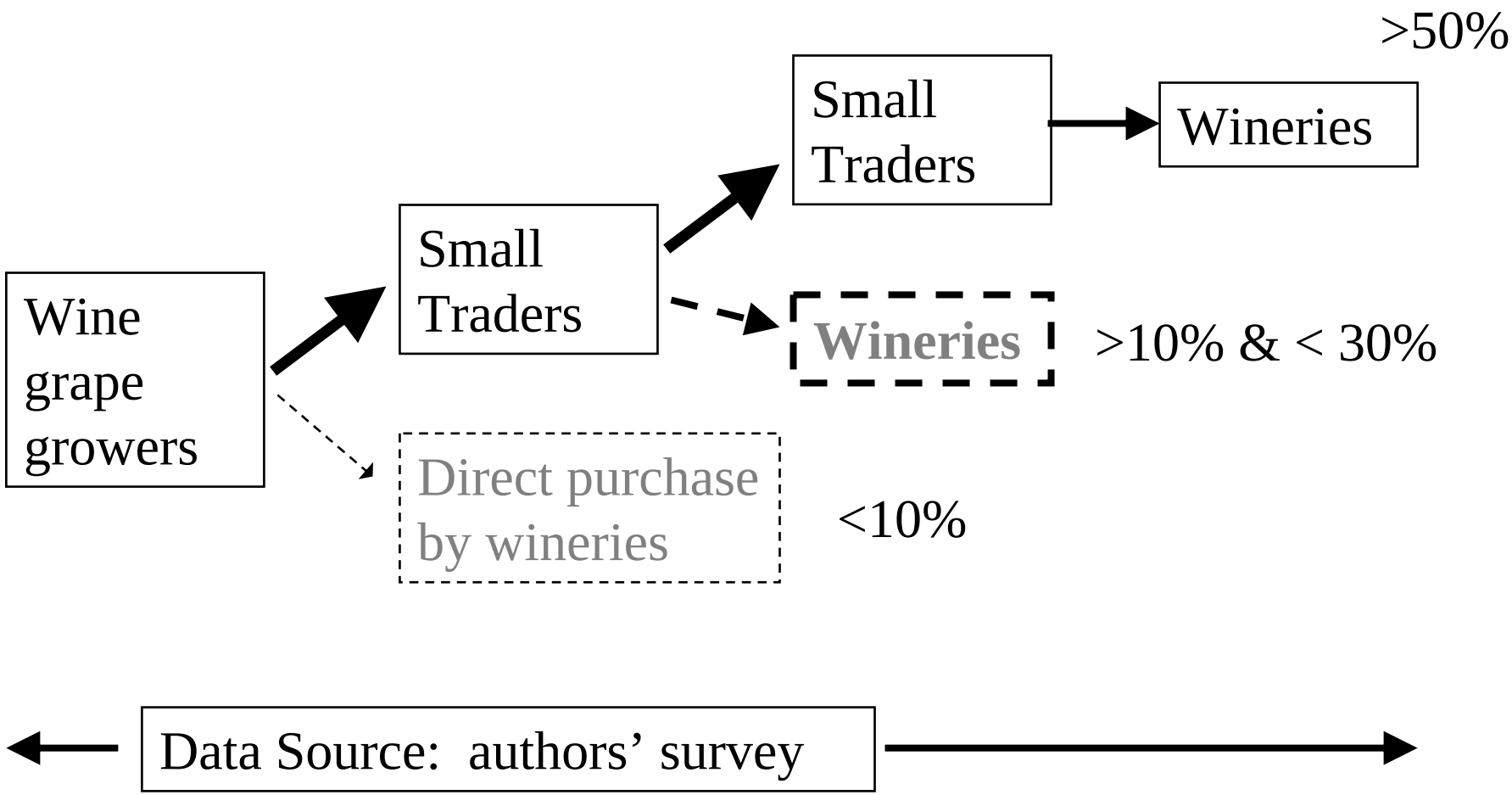
Percent of all purchases



Note; -- Supermarkets only directly involved in 3% of “second trades”

-- Share sold to processing firms rising over time

Wine grape marketing chain in China



Summary: Participants in China's Wine Grape Markets

Farmer	Private 97% own decisions	$2/day
Small Trader	Private	$3/day
Trucker	Private	$2.5/day
Second buyer	>90% private [of 75% of respondents that responded]	

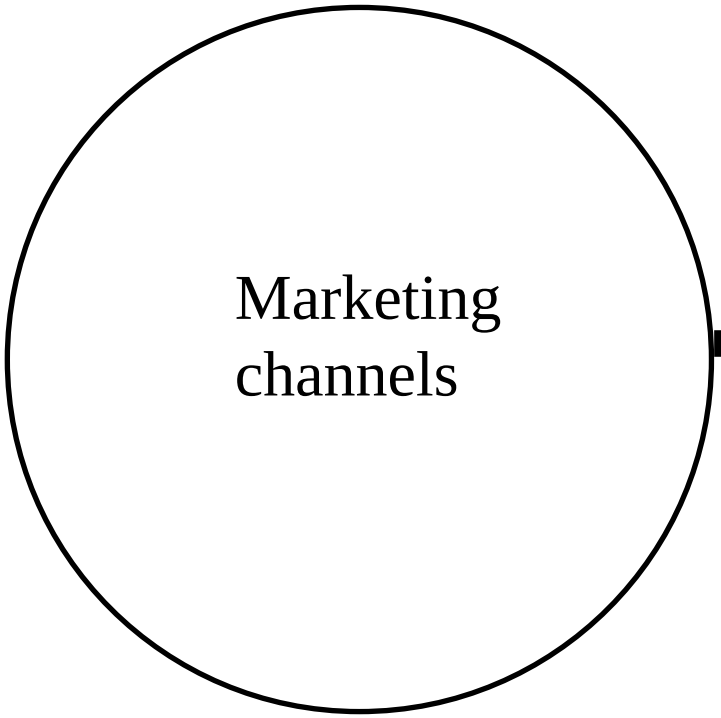
Export business?

Potential Influence of Government

- On-farm (nearly unregulated: projects / low-interest rate loans / extension – very little … especially recently)
- Trading (nearly unregulated: pay fee for stall space in city-run markets / FN&V are untaxed)
- Trucking (nearly unregulated: one-time (high) fees and taxes … gasoline bought at US-like market rates)

- Processing (certainly some wineries have subsidized loans and government grants / access to cheap land … but, not much in most industries)
- Retailing (almost none)

Are Marketing Channels Leading Shifts in Technology in China?



Farmer's choice of technology:

- Variety (NO: only thru market signals … some "deals")
- Pesticide application (technique / type / timing)
- Fertilizer application (technique / type / timing)

NO!

Picking/packing (not any requirement of farmer by trader; but is a shift to "early ownership change" … farmer actually sells F&Vs to small traders "on the vine / on the tree")

Why not?

- Extent of formal contracting: Almost ZERO

- When asked growers if traders / procurement agents were able to dictate their application of fertilizers and pesticides, the most common answer was:

  - A laugh / a pause (as if they did not understand the question) … and then: “of course not … how could they?”
  - Main reason? almost certainly a big reason is that contracting costs are too high / the monitoring and coordination effort of doing so for millions of farmers with 1/2 acre orchards are almost inconceivable

Implications for supply chains

- Can small wine grape growers who sell to small wine grape traders supply a quality and consistent product to an world class industry?

- Small / low cost/ fragmented / unorganized marketing channels …

[But, remember if there is a demand, low cost suppliers will be able to do a lot for a little]

Demand for Wine

What drivers will shape the future of the wine grape demand in China?

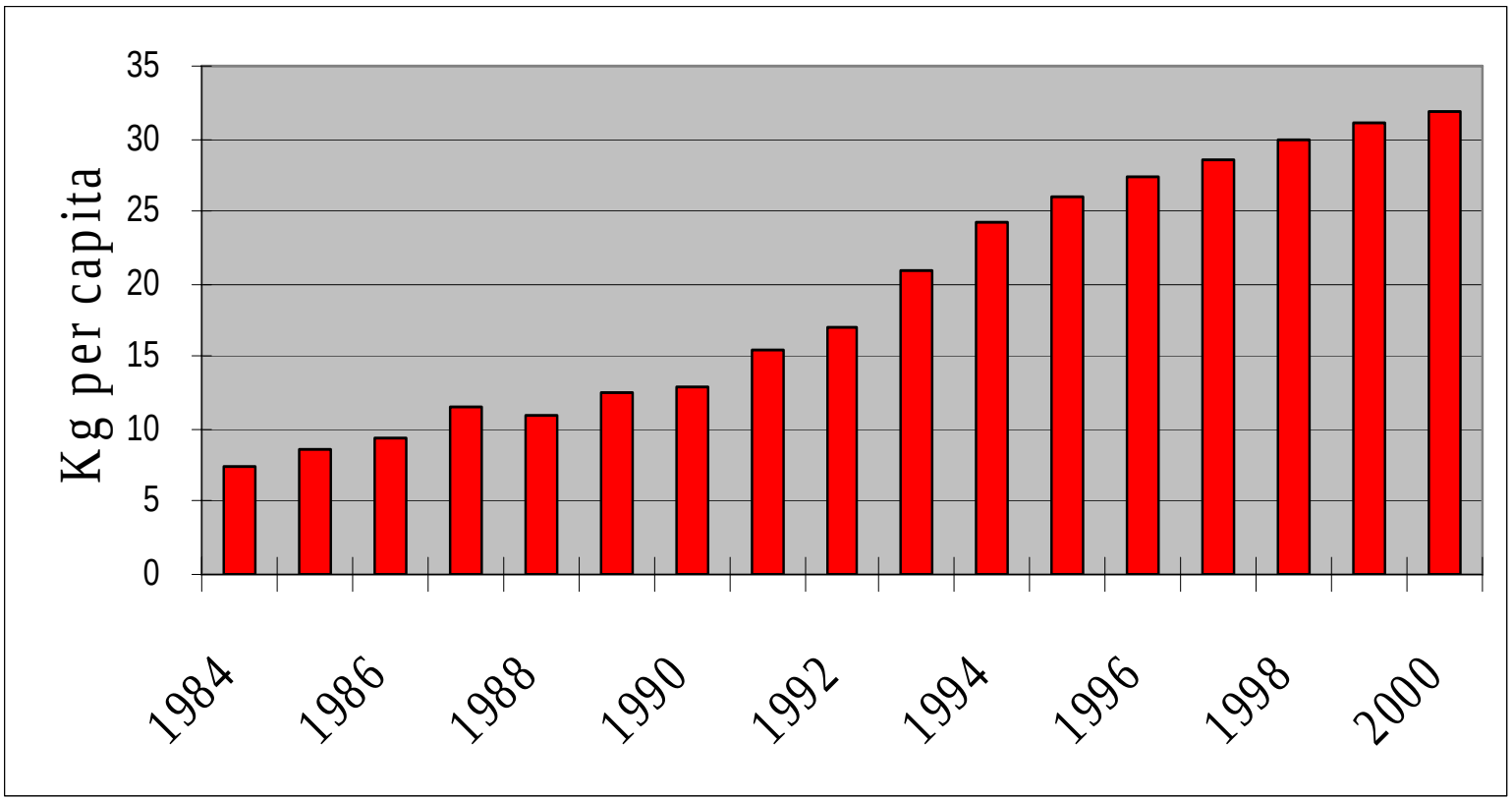
FORCES:

- Rising demand?
- Rise of supermarkets?

[Rise of restaurant culture?]

DEMAND
FORCE 1:

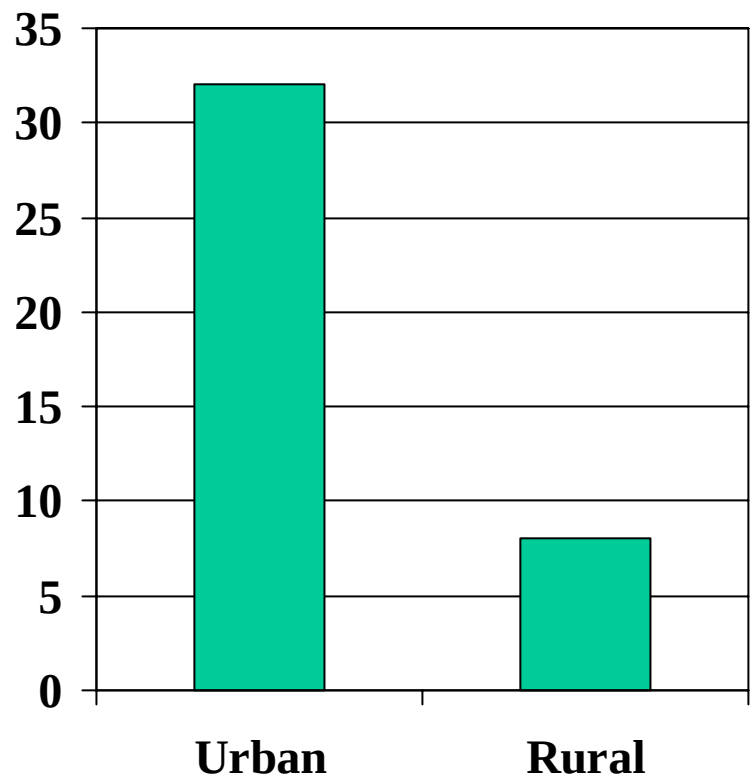
Domestic Fruit Consumption in China



Urban Consumption of Fruit -- CNBS

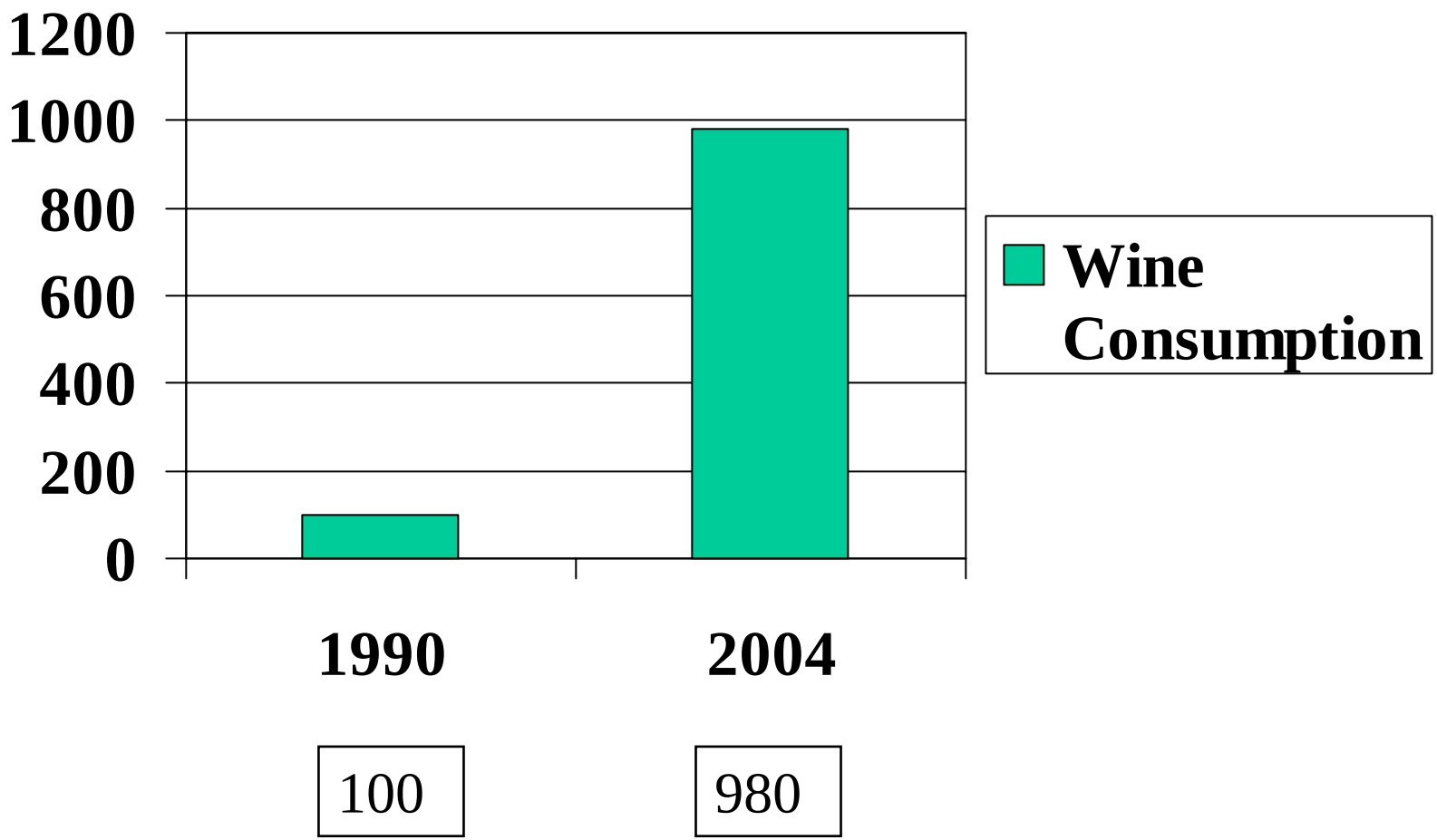
Fruit Consumption: Difference in Rural vs. Urban

- Biggest consumption push will come over the next 10 to 20 to 30 years when hundreds of millions of rural residents migrate to the city …
- … and then consume like them!

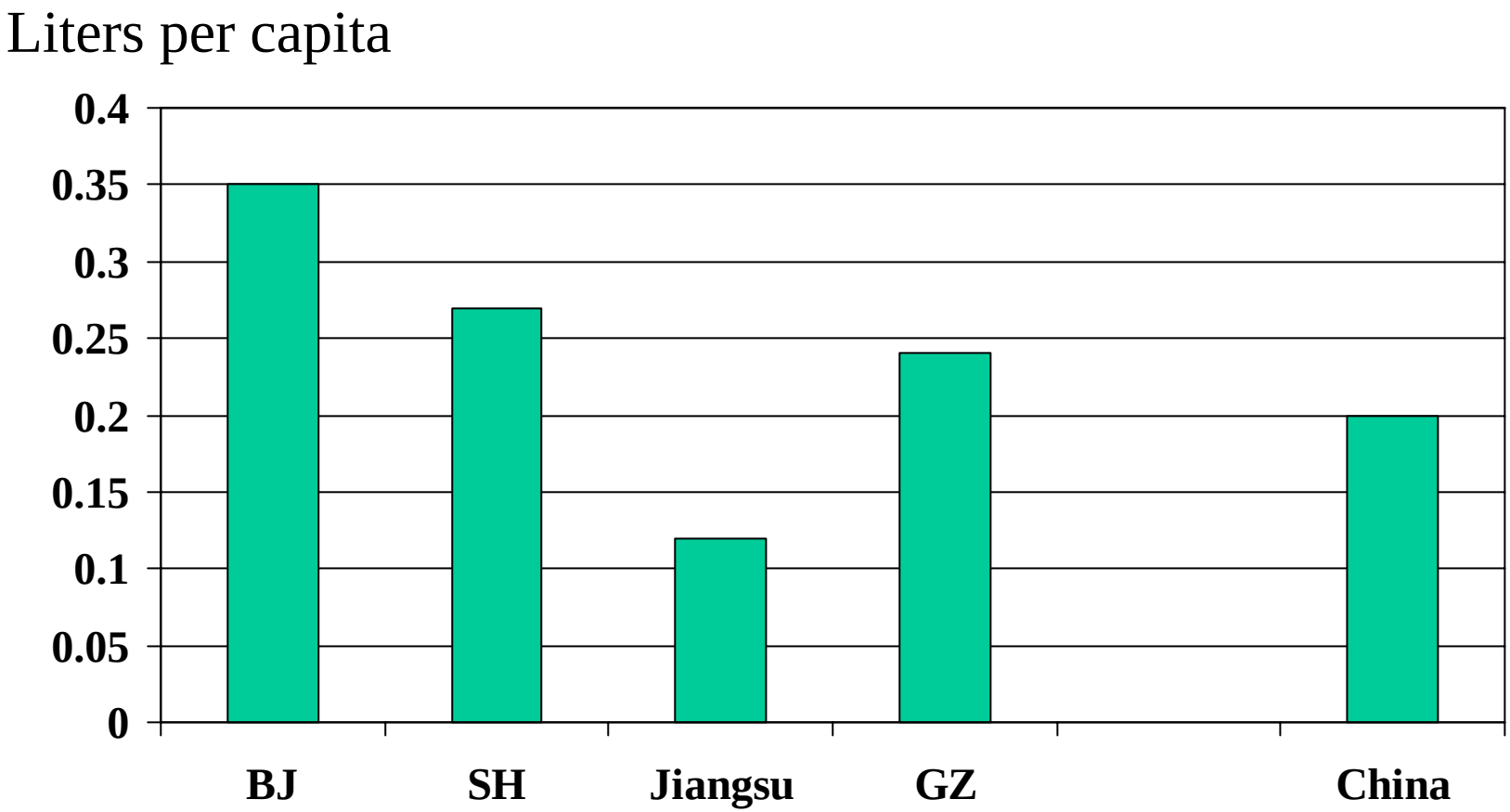


Growth of Wine Consumption

Index (1990 = 100)

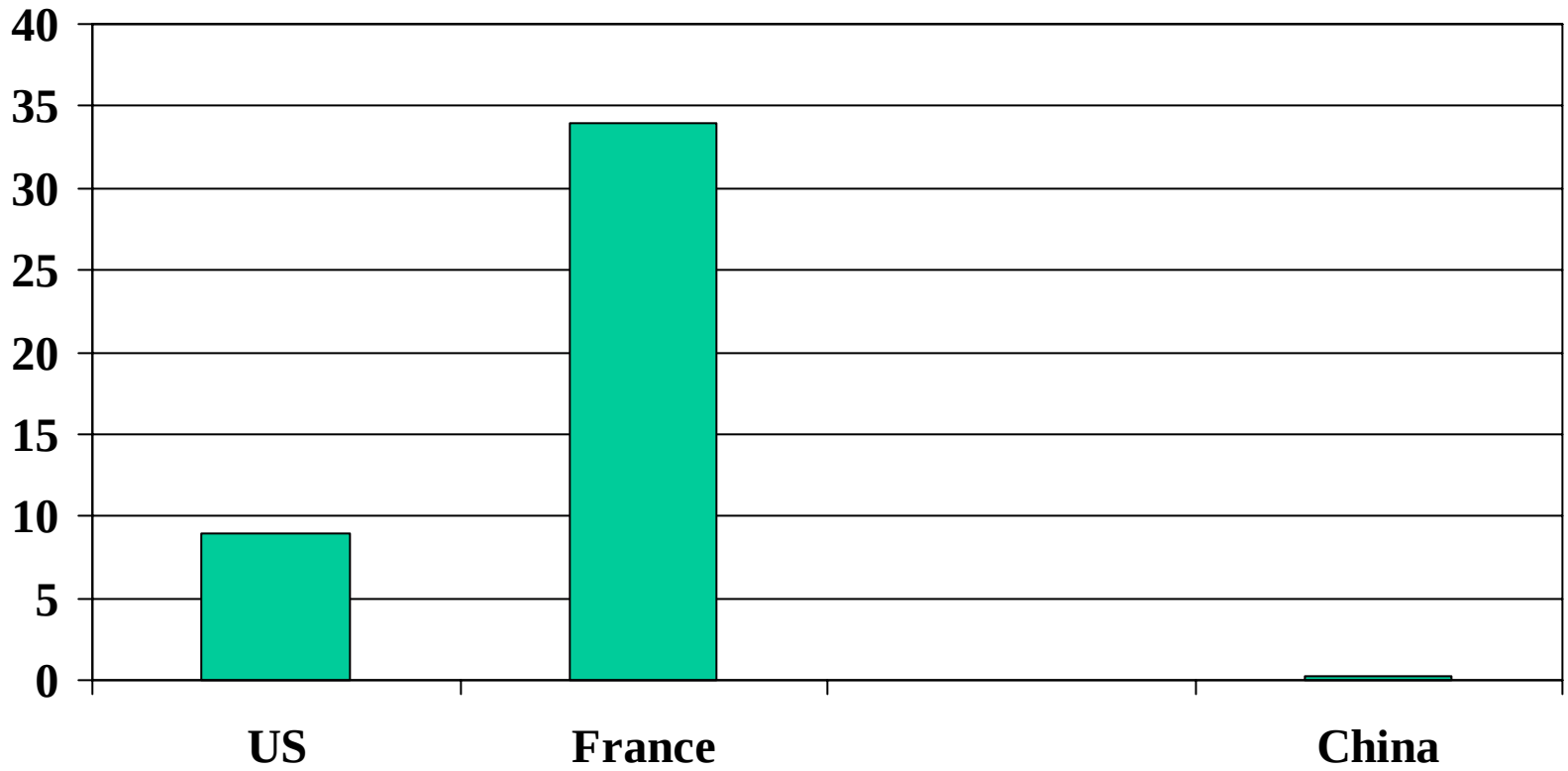


Great growth potential: China's per capita consumption is still very low



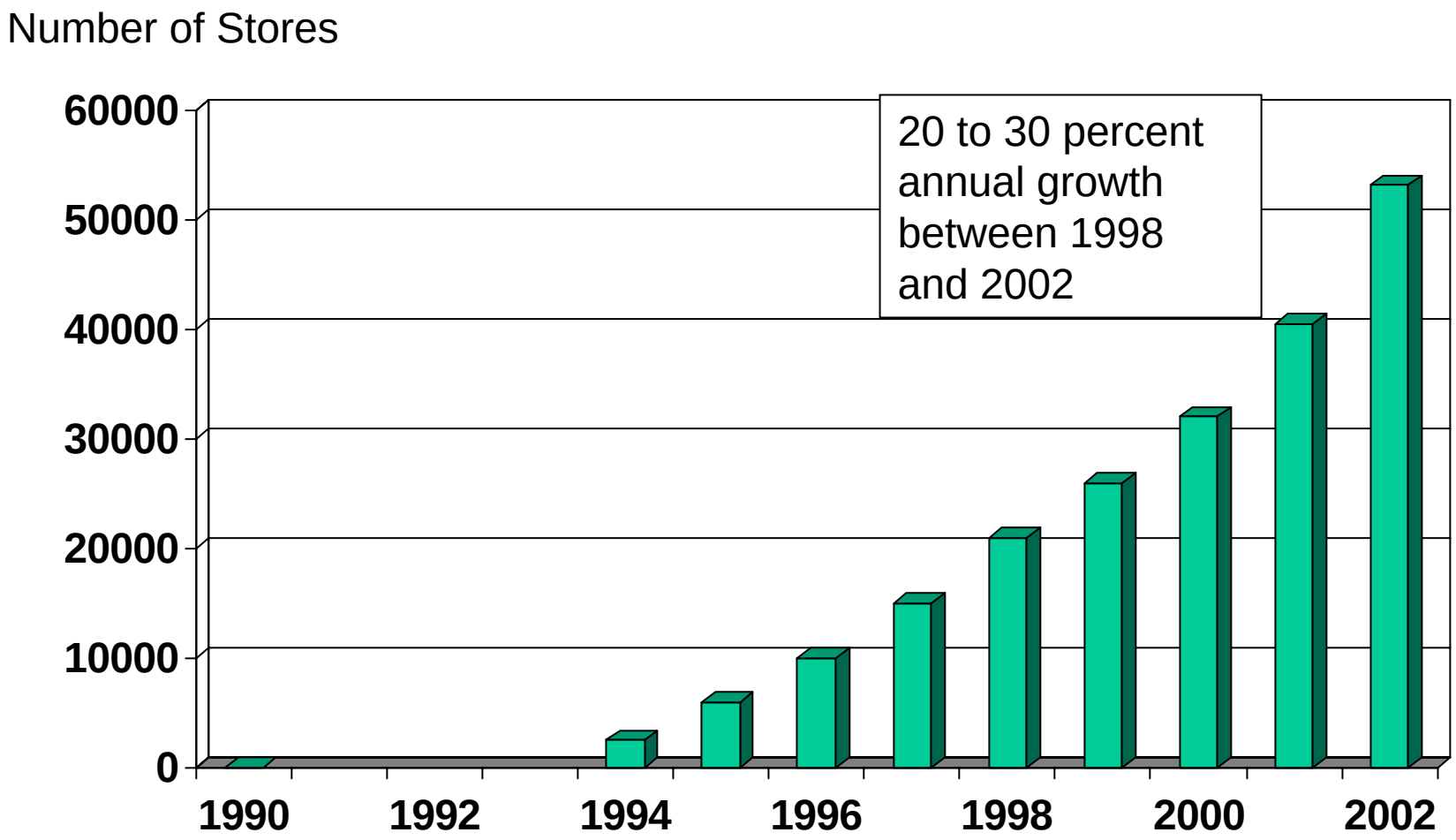
Great growth potential: Comparisons with the Rest of the World

Liters per capita

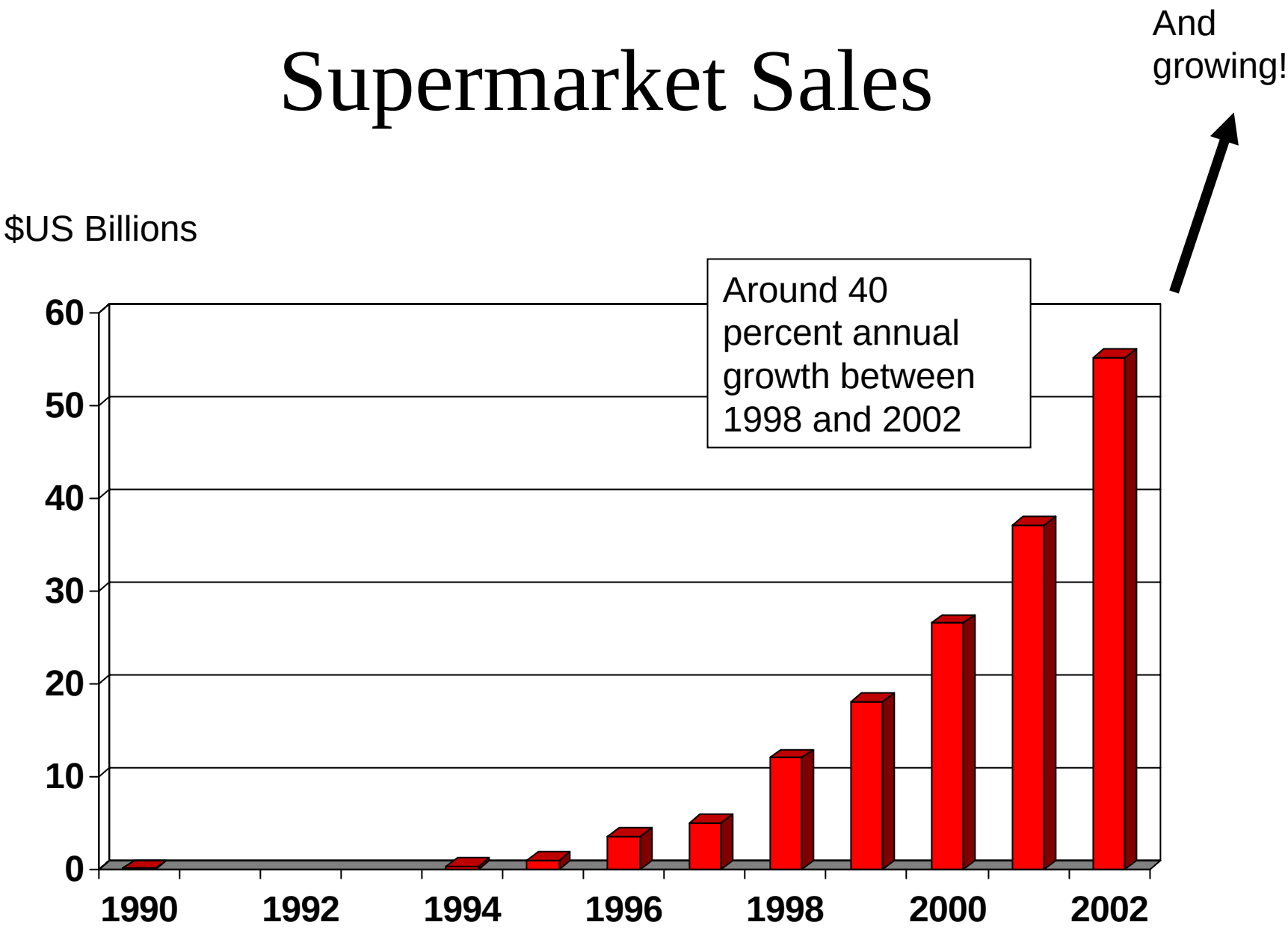


DEMAND FORCE 2:

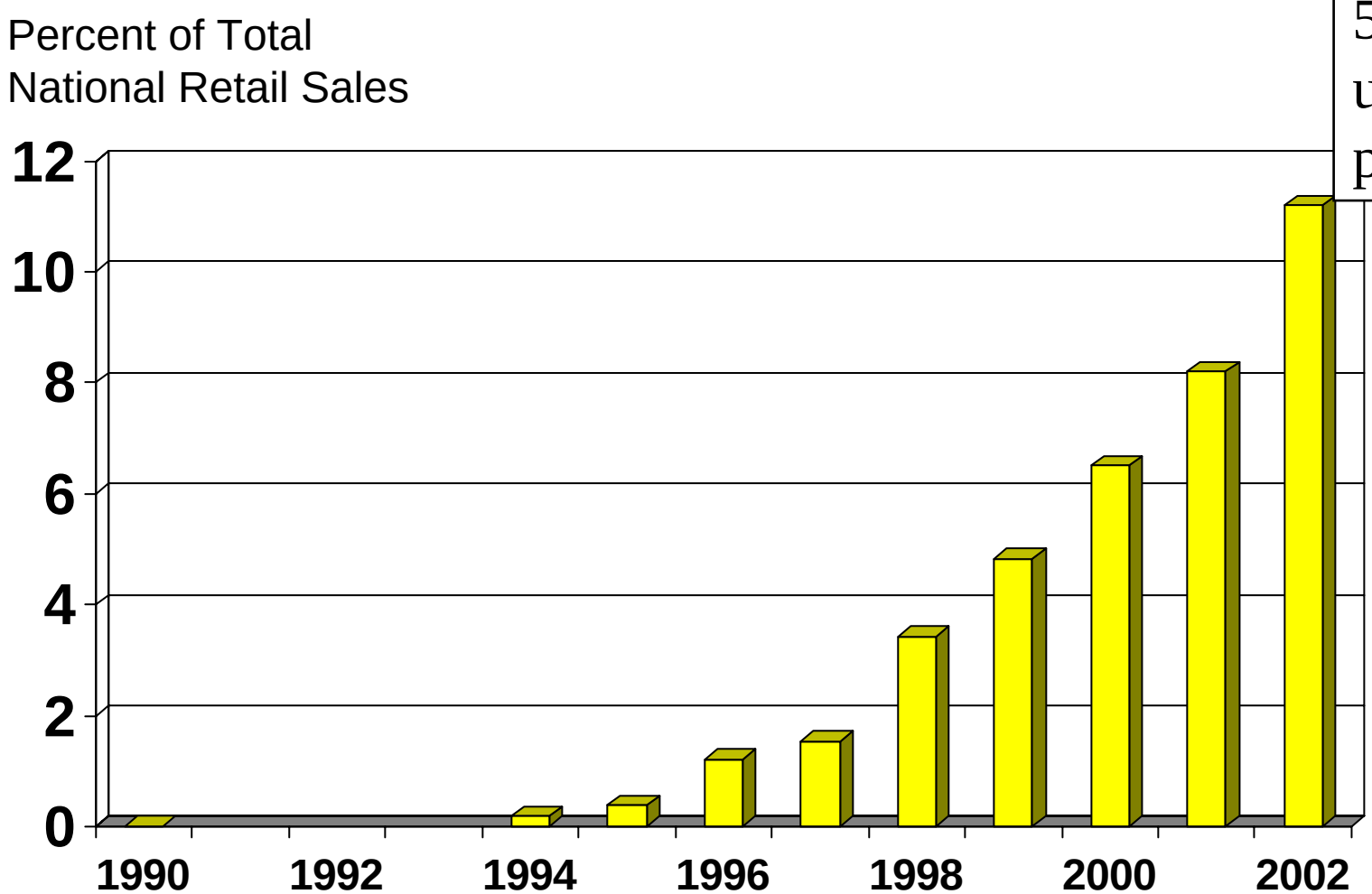
Rise of Supermarkets: Increasing Store Units



Supermarket Sales



Share in National Retail



Nearly 50% of urban food purchases

World Bank: “Retail Olympics”

What does this mean?

- Theory: supermarkets will go to those that will produce a standard, safe produce with a great deal of reliability (at a reasonable price) …
  - Response worldwide: work increasingly with large, well-managed growers … often larger, well-educated producers …
- Can China's small, poor farmers and China's wineries do this?

[If not, who will? An alternative: imports]

A closer look at China's supermarkets and wine demand

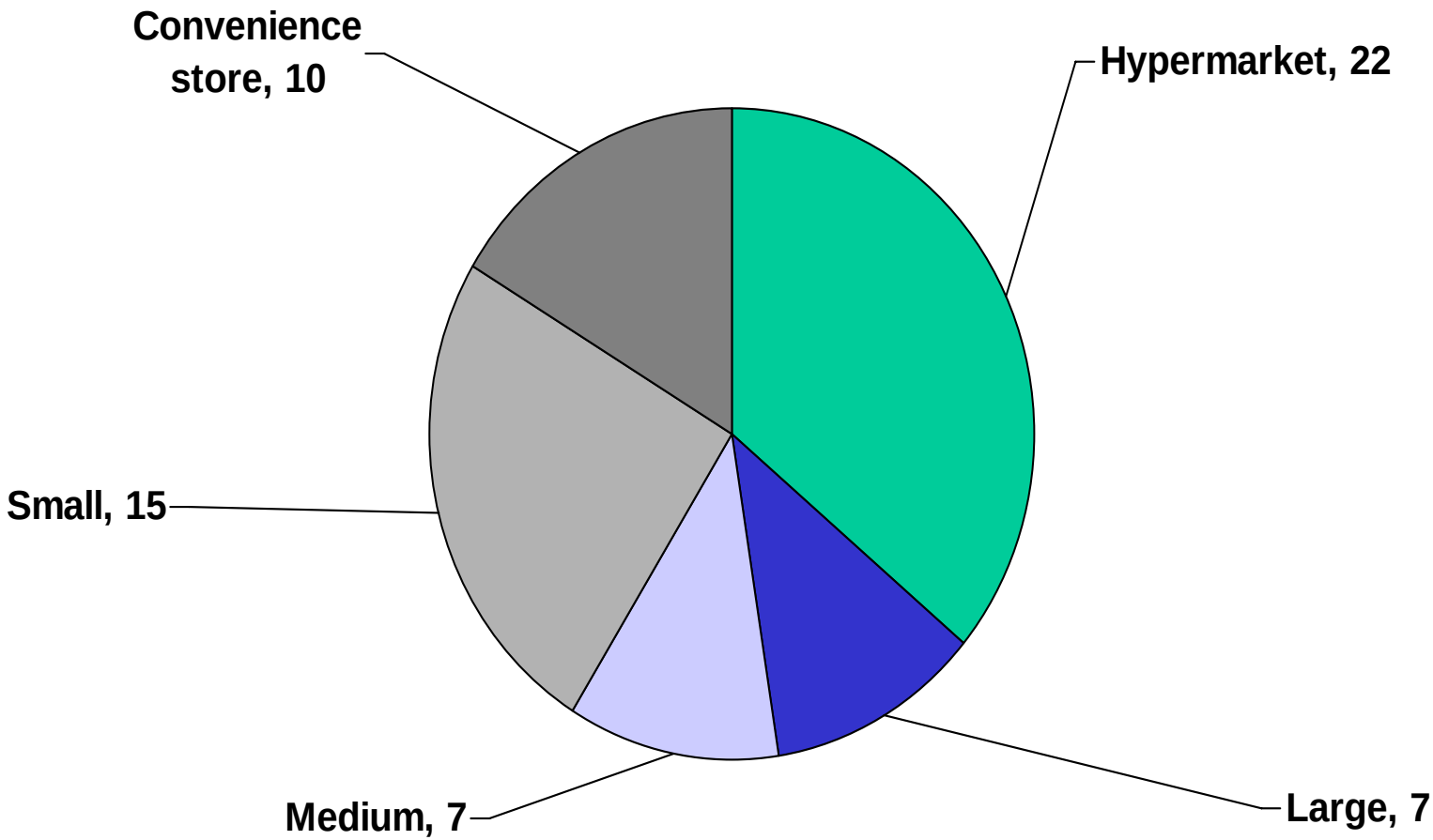
- The Survey
- Wine and China's Supermarkets
- Selling California Wine

2005 China Wine Marketing Survey

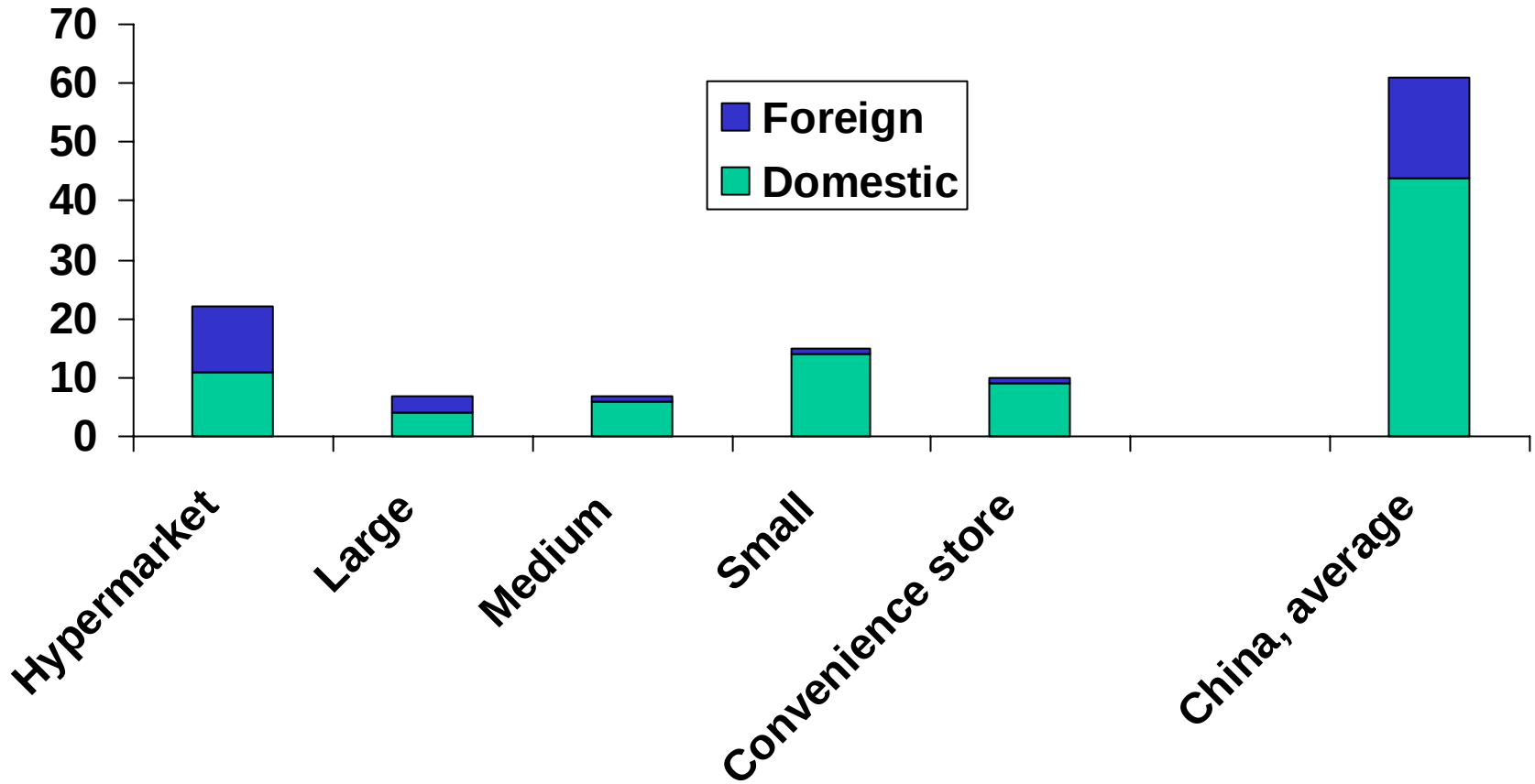
Symbols: * = small city ** = medium-sized city

*** = large city **** = mega-sized city

Number of Stores in Survey, by Type, N=61

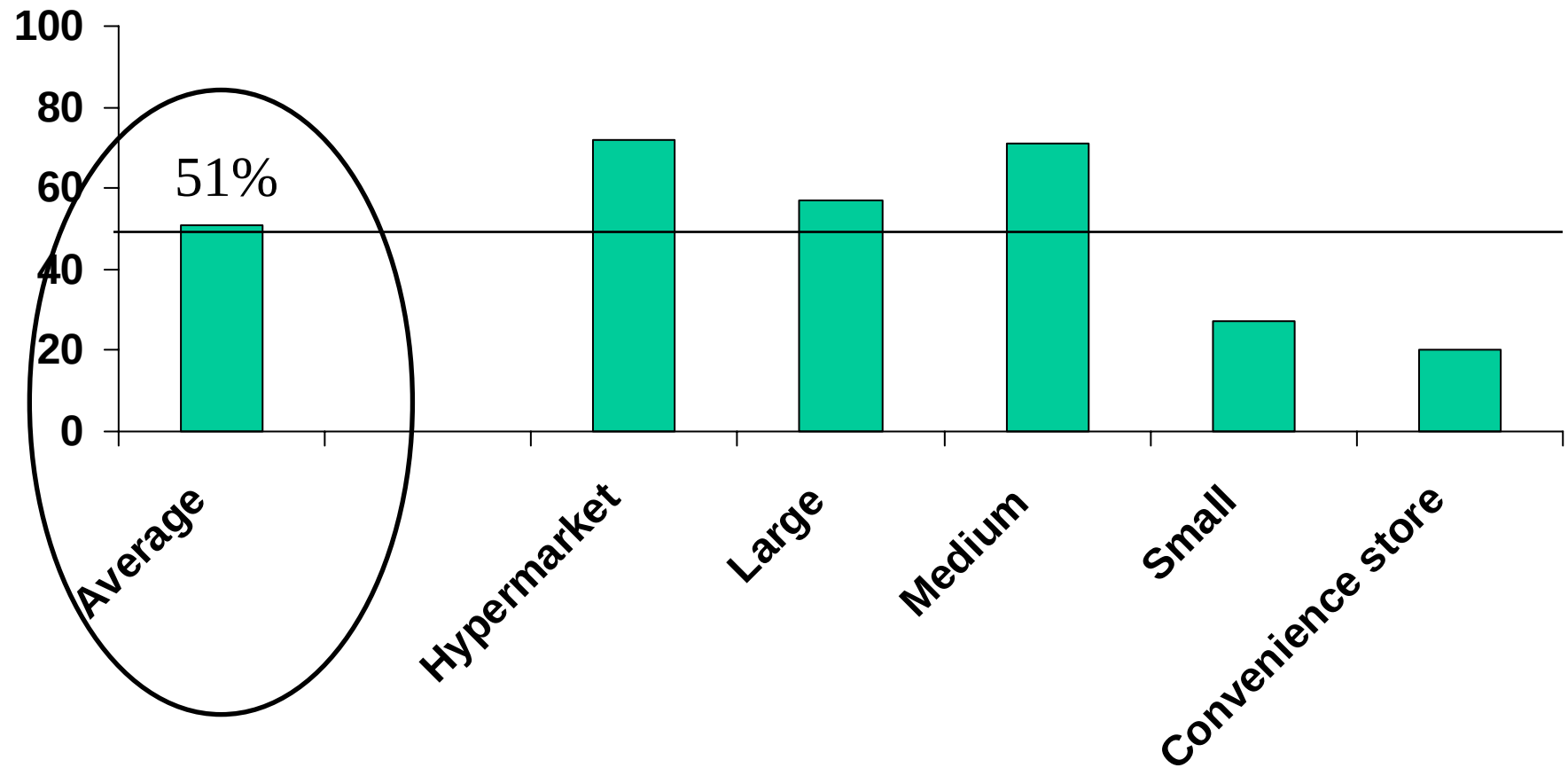


Number of Observations, by Store Type, by Ownership

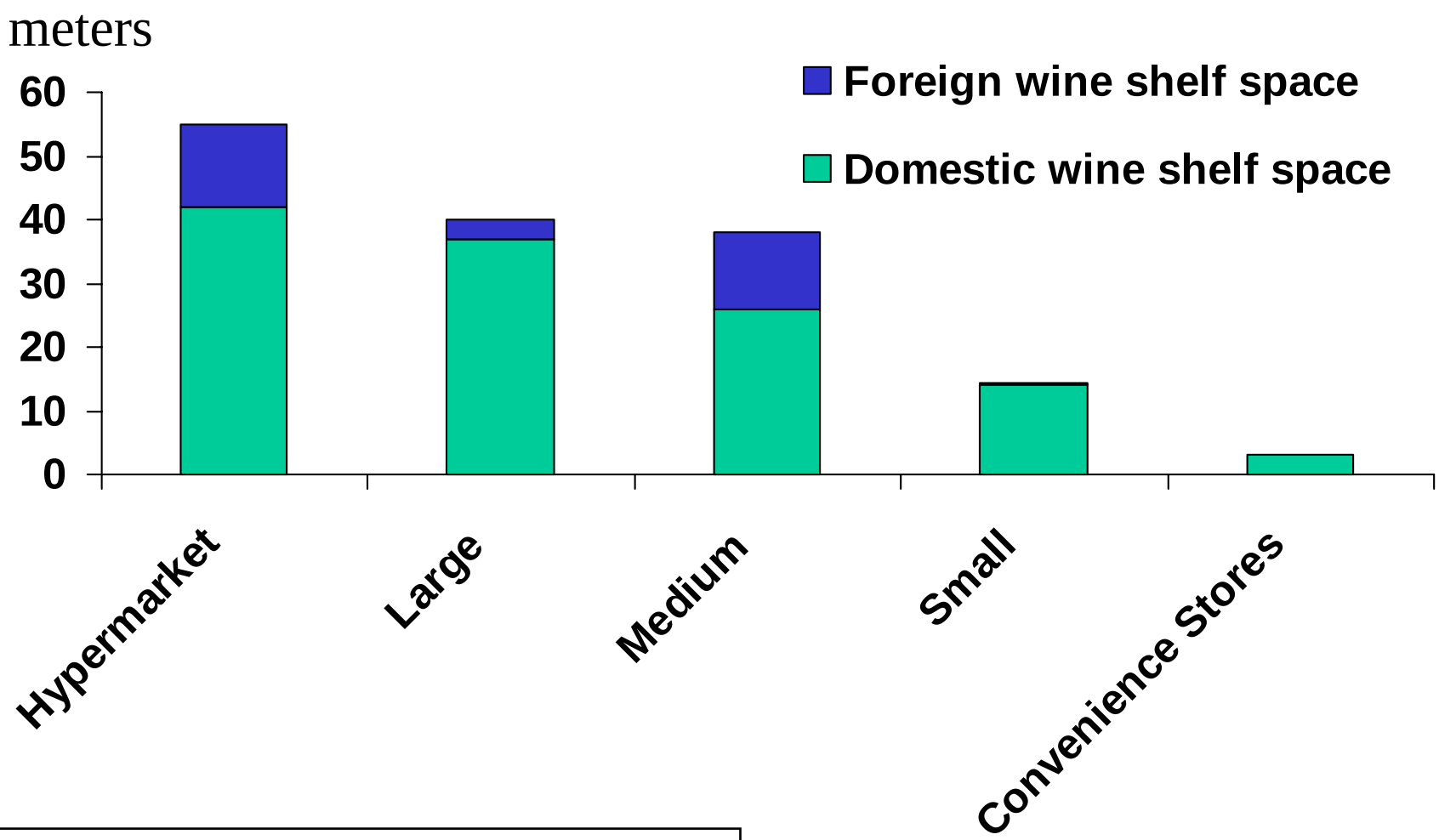


Supermarkets and Foreign Wine

Percentage of Stores that Carry Foreign Wines



Wine Shelf Space—Domestic vs. Foreign



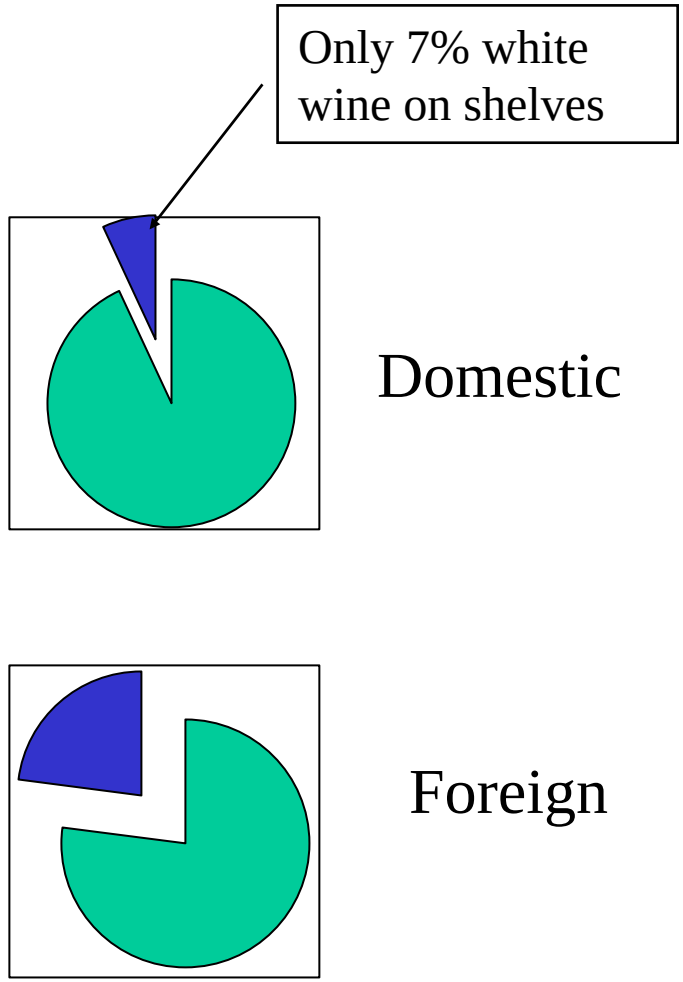
Foreign wines now account for 21% of total wine shelf space

Strong Preference for Red Wines

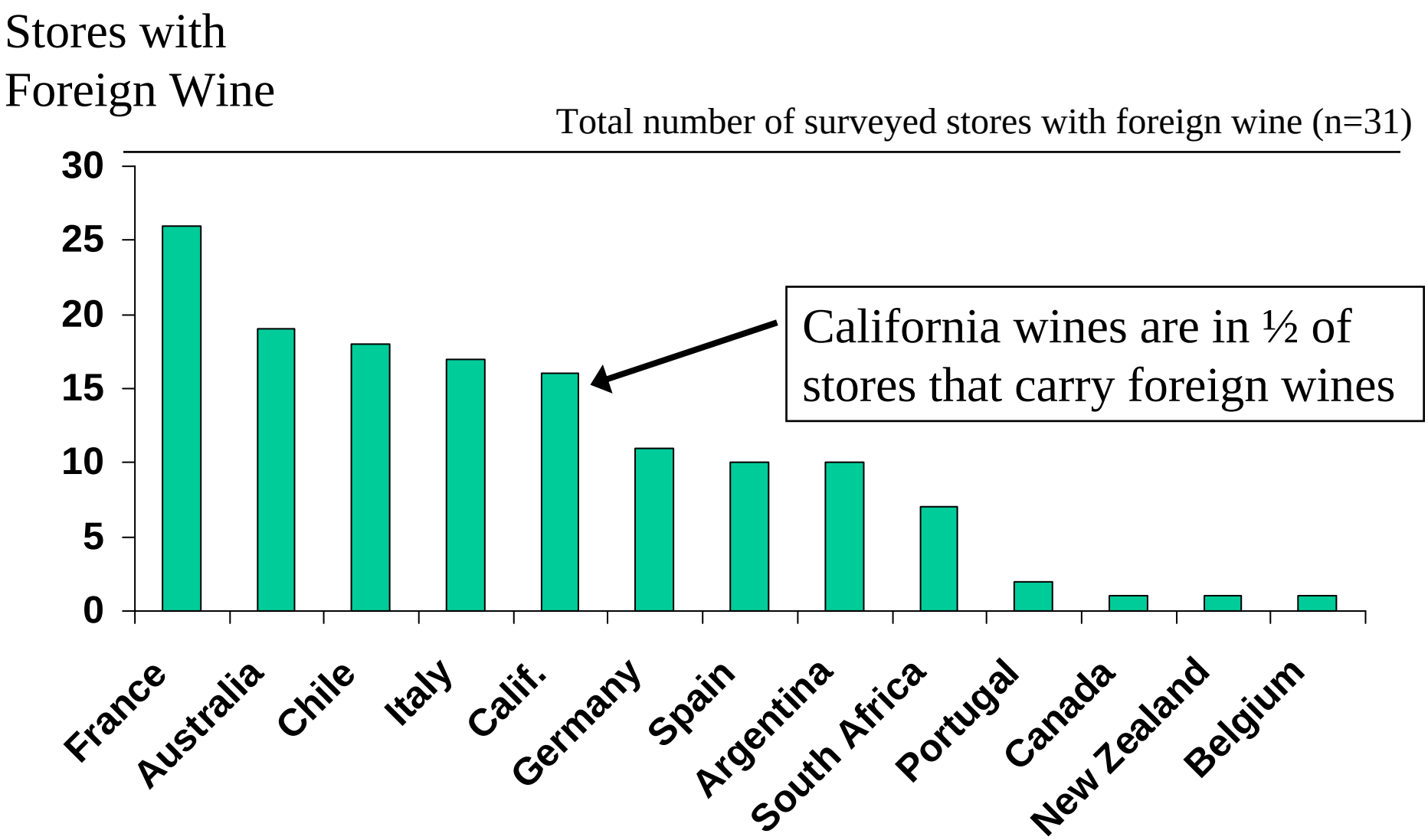
- Red wine paradox:
  - Chinese consumers traditionally like wine that is sweet or that is extremely high alcohol content
  - Liquor > wine
  - Red > white
- So why to consumers want red wine over white?

RESPONSE:

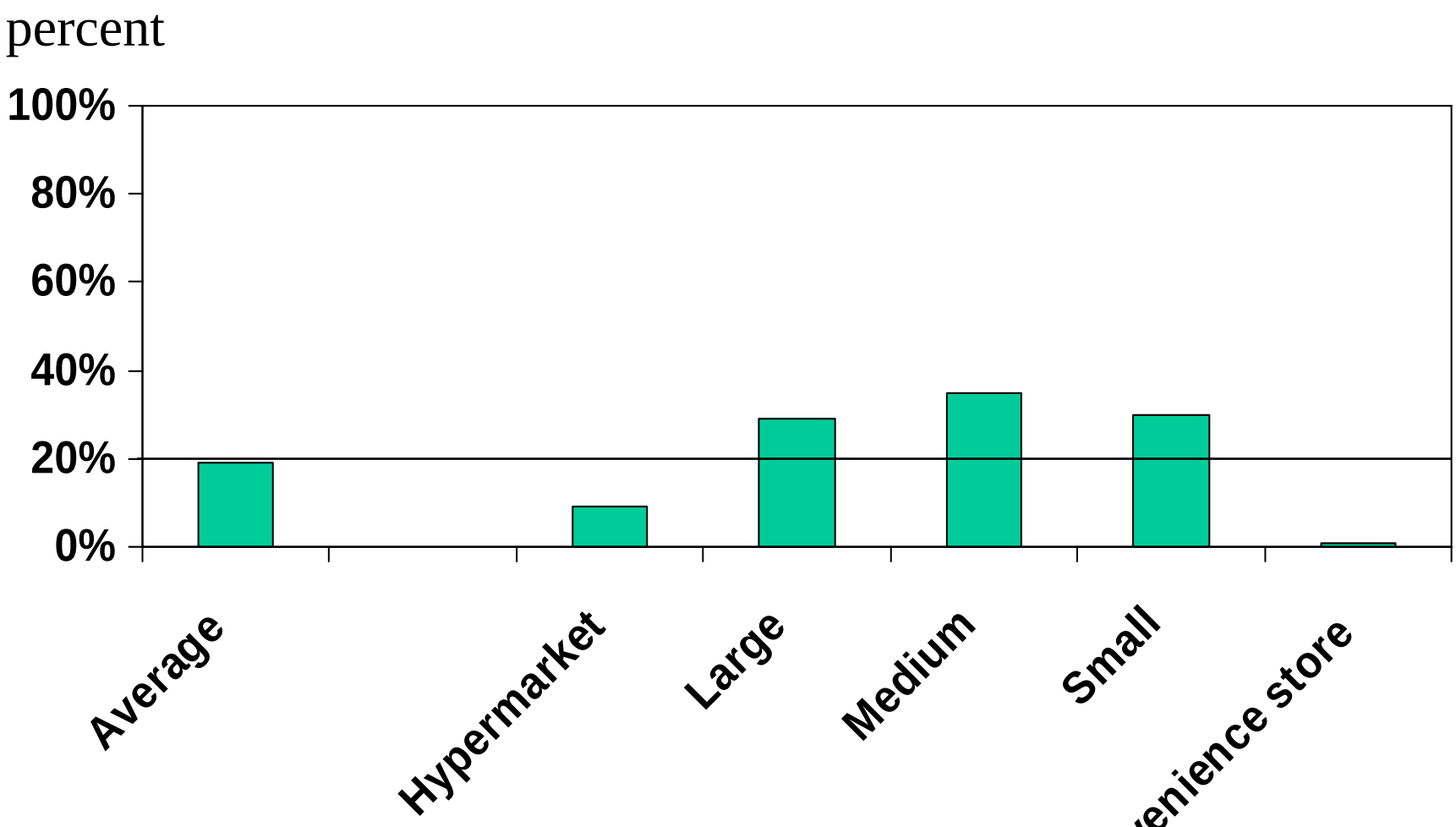
- sometimes will put in ice cubes to dilute … and then even add Sprite to sweeten …
- it is recognized red wine is healthy



California and Foreign Competitors



California Wine Shelf
(in stores that carry California wine)



California wine accounts for 7 to 8 percent of foreign wine shelf space

Table 6. Information on supermarkets that featured California wine as their most prominent foreign wine in China, 2005.

Characteristics		"Beiguo Shopping Center"	"Next Mall"
Formats of the stores		Medium	Large
City		Shijiazhuang, Hebei province	Nanjing, Jiangsu province
Distance to Central Business District	(km)	0.5	1.8
Income level of nearby neighborhood		Relative high	Relative high
Domestic wine space [a]	(m)	50	37
Foreign wine space [b]	(m)	2	8

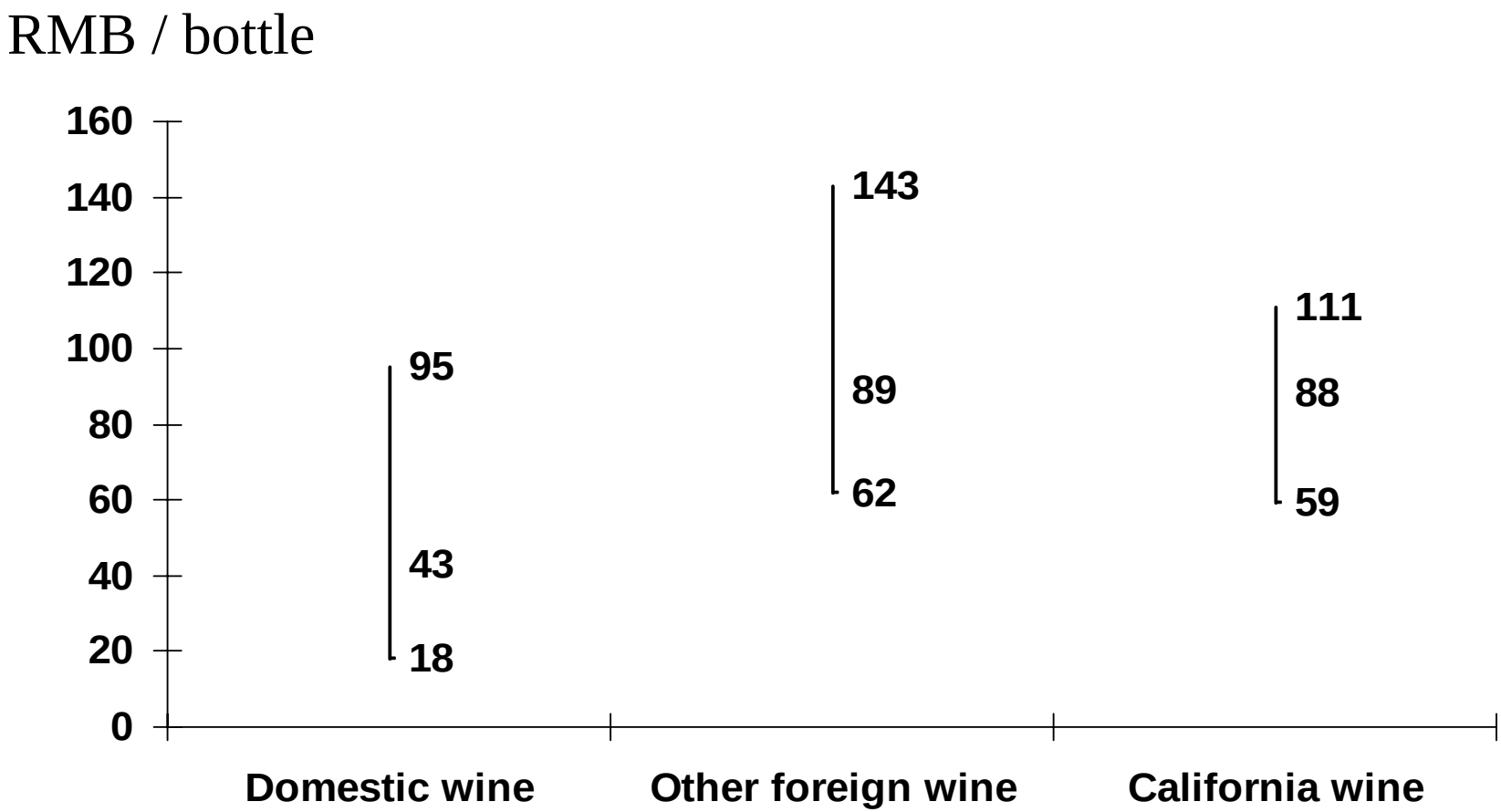
Sales of Domestic and Foreign Wines

- The percentage of sales of domestic wines are even higher than the percentage of shelf space

- Why?

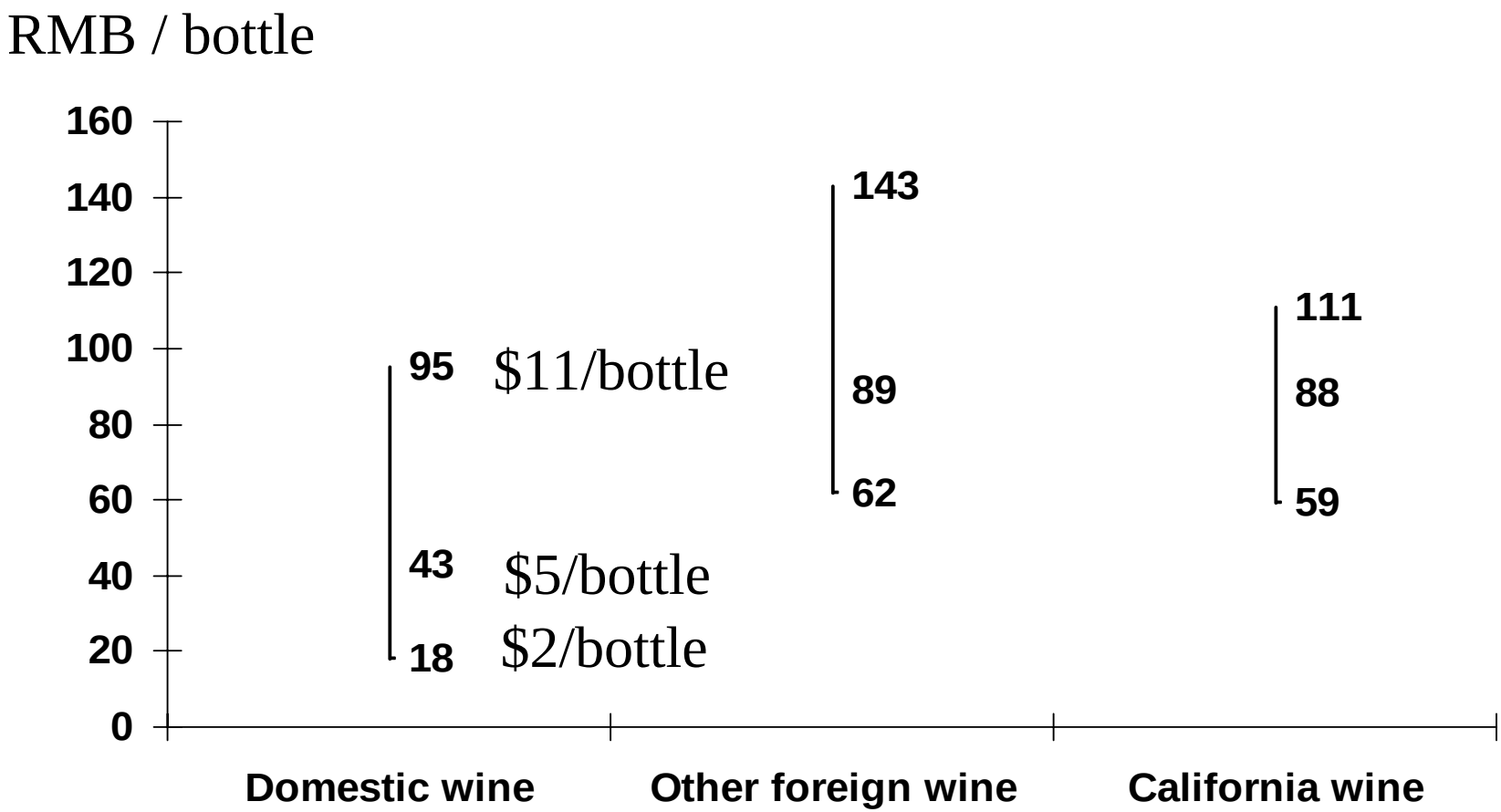
China Wine Prices:

High (90th percentile), Median and Low (10th percentile)



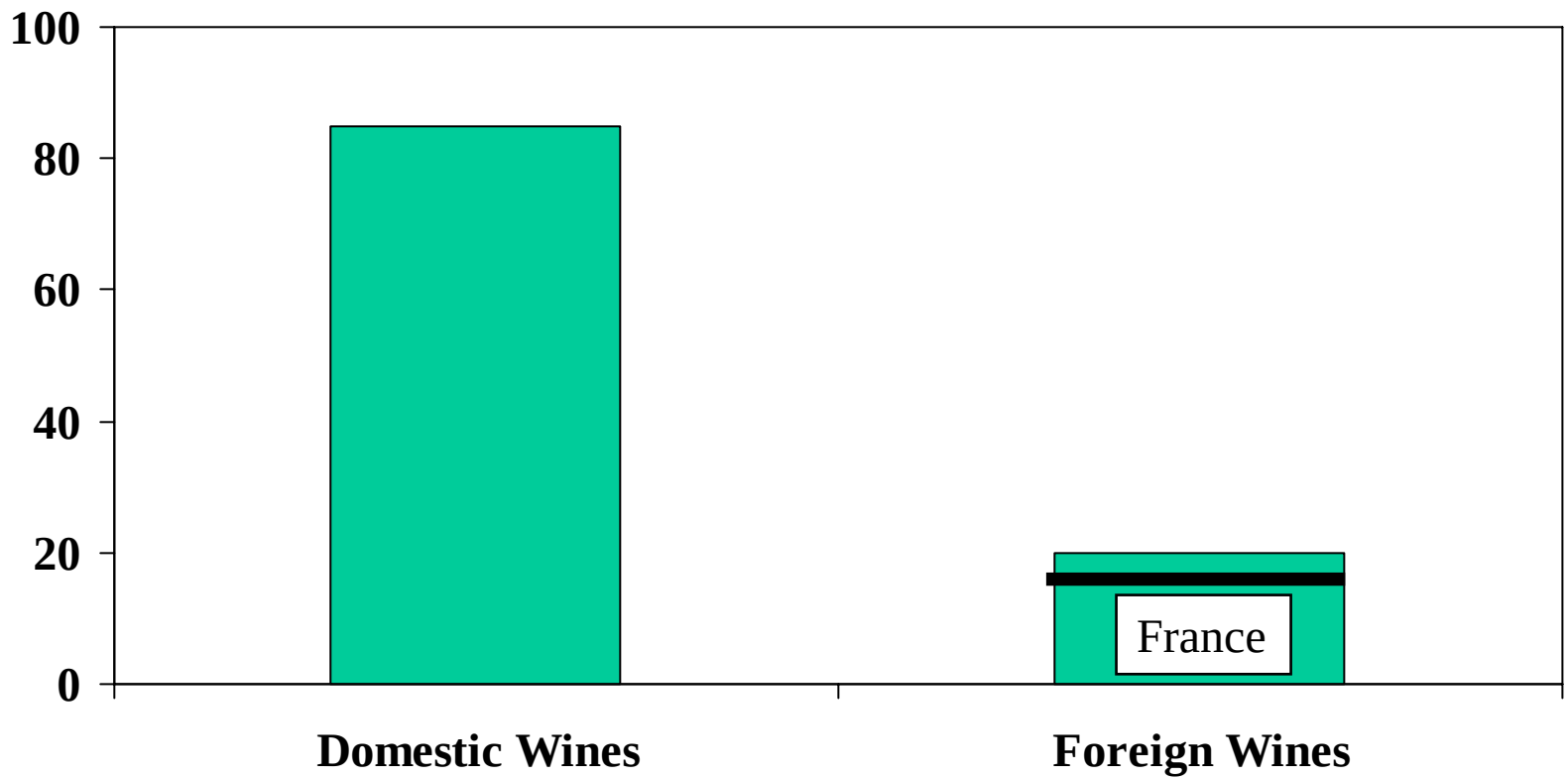
China Wine Prices:

High (90th percentile), Median and Low (10th percentile)



Promotions of wines in supermarkets

Percent of stores that carry domestic/foreign wines

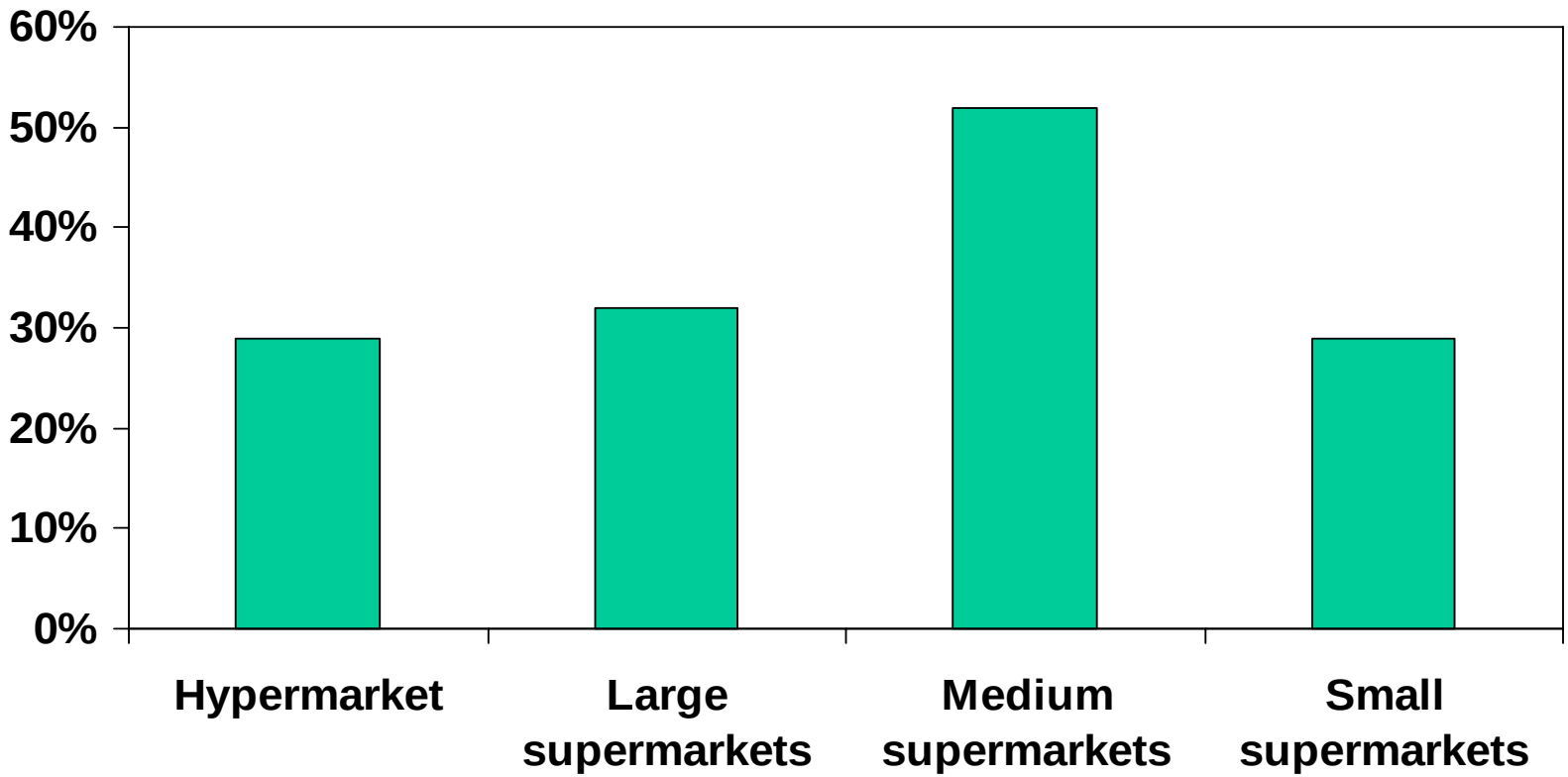


Types of promotions

- Discounted prices
- Buy one / get one free
- Buy one (wine) / get partner product free (my favorite: “Red Bull”)
- Wine tasting
- Can enter prize drawing

Of stores that carry California wine, percent that have special sales promotions: ZERO

Average Discounts for Wine by Store Type (mostly given by domestic wineries)



Key person in the promotion game: Wine department “manager” or “sales person”

- More than ½ of med/large/hyper stores had at least one person assigned 100% of time to the wine department
- Very low level of knowledge (but higher than average consumer)

- Their knowledge of geography / history is worse (which has implications for selling California wines)

Implications?

- Small farmers / small traders
  - Market signals pass directly to farmers (fast)
  - Not very capable to implement or enforce standards/quality product
- With rise of supermarkets / Emergence of “more sophisticated” wine culture / new demand for higher quality product

- Key question: Will China respond? Can they respond? If not, there is huge opportunity in China’s markets

Implications for California Wine Growers and Distributors

- Have to get California “on the mental map” of China’s distributors, retailers and consumers
- “California” sells ➔ Need to promote it
- Constraint appears to be in export/distribution links … ways around?

China's Rapid Economic Growth under Globalization:

Implications for China and the Rest of world

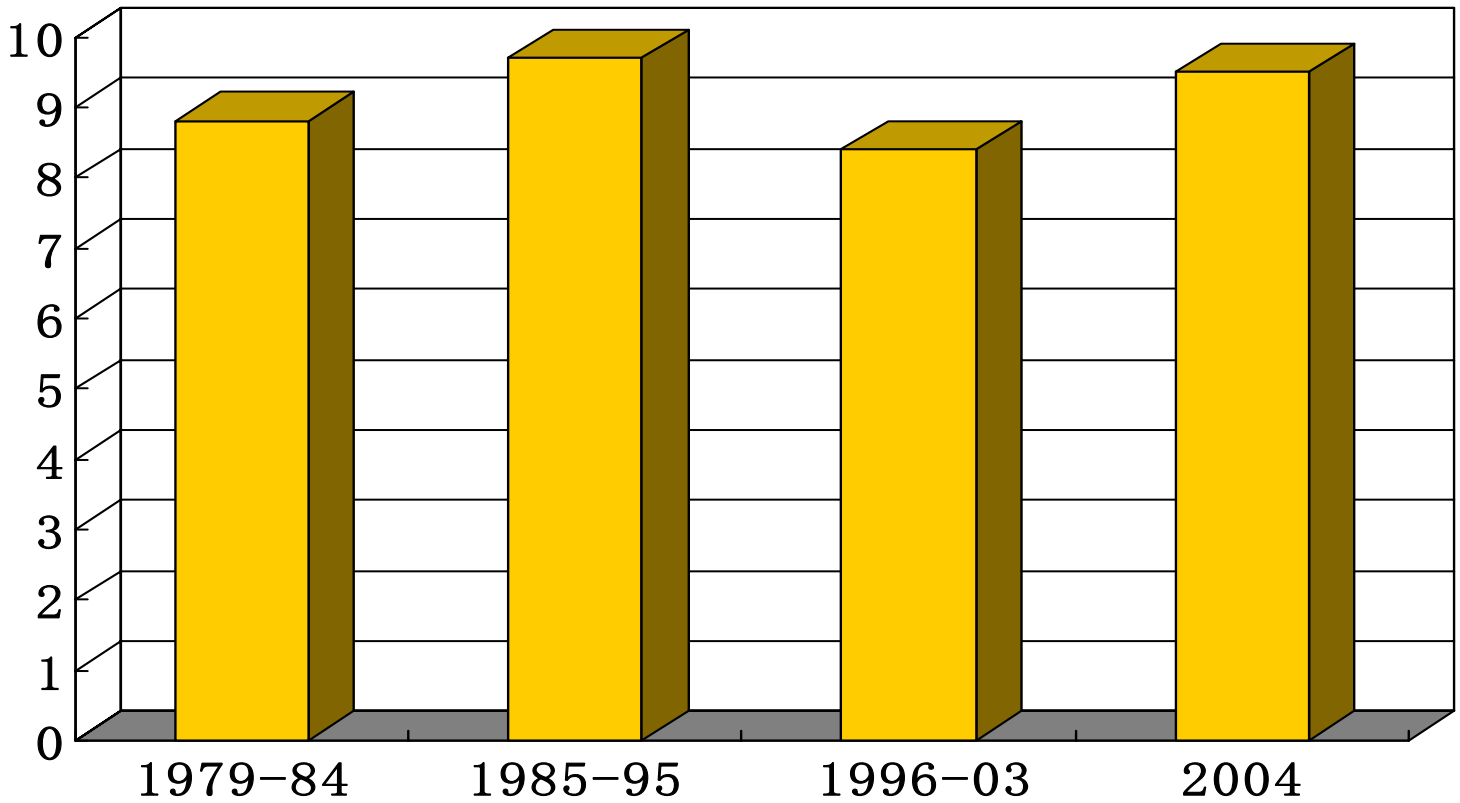
Jikun Huang and Jun Yang

Center for Chinese Agricultural Policy, CAS

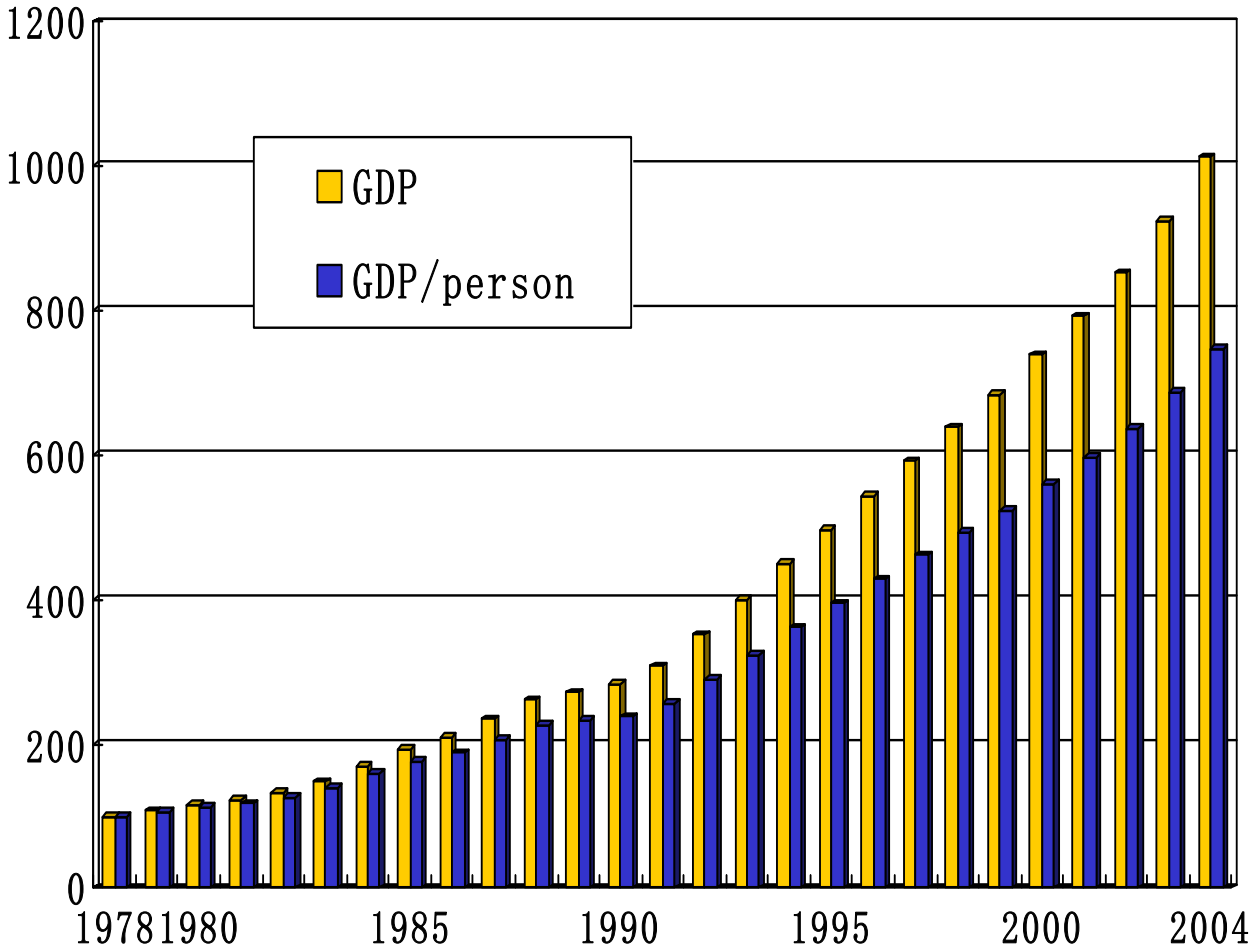
Scott Rozelle

University of California, Davis

China's economy grew at about 9% annually in 1979-2004



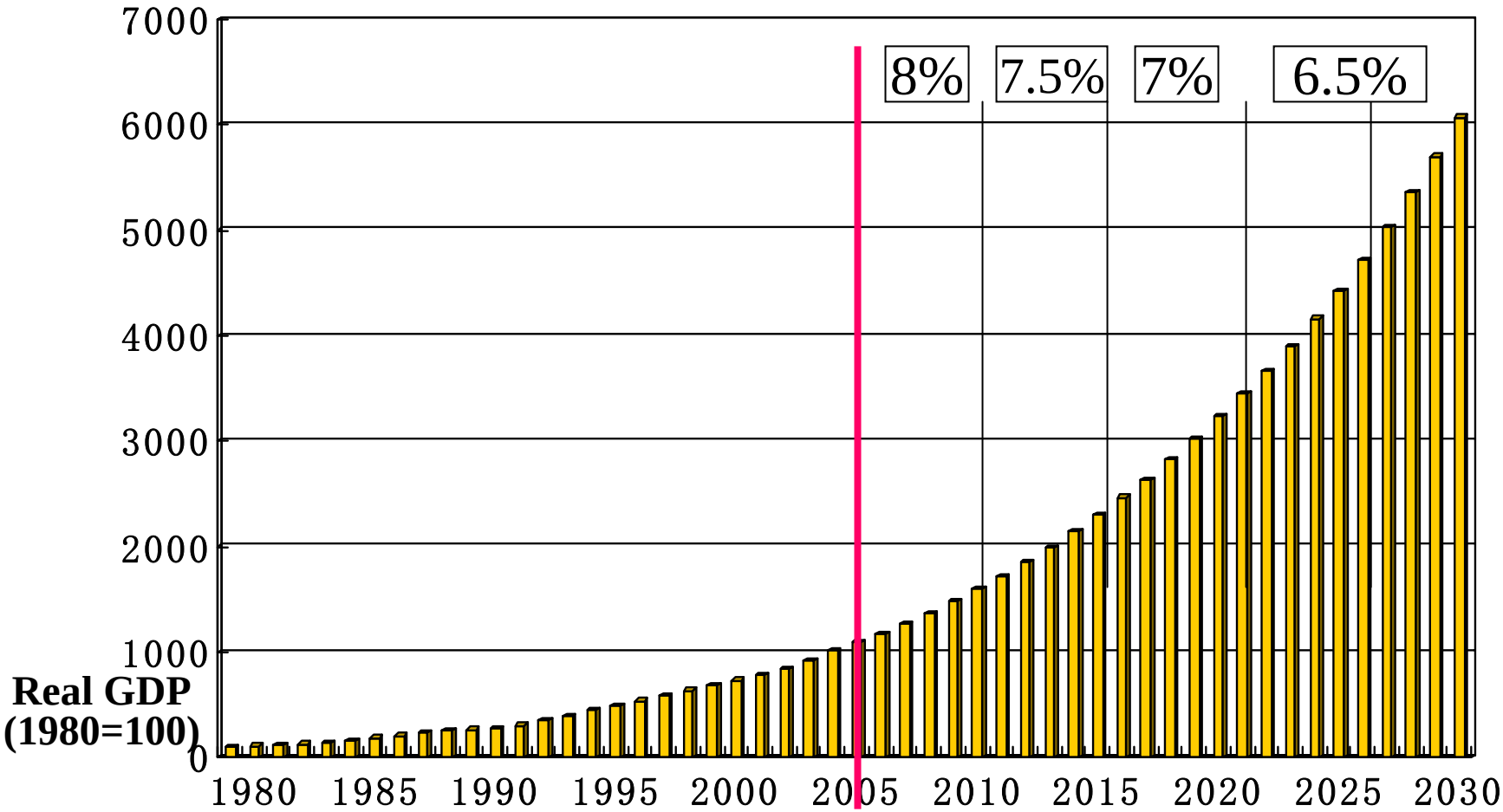
Economy now is more than 10 times as that in 1978



(Export+import)/GDP

10% in 1980 → 60% in 2005

If real GDP will grow as we project, China's economy in 2030 will be about 6 times as large as it was in 2004



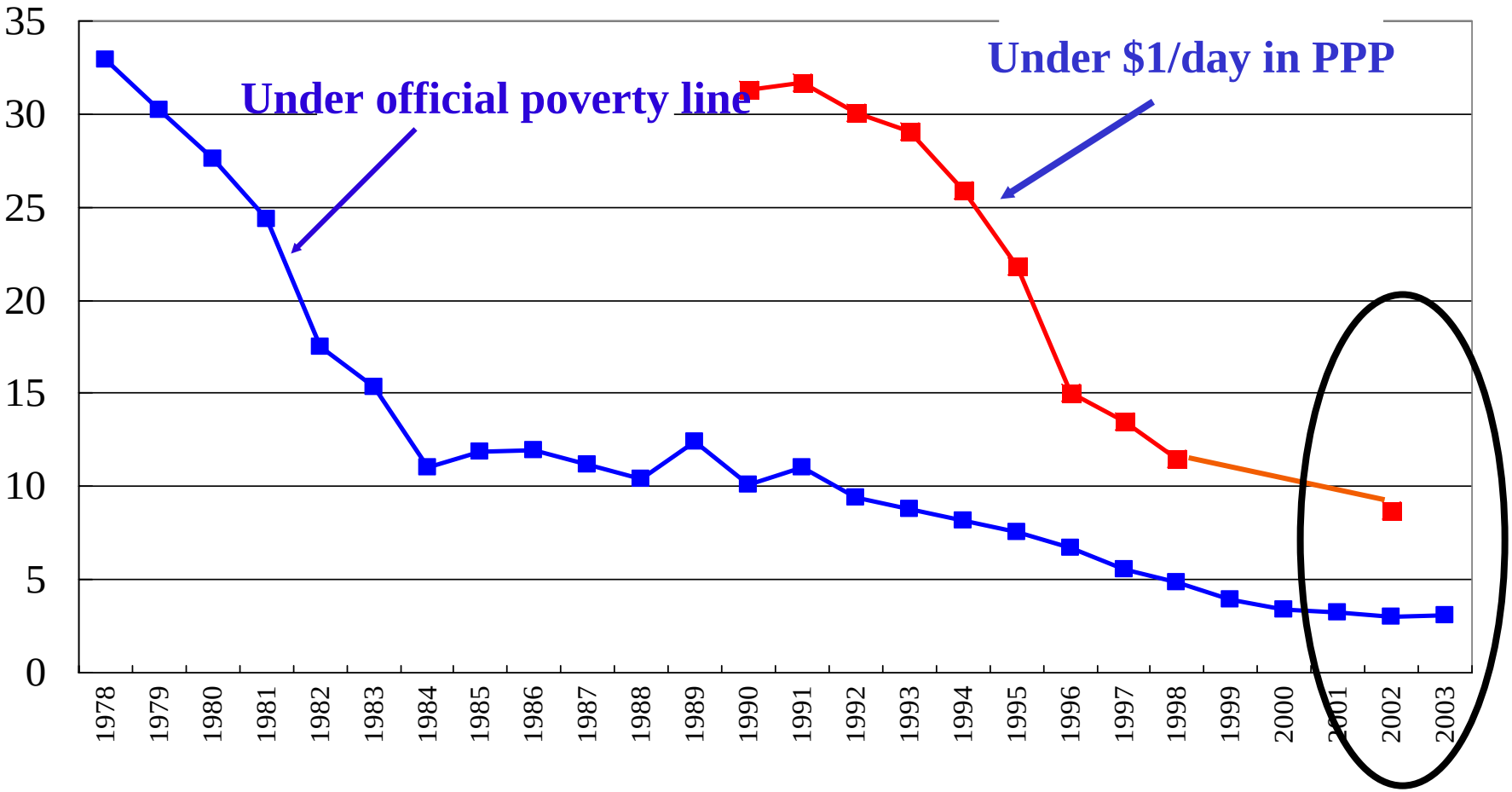
Global Concerns

What will be opportunities and challenges from the rising China's economy for the rest of world through trade … as it is now … as it will be if the China liberalizes further?

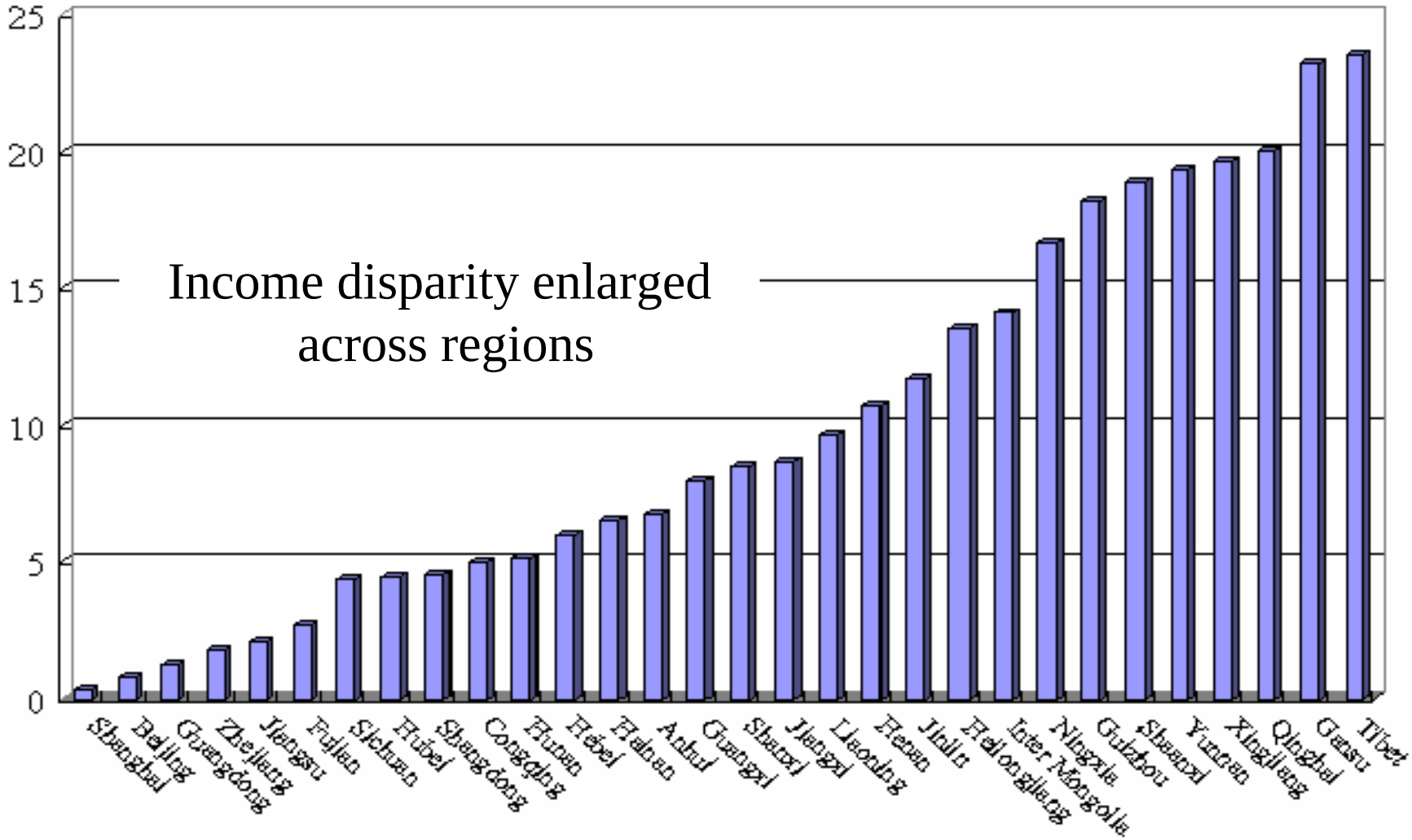
- **Food security?**
- **Resource security?**
- **Overall economic growth?**

China's also has its own concerns about trade liberalization

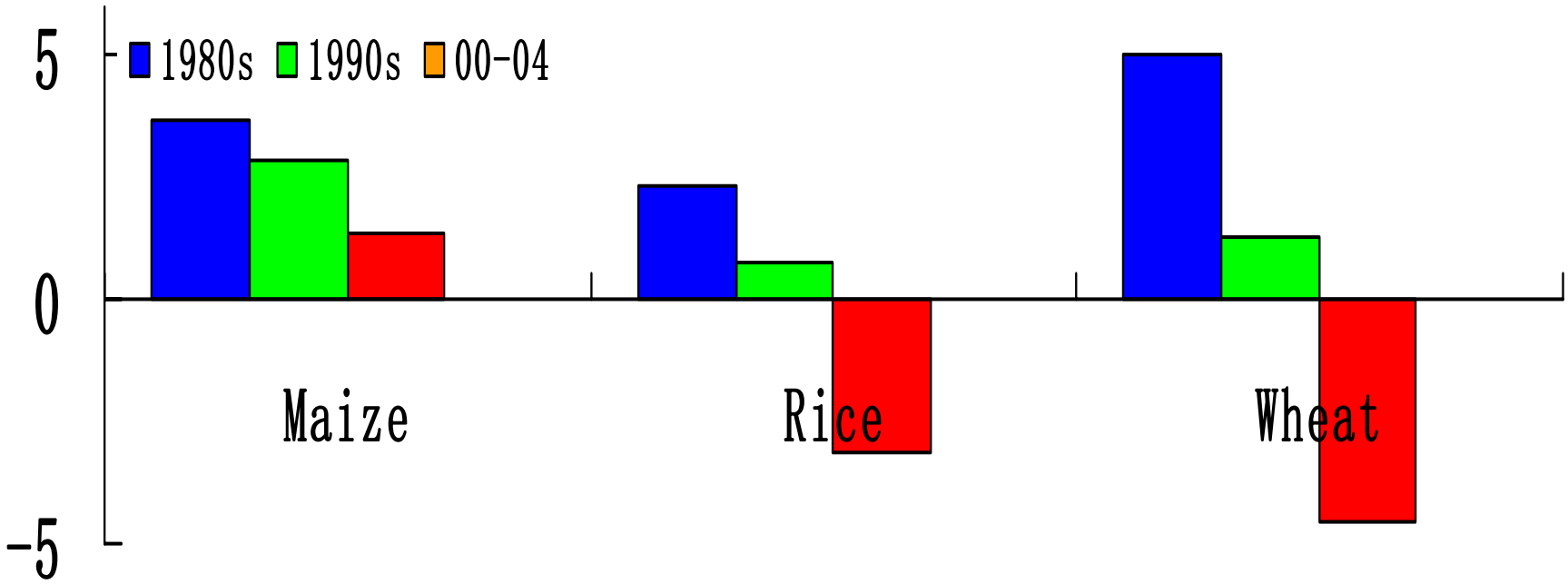
Rural poverty incidence (%) in China, 1978-2003



Shares of rural population lived under $1/day (in PPP) vary substantially across provinces (2003)



Annual growth rates (%) of maize, rice and wheat production in China, 1980-2004



Slowdown of grain production, China's WTO accession and further trade liberalization have led to many concerns on food (grain) security and farmer's income

China's Concerns on Trade Liberalization

"5 Balanced Growths"

- Grain security + farmer income
- Growth + equity
- Development + resource/environment
- China itself + ROW (rest of world)

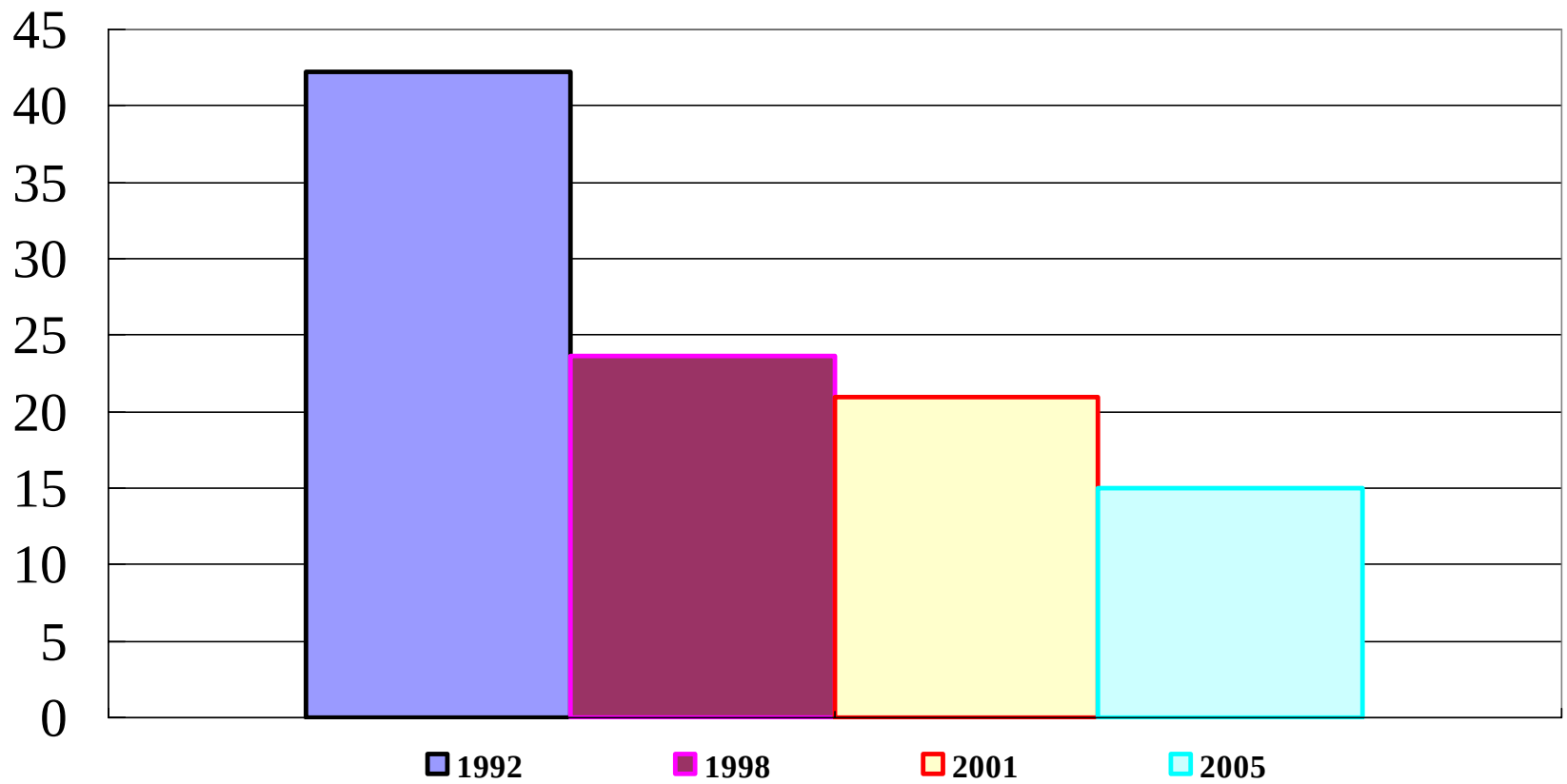
Outline for the rest of presentation

- **Trends of China's trade liberalization**
- **Methodology**
- **Impacts of trade liberalization in China on:**
  - **Overall economy**
  - **Food and agriculture**
  - **The poor**
- **Implications of China's rapid growth for ROW**
- **Concluding remarks**

Agricultural tariff rate (%):

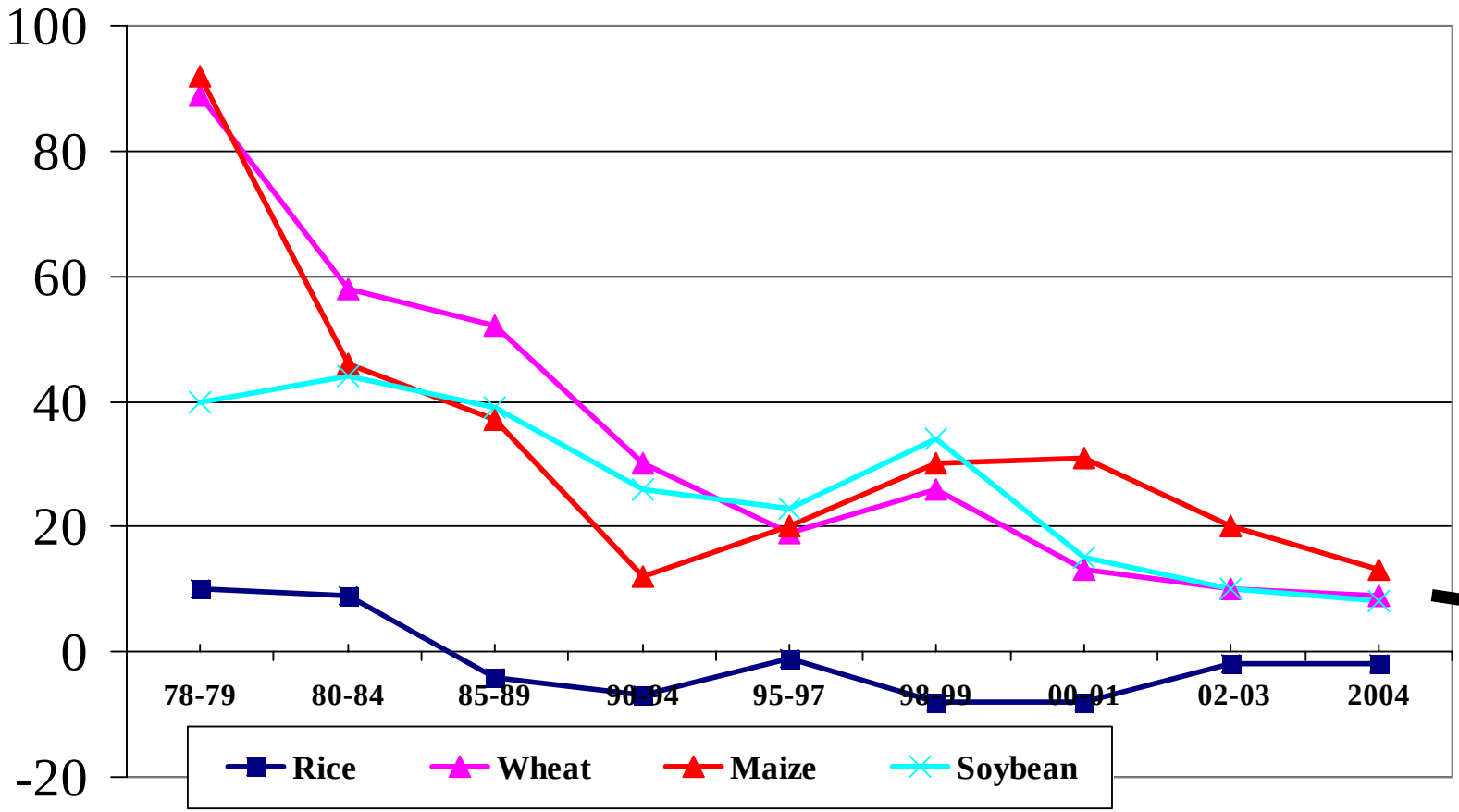
Prior to WTO accession, 1992-2001: 42.2%→ 21%

WTO commitment, 2001-2005: 21%-15%

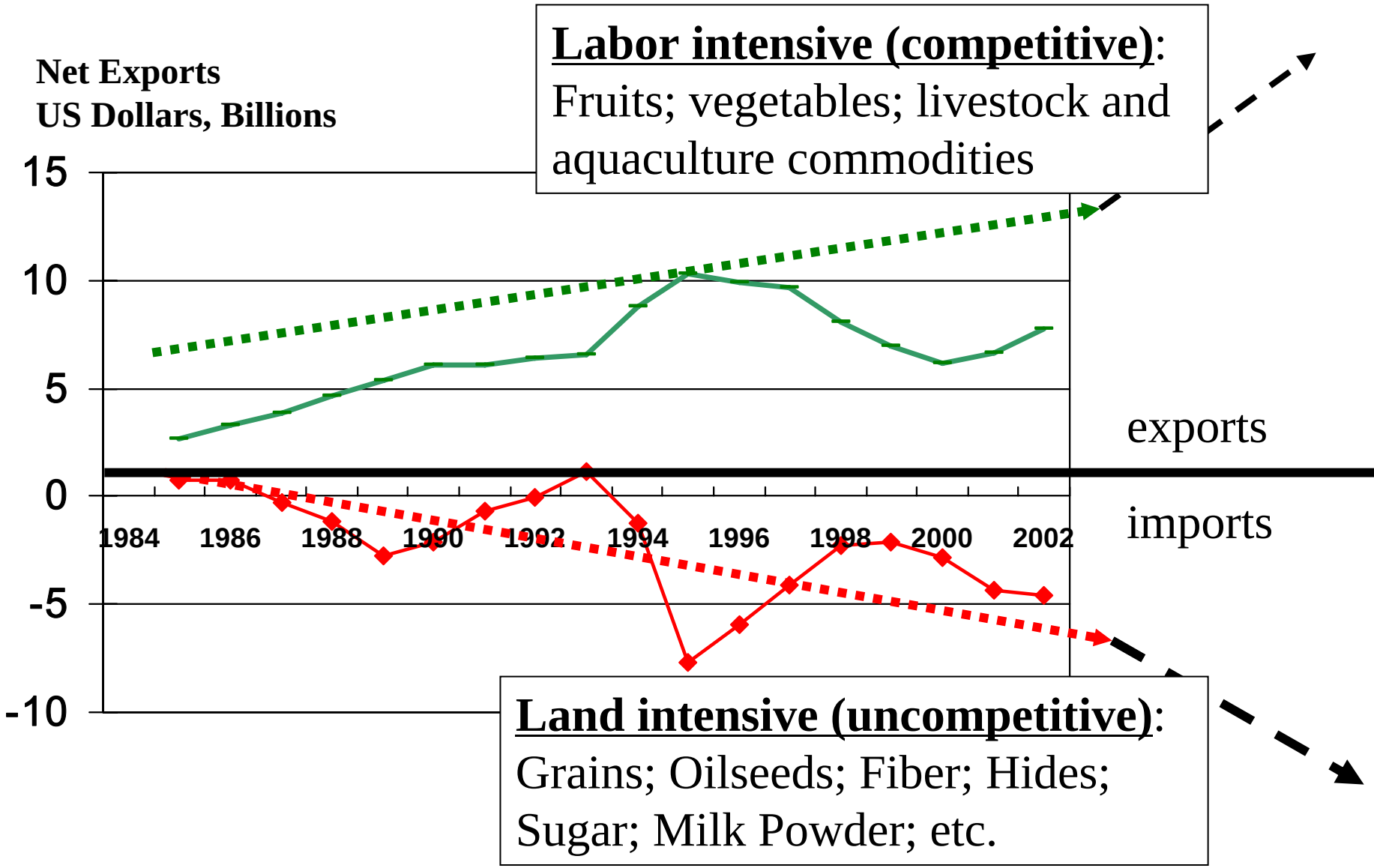


Nominal Protection Rates (NPR) for cereal and soybean

$(P_d-P_w)/P_w$ x 100

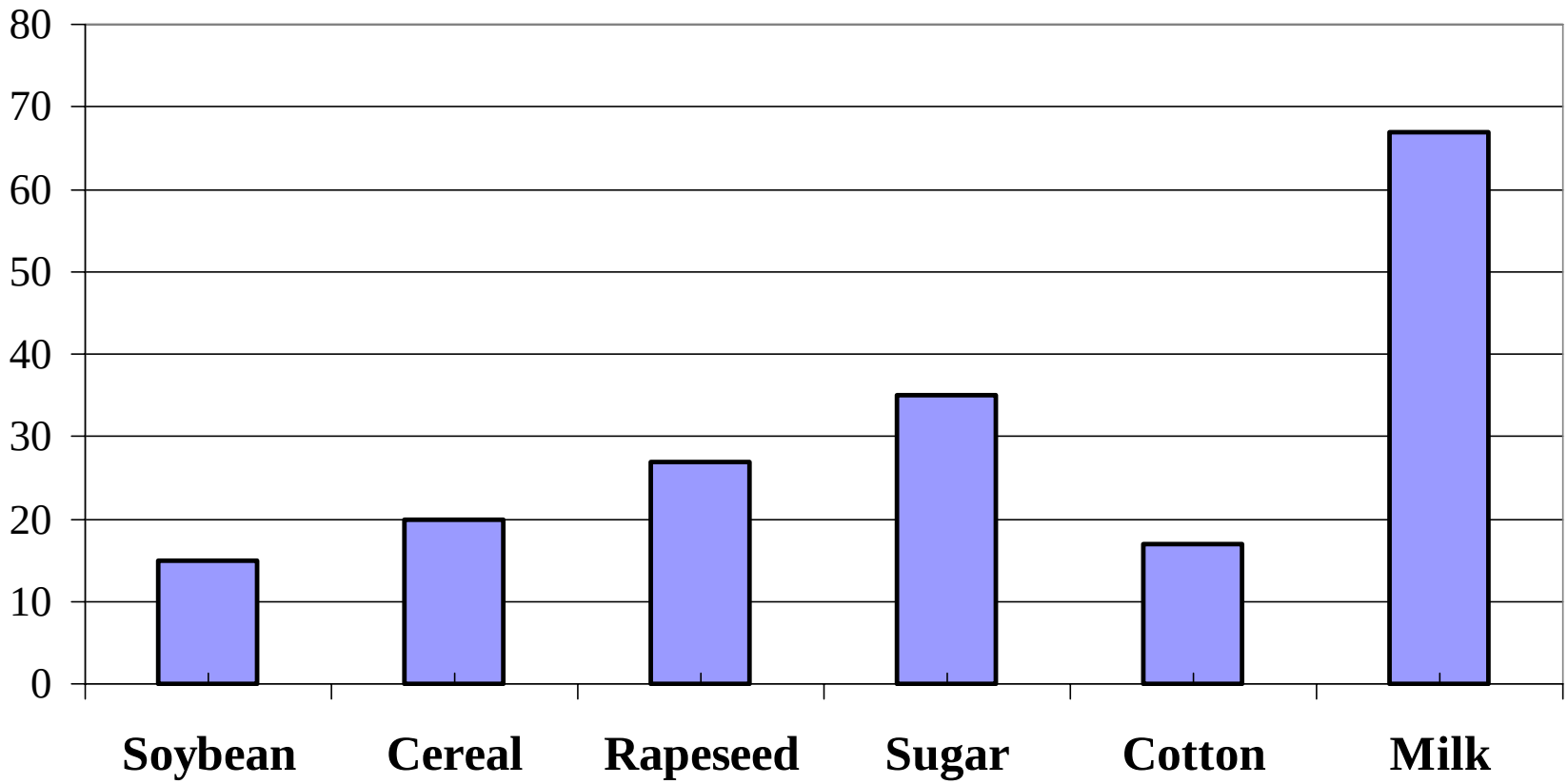


Agri. Trade Balance by Factor Intensity (mil US$)

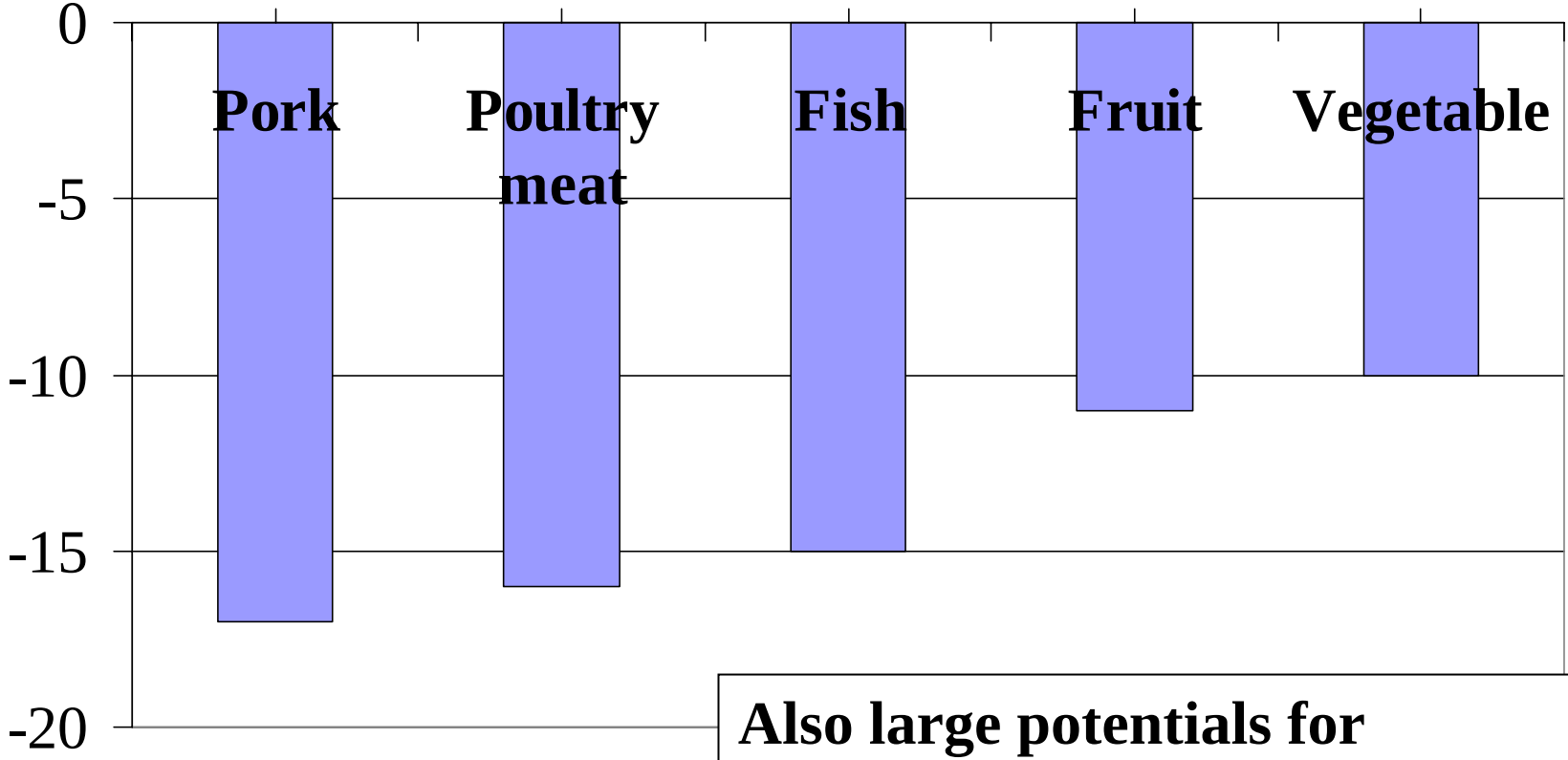


NPRs (%) for land-intensive products (uncompetitive), 2001

Percent above world market prices



NPRs (%) for labor-intensive products (competitive), 2001



Percent below world market prices

Also large potentials for increasing exports of commodities in which China produces at below market costs

Methodologies

- **GTAP (Global Trade Analysis Program)**
  - **Impacts of trade liberalization on China**
  - **Impacts of the rapid rising China's economy in the rest of world**

- **CAPSiM, Partial equilibrium**
  - **Impacts of trade liberalization by region**
  - **Impacts of trade liberalization on different household**

Scenario 1: trade liberalization

- **Baseline**

  (no WTO accession)

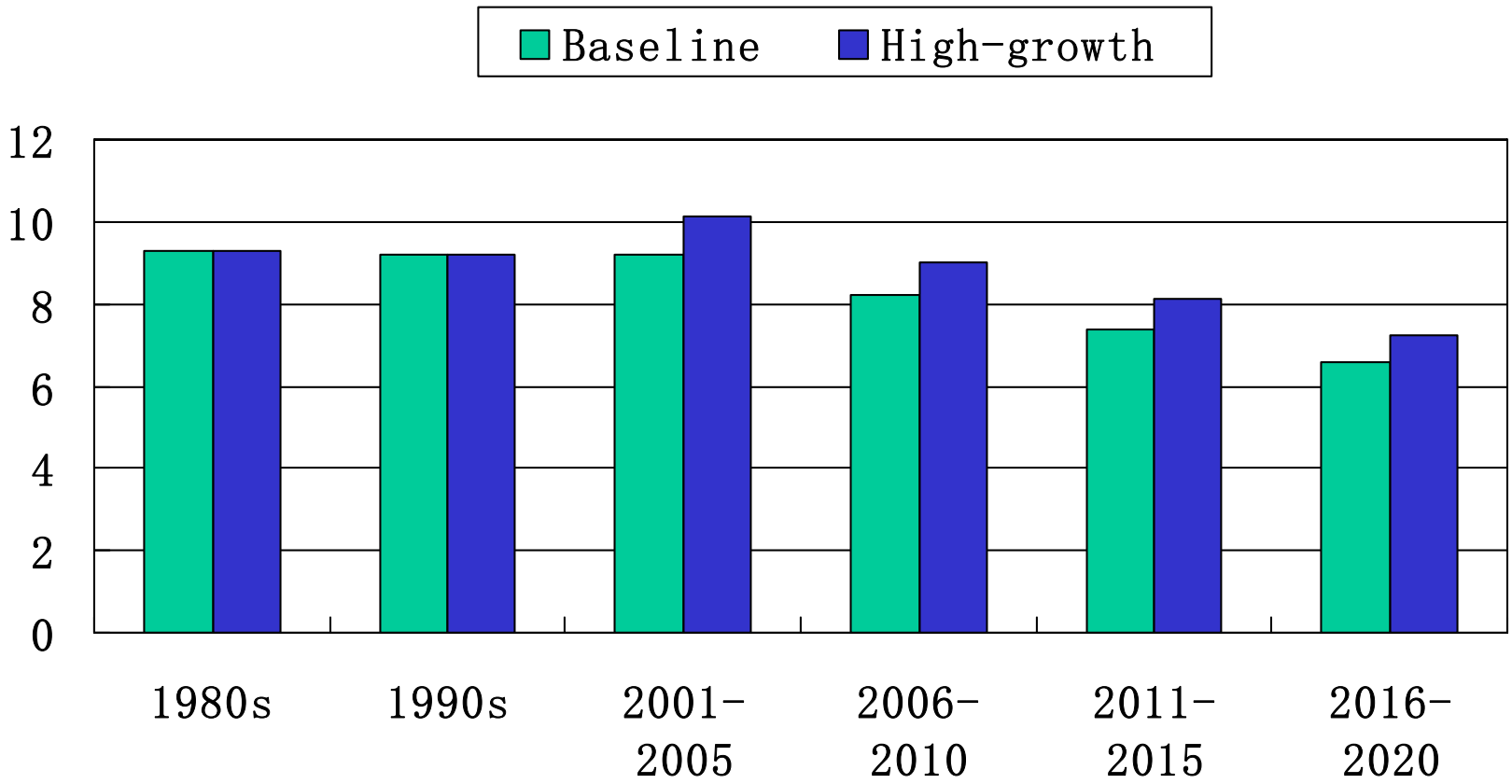
- **Trade liberalization**
  - **WTO accession**
    (2001-2005)
    actual
  - **Doha Round**
    (2006-2010)
    mixture of Cairns/USA/EU proposals

Scenario 2: the rising China's economy

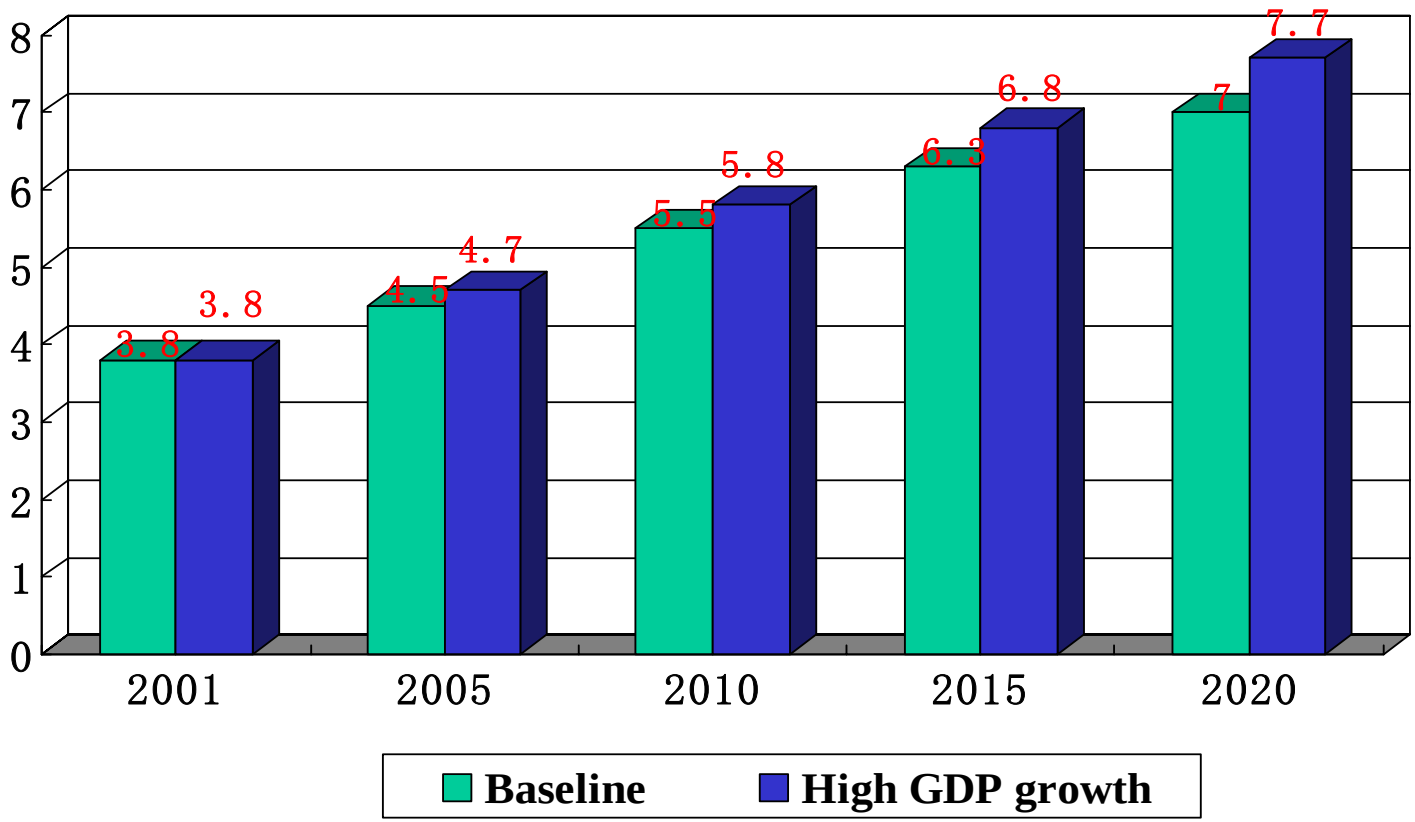
- **Baseline**

- **High GDP growth (10% higher in growth rates)**

Assumptions of Annual GDP growth (%)



China’s GDP share in the world



Scenario 2: the rising China's economy

- **Baseline**

- **High GDP growth (10% higher in growth rates)**
  [PLUS further simulations]
  - **"No policy response" versus "Active policy response"**

    ✓ **higher productivity growth in food sector** (0.47% per year)

    ✓ **promoting energy saving technology**
    (the bias technology improvement in China's manufacture and service sectors in energy saving, -0.47% per year)

Results

- **Impacts of trade liberalization in China**

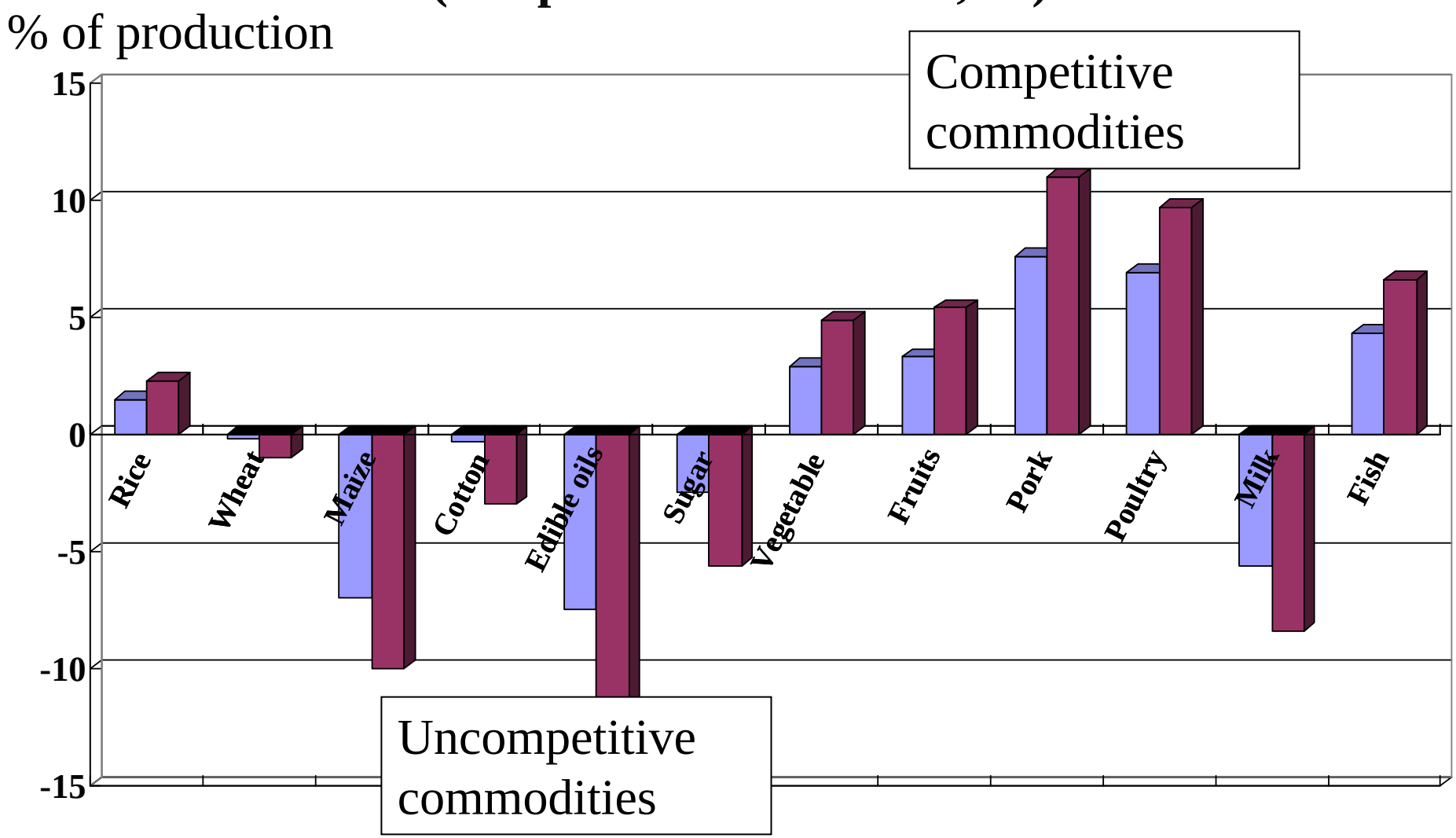
Scenario 1:

Impacts of China's Trade Liberalization, 2010 (compared with baseline, %)

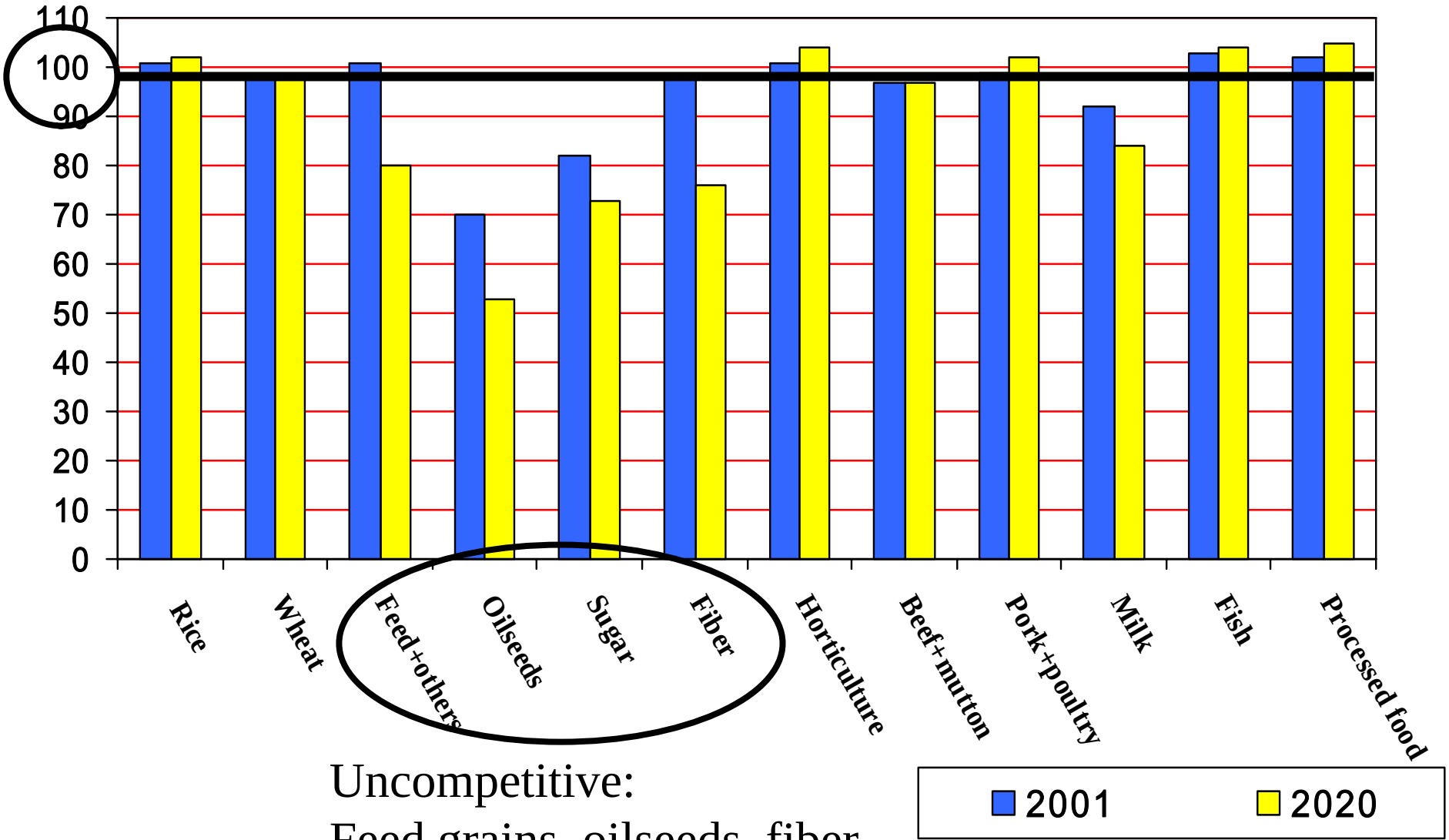
OVERALL: CHINA GAINS!

- **National income: + 8 billion US$, +0.8%**
- **Agricultural production: +3% to +4%**

Impacts of China's Trade Liberalization: Chang in agricultural production between 2005 and 2010 (compared with baseline, %)

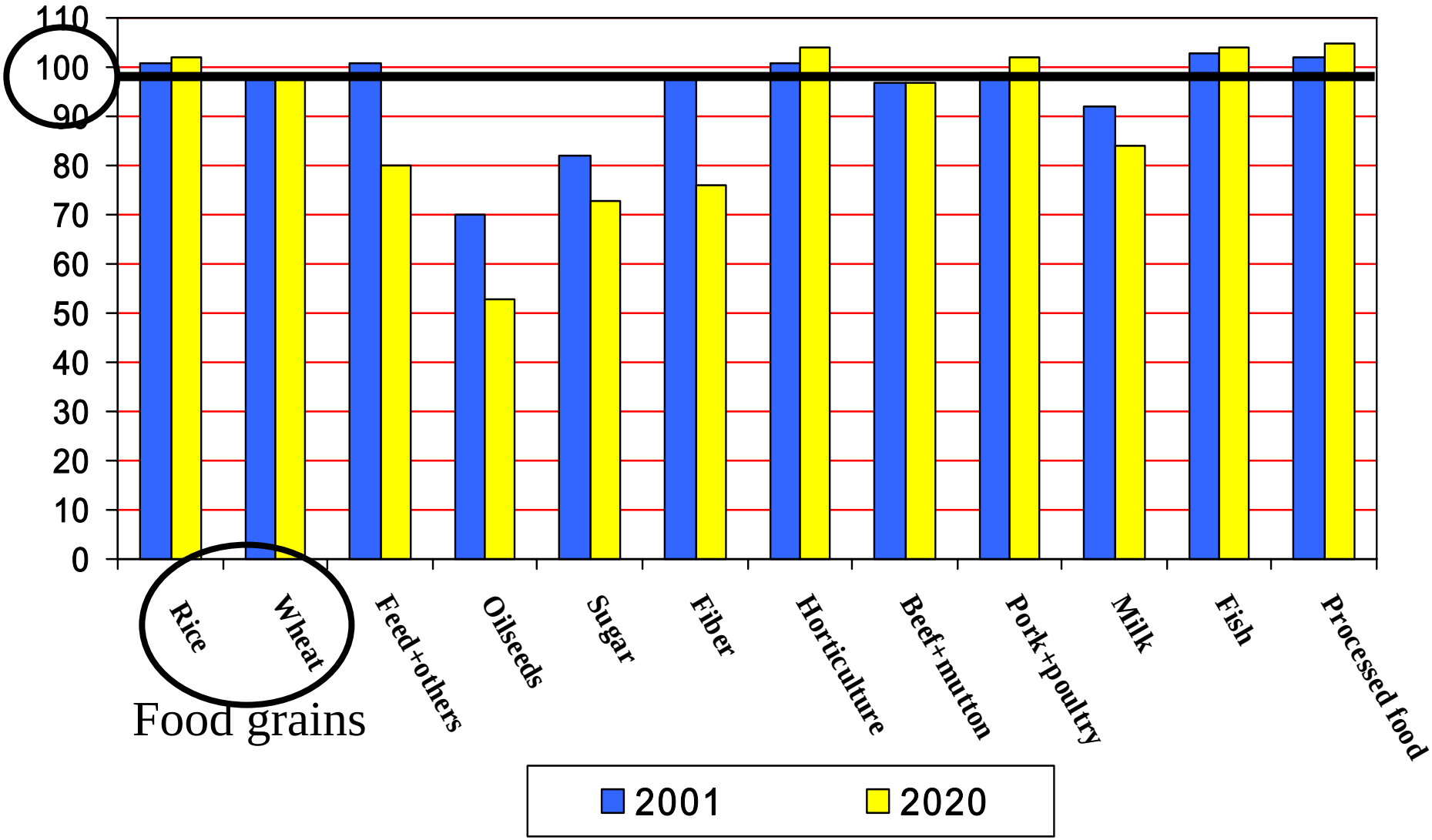


Self-sufficient levels (%) of food, feed and fiber

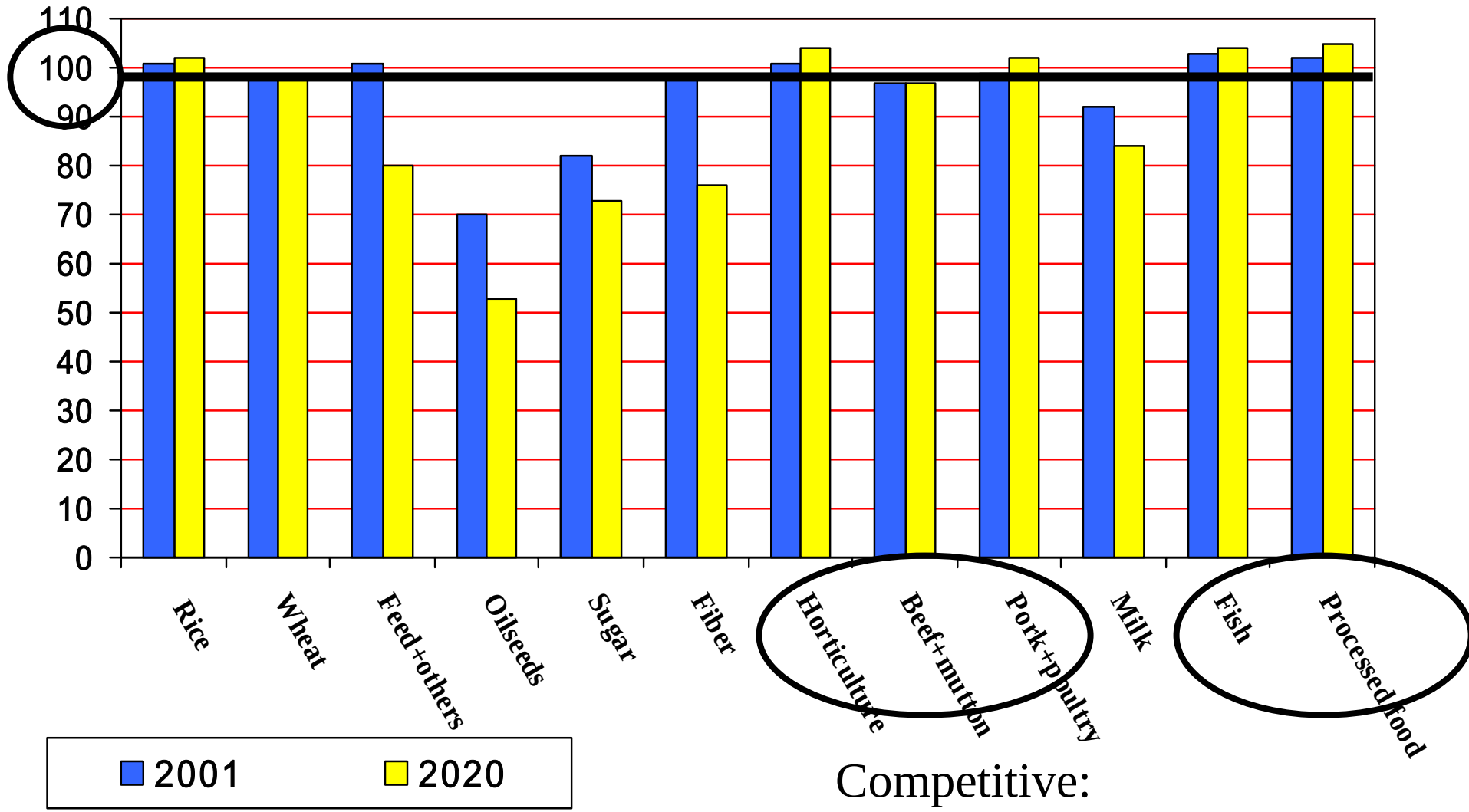


Uncompetitive:
Feed grains, oilseeds, fiber

Self-sufficient levels (%) of food, feed and fiber
"Will China Starve the World?"

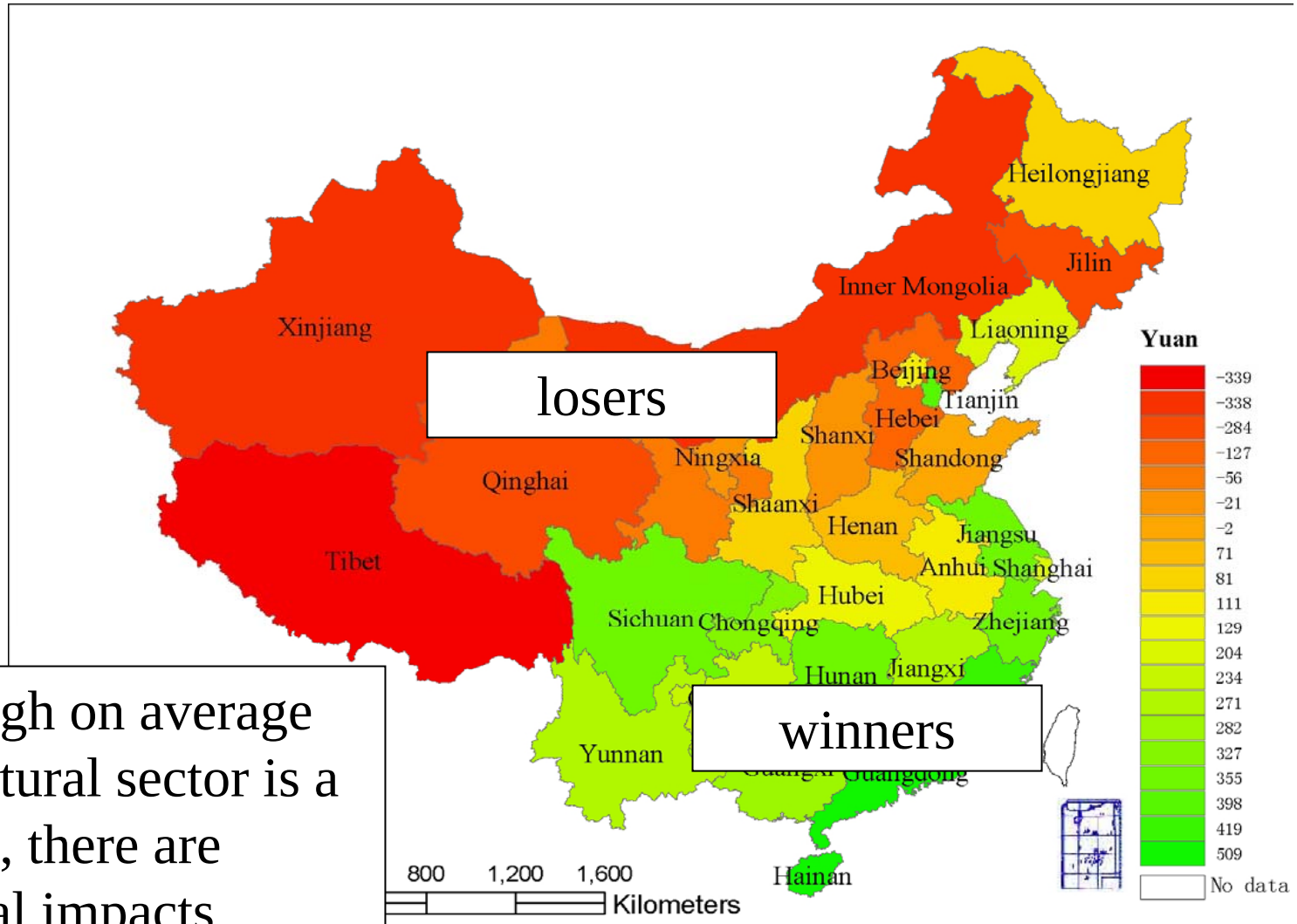


Self-sufficient levels (%) of food, feed and fiber



Competitive:
Fruits / vegetables and processed foods

Impacts of WTO on agri. output for average farm by province in China, 2005 (%)

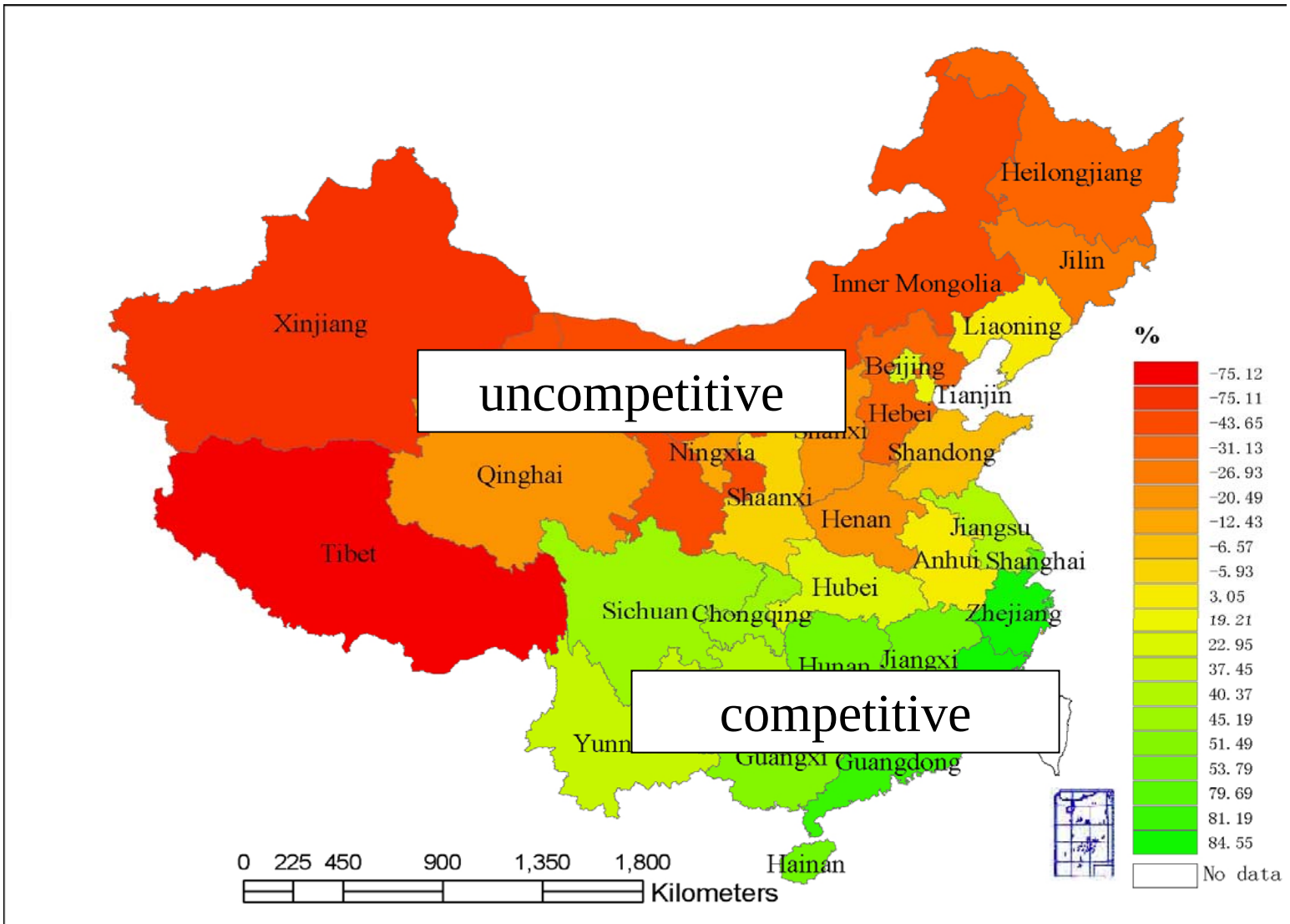


lose

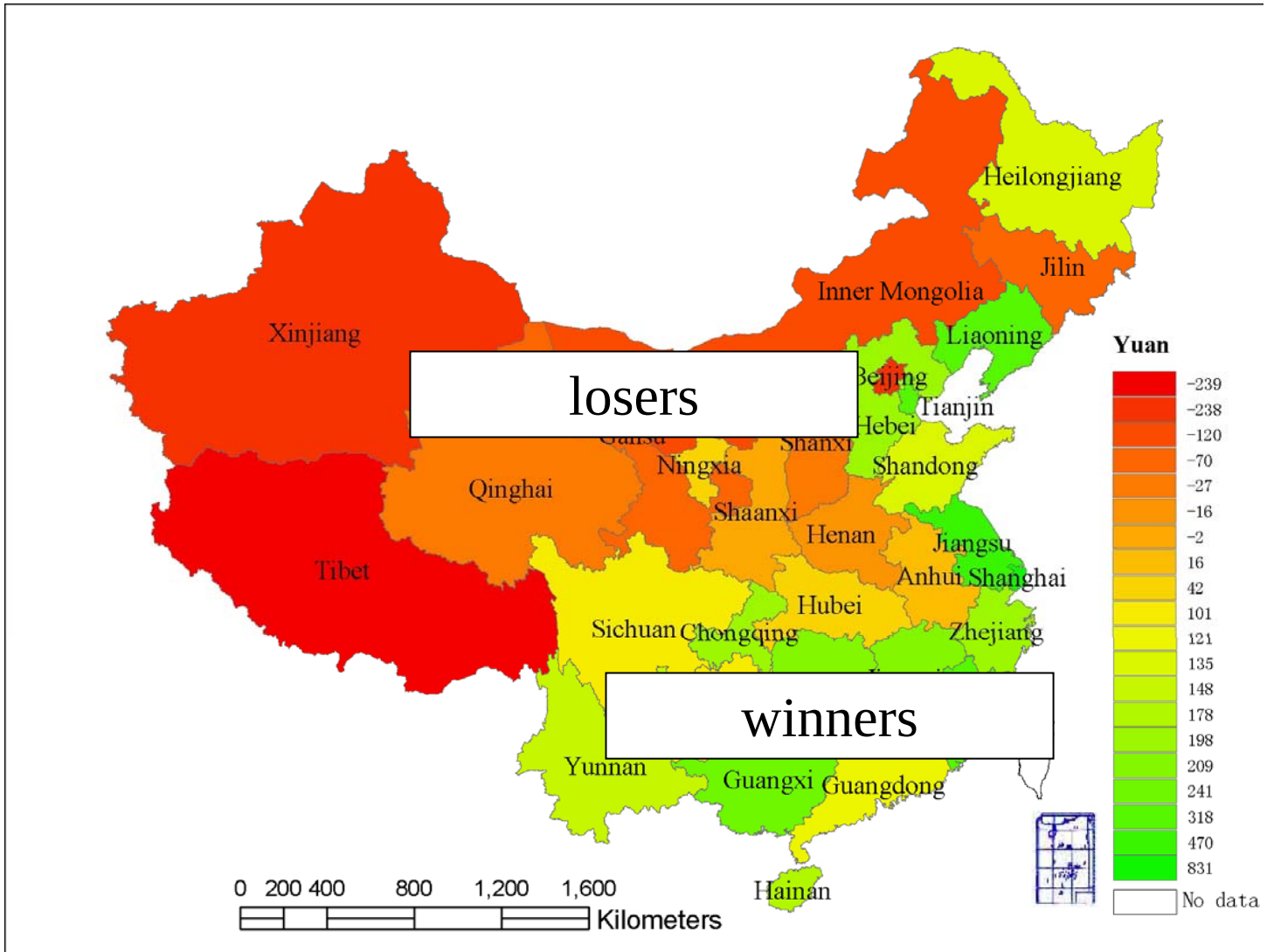
gain

Although on average agricultural sector is a winner, there are regional impacts

Why? Examine:
Regional agricultural production structure:
(importable output-exportable output)/total output %



Impacts of WTO on agricultural output on farmers under poverty in China in 2005 (yuan/household)



Summary: impacts of China's WTO accession and Doha round in China

- **Overall economy: positive**
- **Agriculture：**
  - **Overall → positive**
  - **Not threaten to grain security**
  - **Positive impacts in rich regions (coastal and south)**
  - **Negative impacts in poor regions (western and northeast)**
  - **Gains： the poor < the rich**

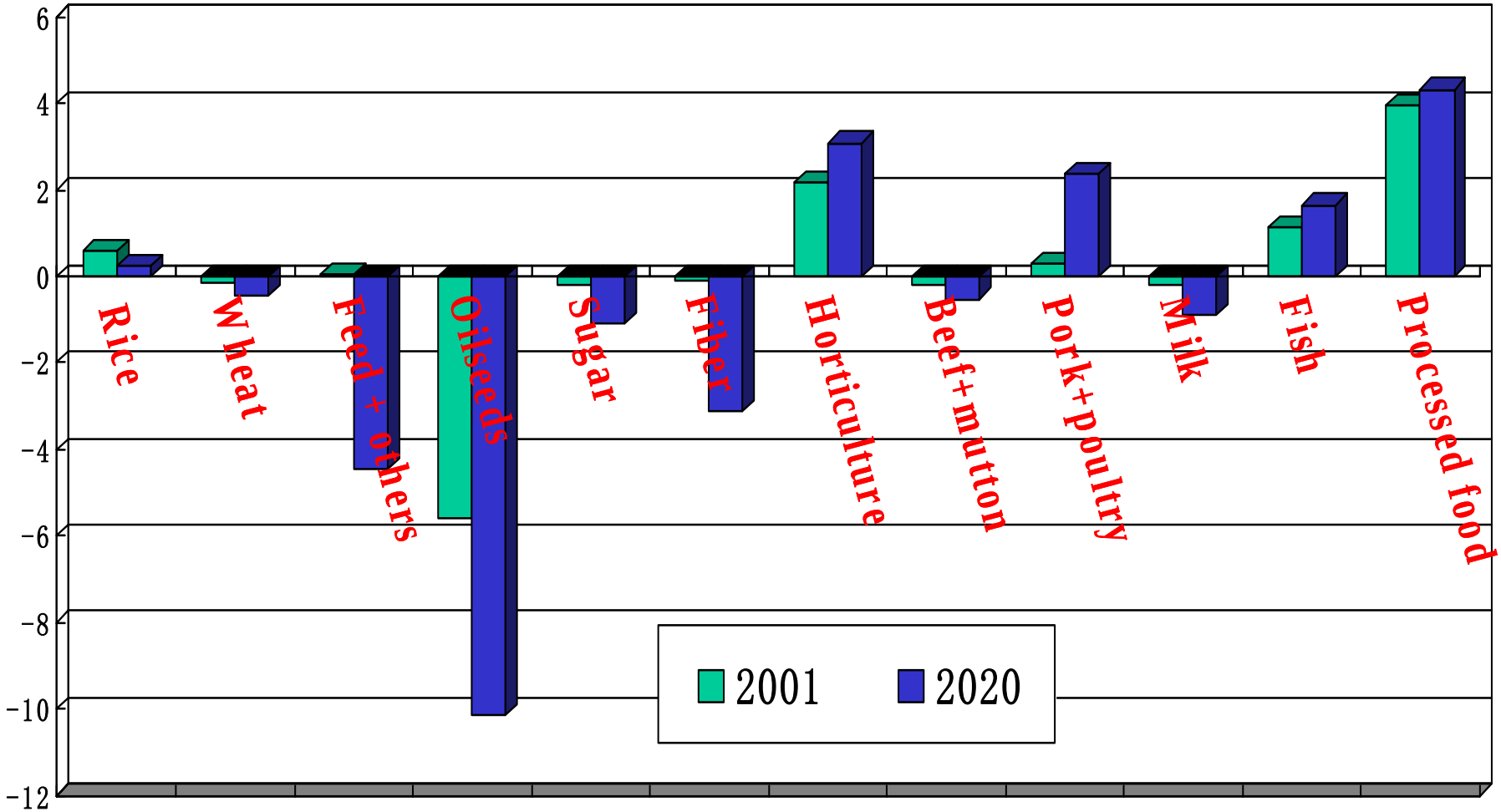
Income disparity will be enlarged … so if do not want this to happen, need to choose to either "limit trade" or "adopt pro-poor policy intervention" [e.g., education fee reduction; ag. tax reduction; etc.]

- **Implications of China's rapid growth for the rest of world**

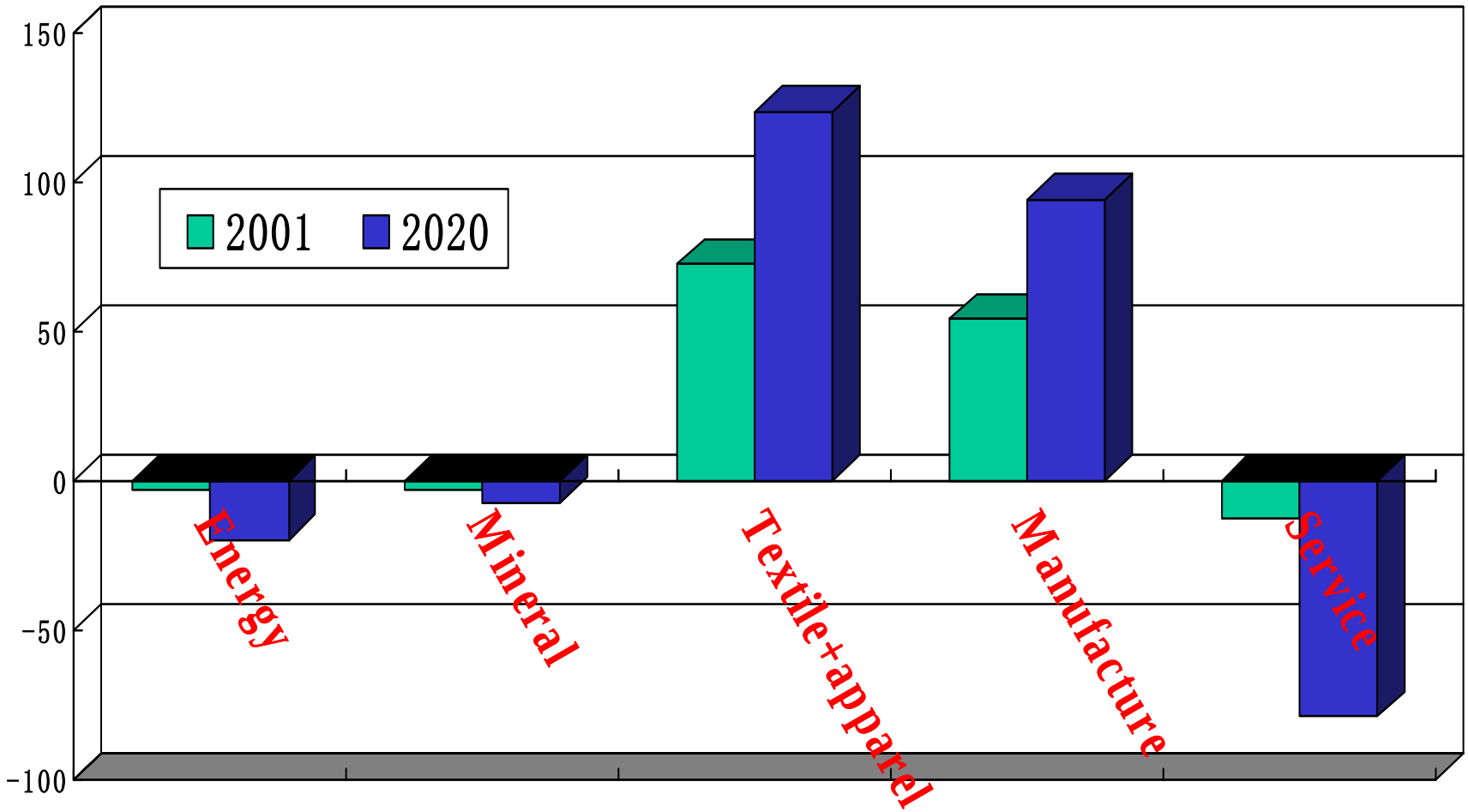
- **Scenario 2 (Baseline vs. High Growth)**

Baseline: agricultural net export in 2001 and 2020

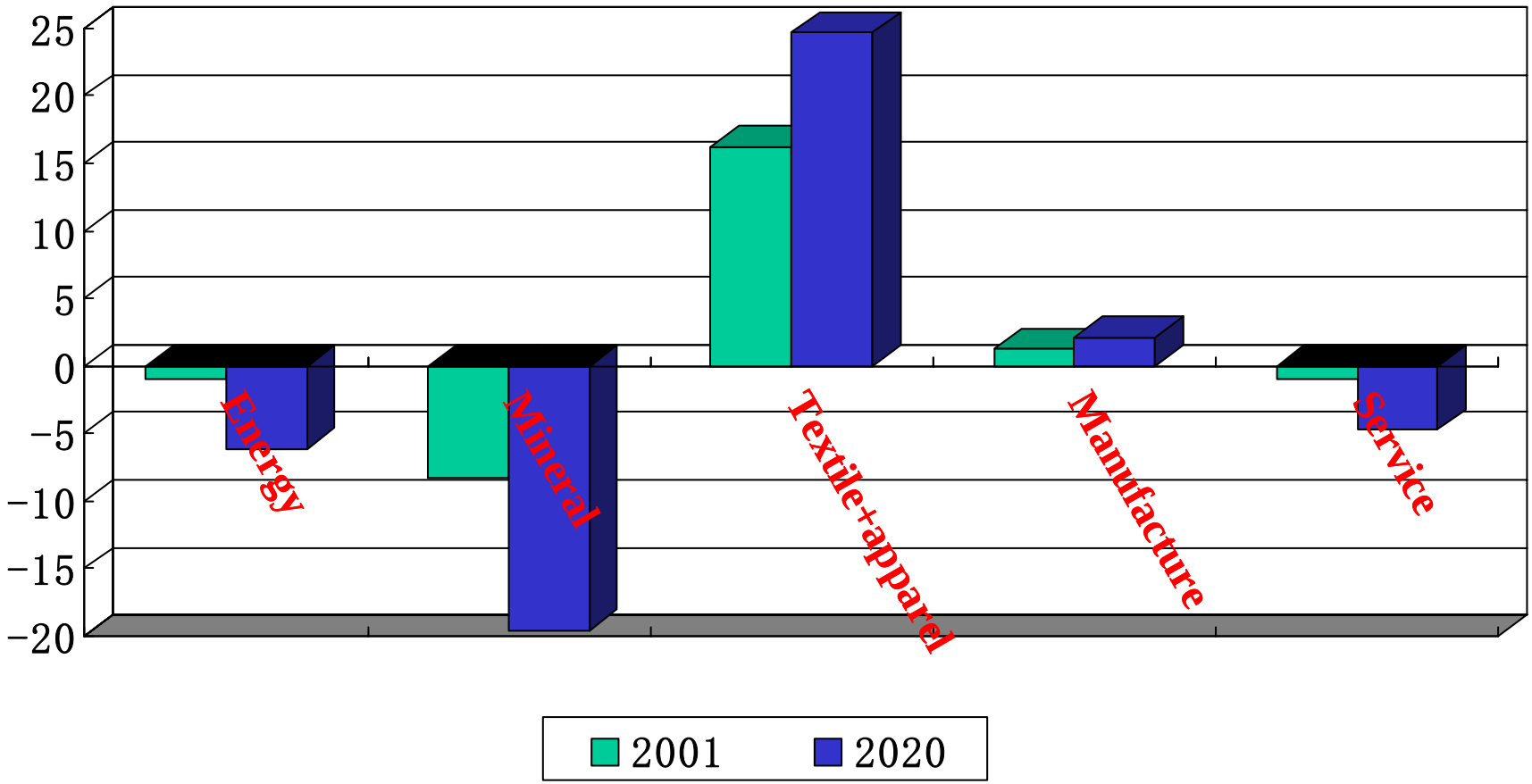
(billion US$)



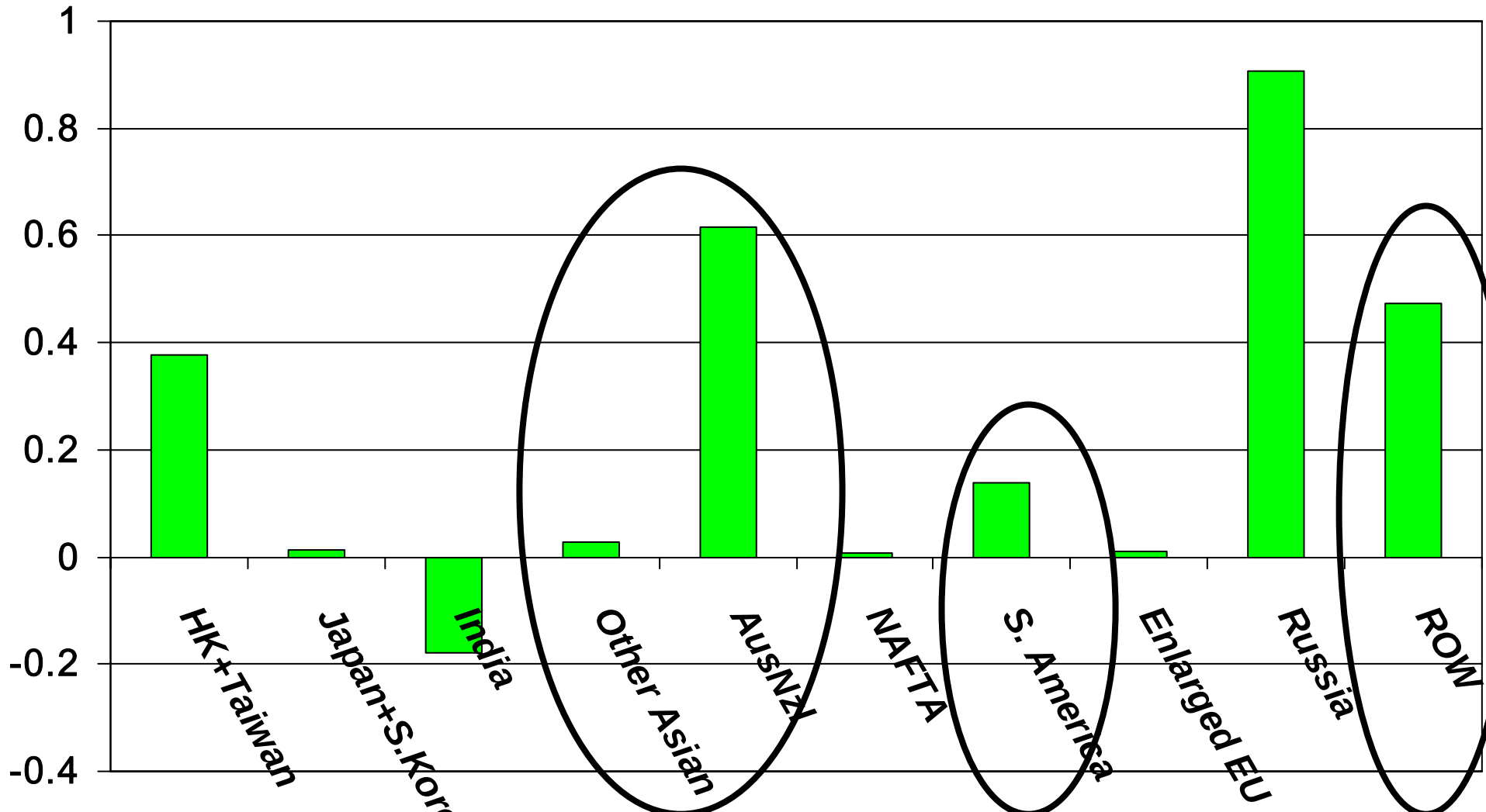
Baseline: Net export in 2001 and 2020 (billion USD)



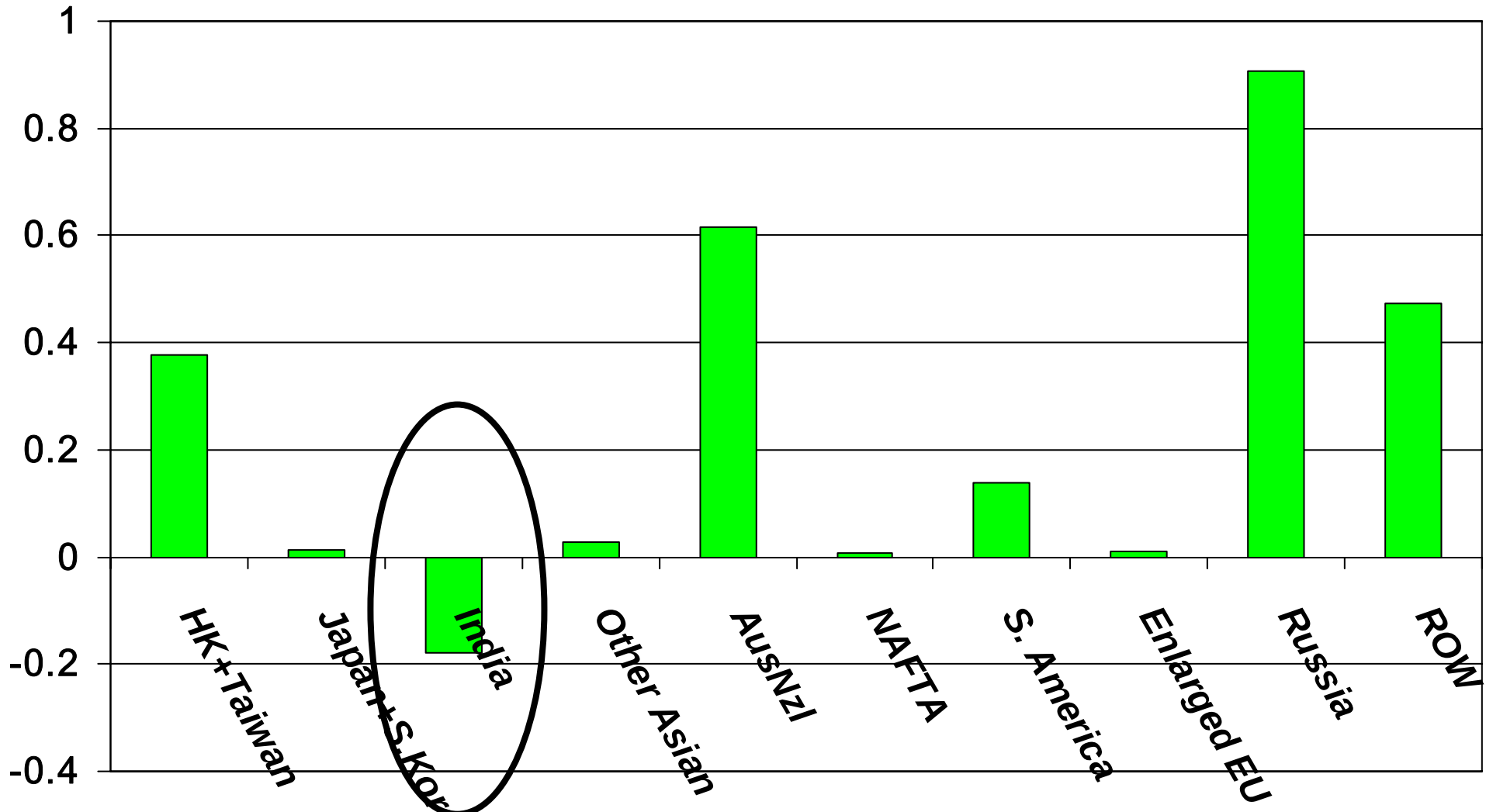
Baseline: Percentage of China's net export in world total export in 2001 and 2020



Impacts of high GDP growth scenario:
Welfare change (%) in different regions in 2020

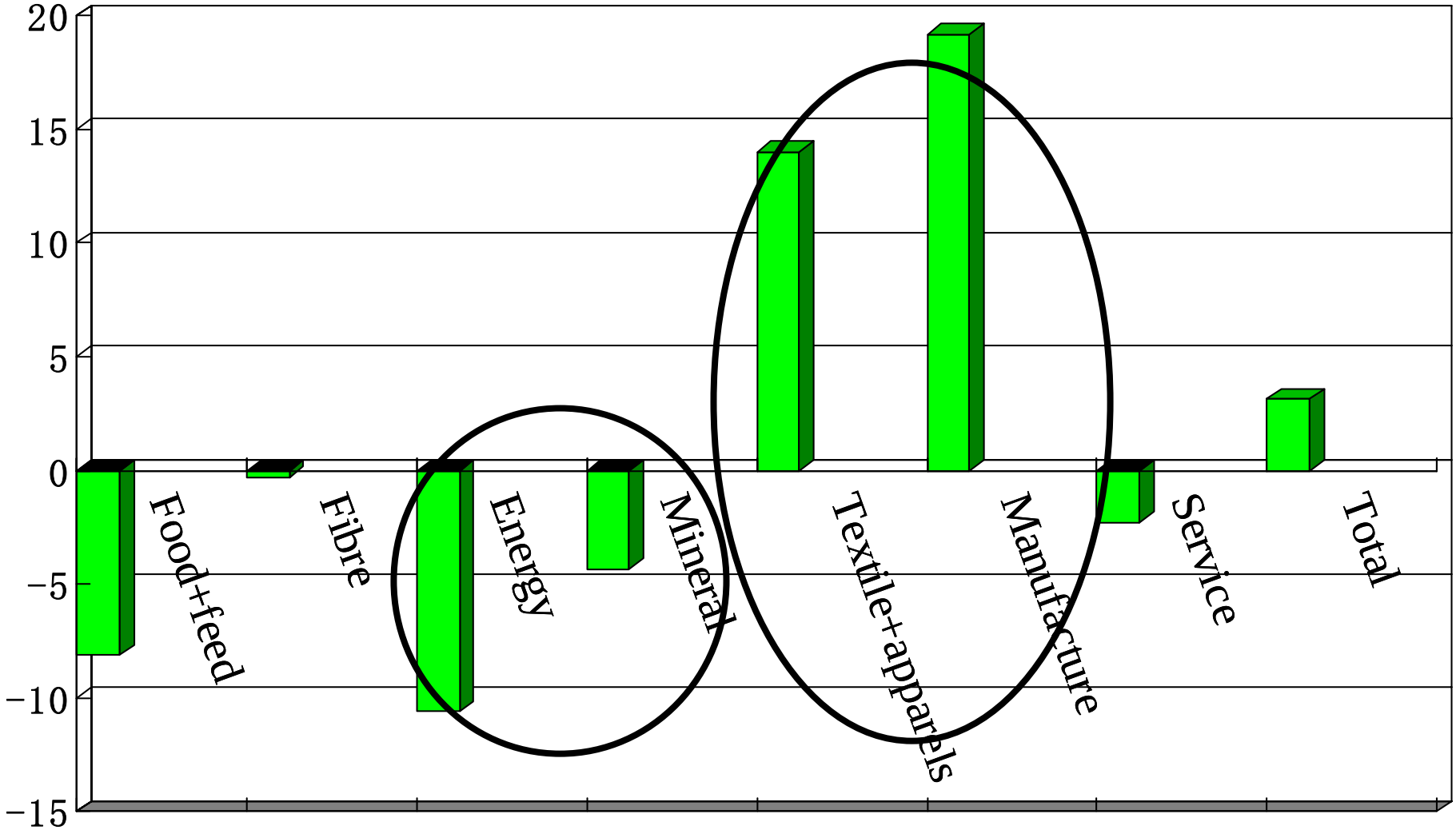


Impacts of high GDP growth scenario:
Welfare change (%) in different regions in 2020

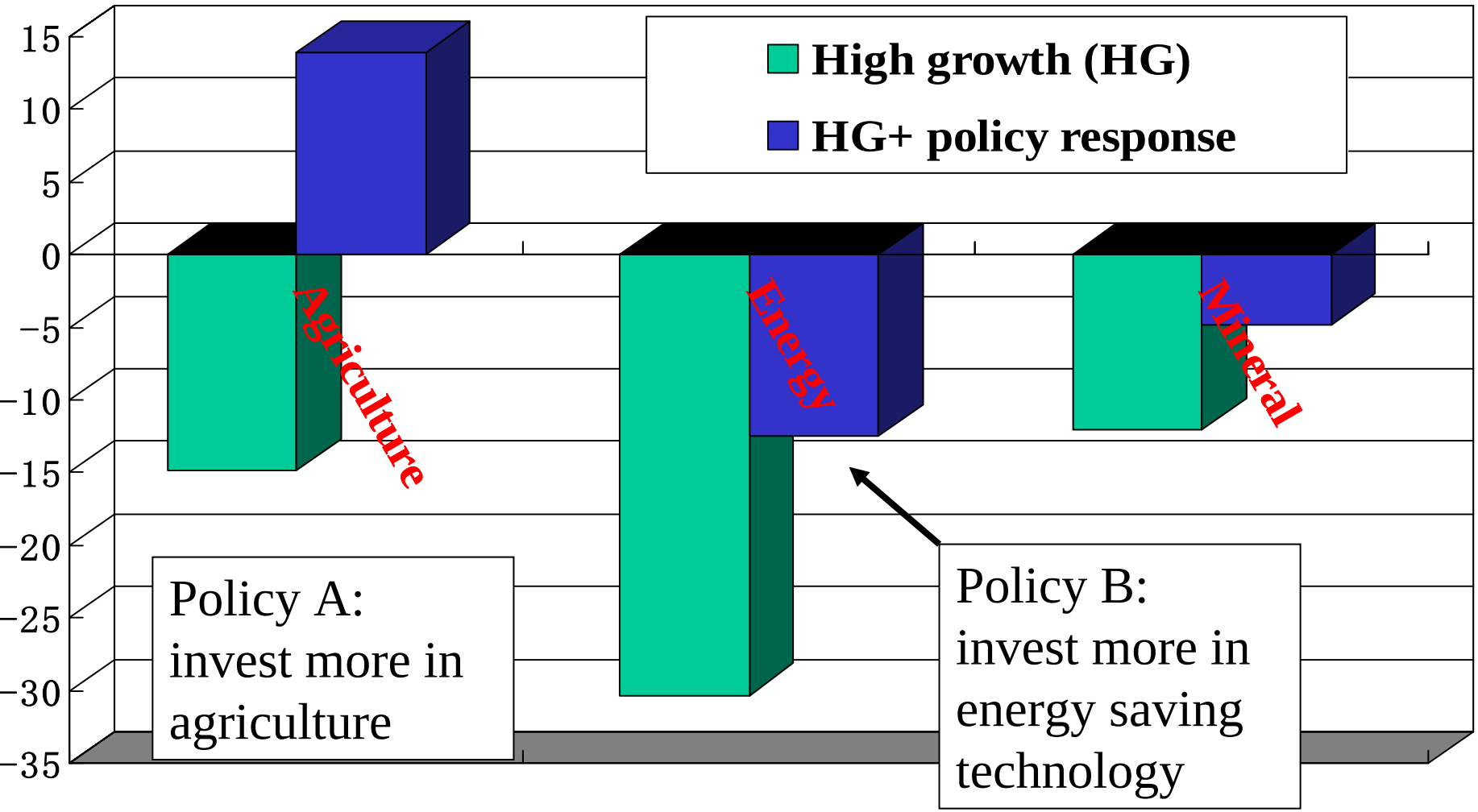


Impacts of high GDP growth scenario

Net export change comparing to baseline (%)



Net exports under high growth scenario: with and without policy responses (billion USD)



Concluding Remarks: Trade Liberalization

- **Positive impacts on national income, including agriculture**
- **Benefits from non-agricultural sectors are much large than that in agriculture**

Concluding Remarks: Trade Liberalization

- **Trade liberalization will *not* threaten China's food grain security**
- **Regional income disparity will be enlarged as the impacts differ largely among regions**
  - **Need offsetting policies (better than restricting trade)**

Concluding Remarks: Trade Liberalization

- **China should take a pro-active and play aggressive role in the Doha round of talks**
- **Pro-poor policies must be adopted to target those who are hurt and those who are vulnerable**

Concluding Remarks: the Rising China's economy

- **Food security: the rising China's economy will not threaten its own food security nor that of the world food security**

- **Instead, increasing imports of edible oil, sugar, and cotton will help both developing and developed countries to expand their production**

Concluding Remarks: the Rising China's economy

- **Although energy and mineral will rise as China's economy expanded, China's share in world trade will remain low.**

- **Moreover, if there would be a significant rise, it is expected that there would also be strong policy responses (there needs to be!)**

Concluding Remarks: the Rising China's economy

- **The rapid growth of China's economy will stimulate overall world economic growth**

  Market opportunities: capital intensive manufactures, natural resources, service, and many land intensive agricultural products

Concluding Remarks: the Rising China's economy

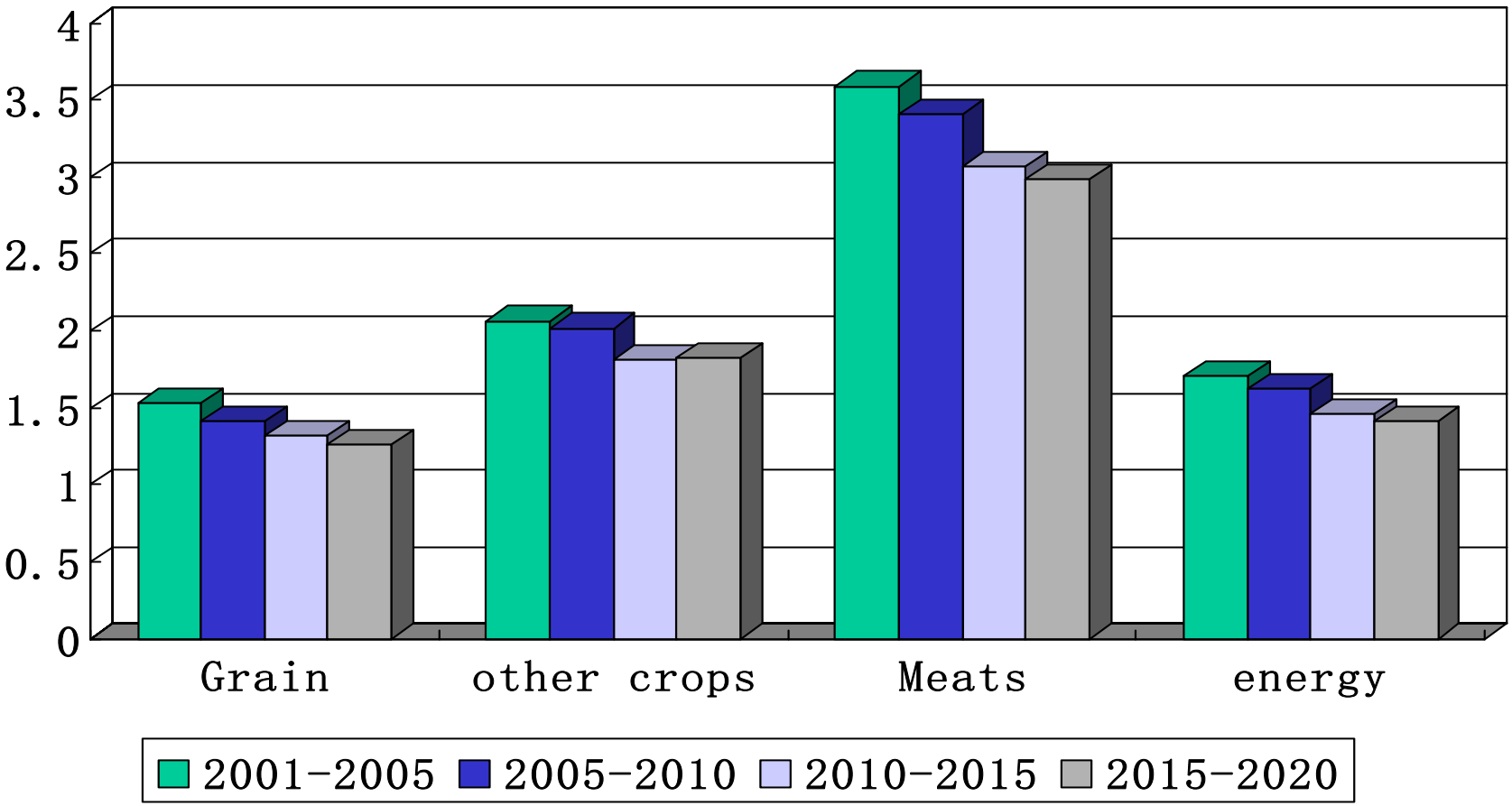
- **The ability to gain additional benefits from China's market expansion highly depends on the competitive and the structural adjustment in the rest of world (especially the developing countries)**

Thank you

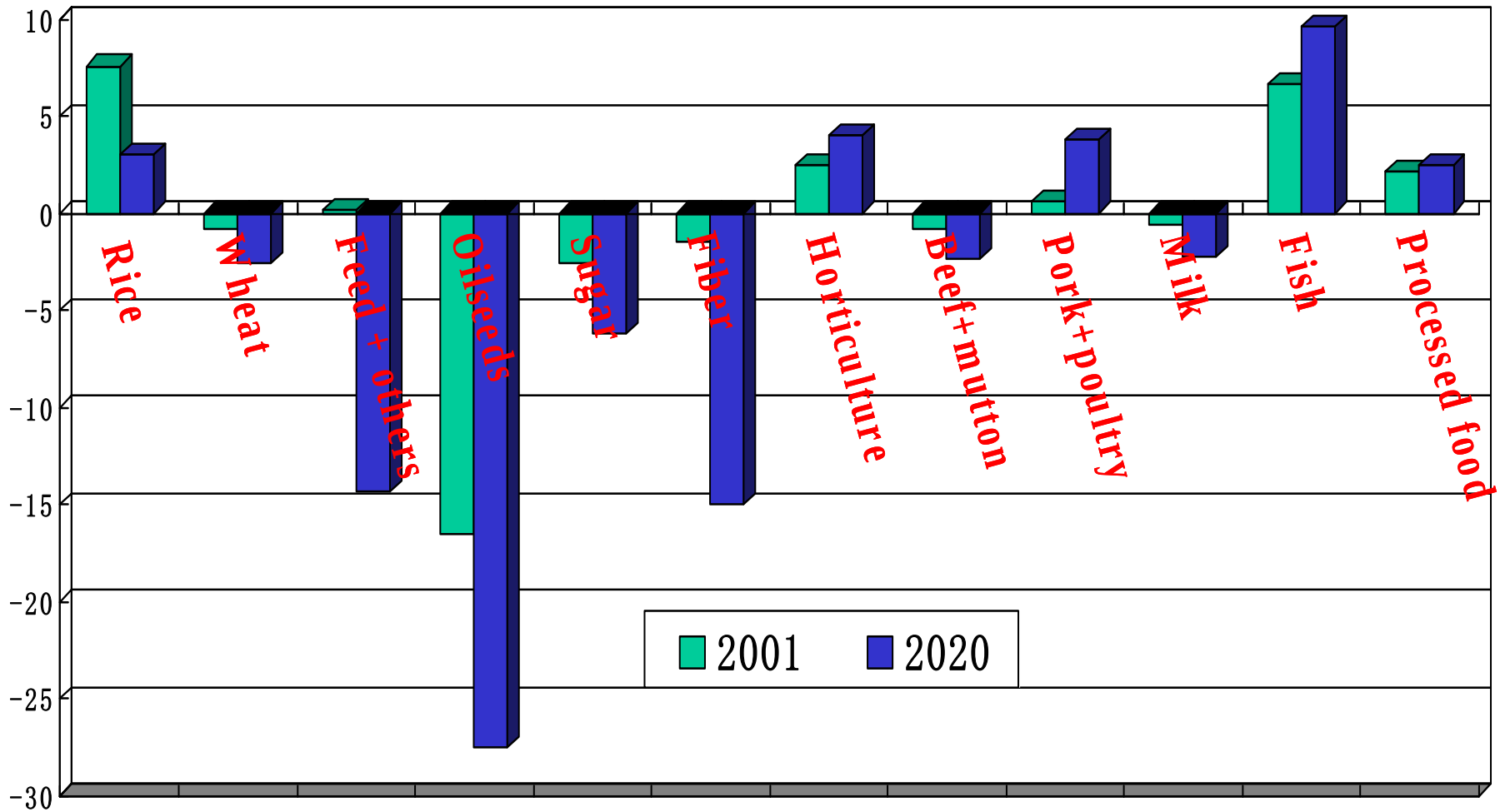
Sources of assumptions

- GDP — WB, IIASA, ADB, Terries et al (2000)
- Physical Capital — WB, ADB, Terries etc (2000)
- Population — WB, Terries et al (2000)
  - Skilled labor
  - Unskilled labor
- Natural resources — Frank et al (2004)

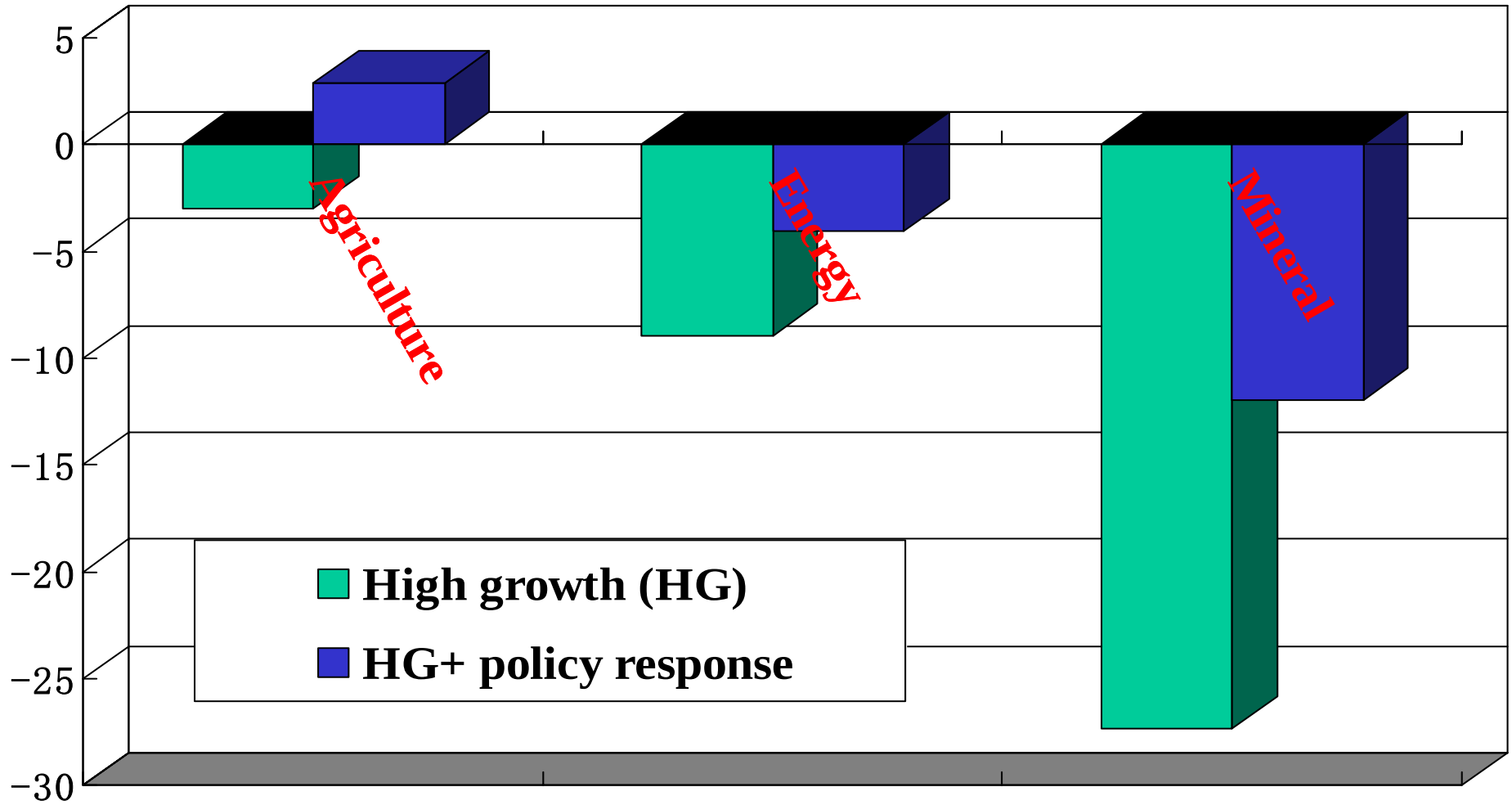
Calibration results of TFP



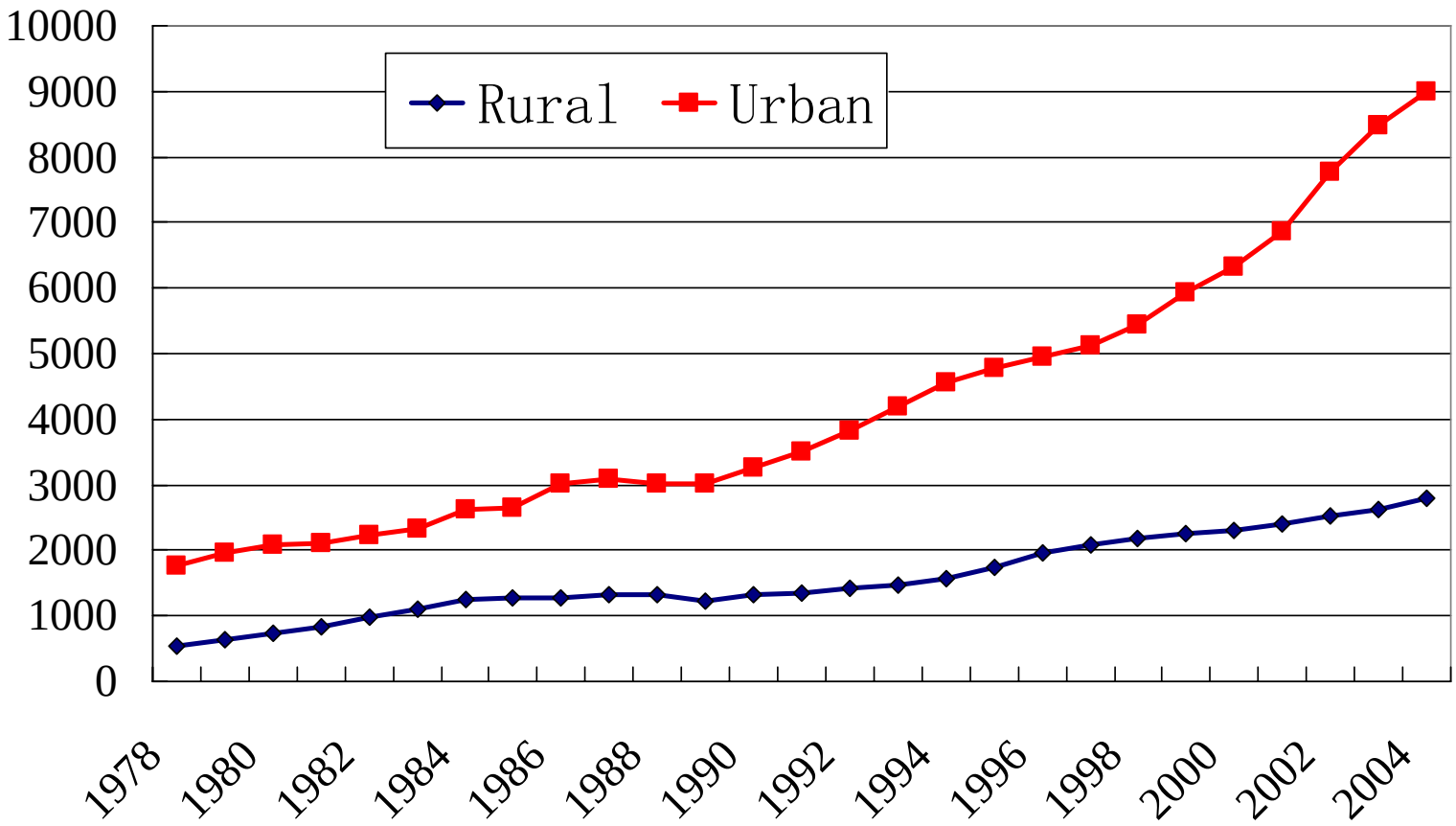
Baseline: Percentage of China's net export in world export in 2001 and 2020



Net exports as share (%) of world total exports under high growth scenario: with and without policy responses

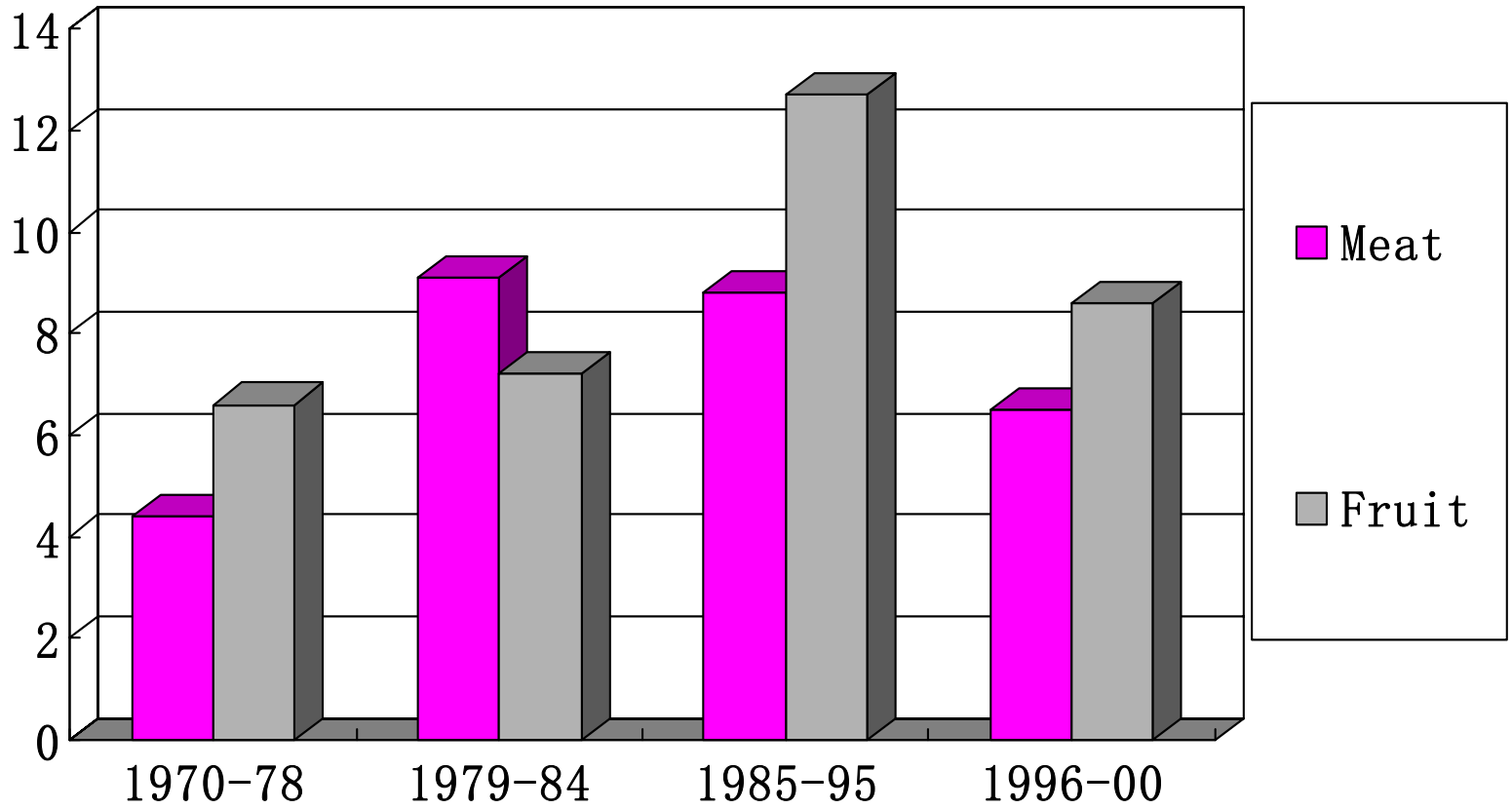


Per capita income (at constant 2000 prices)

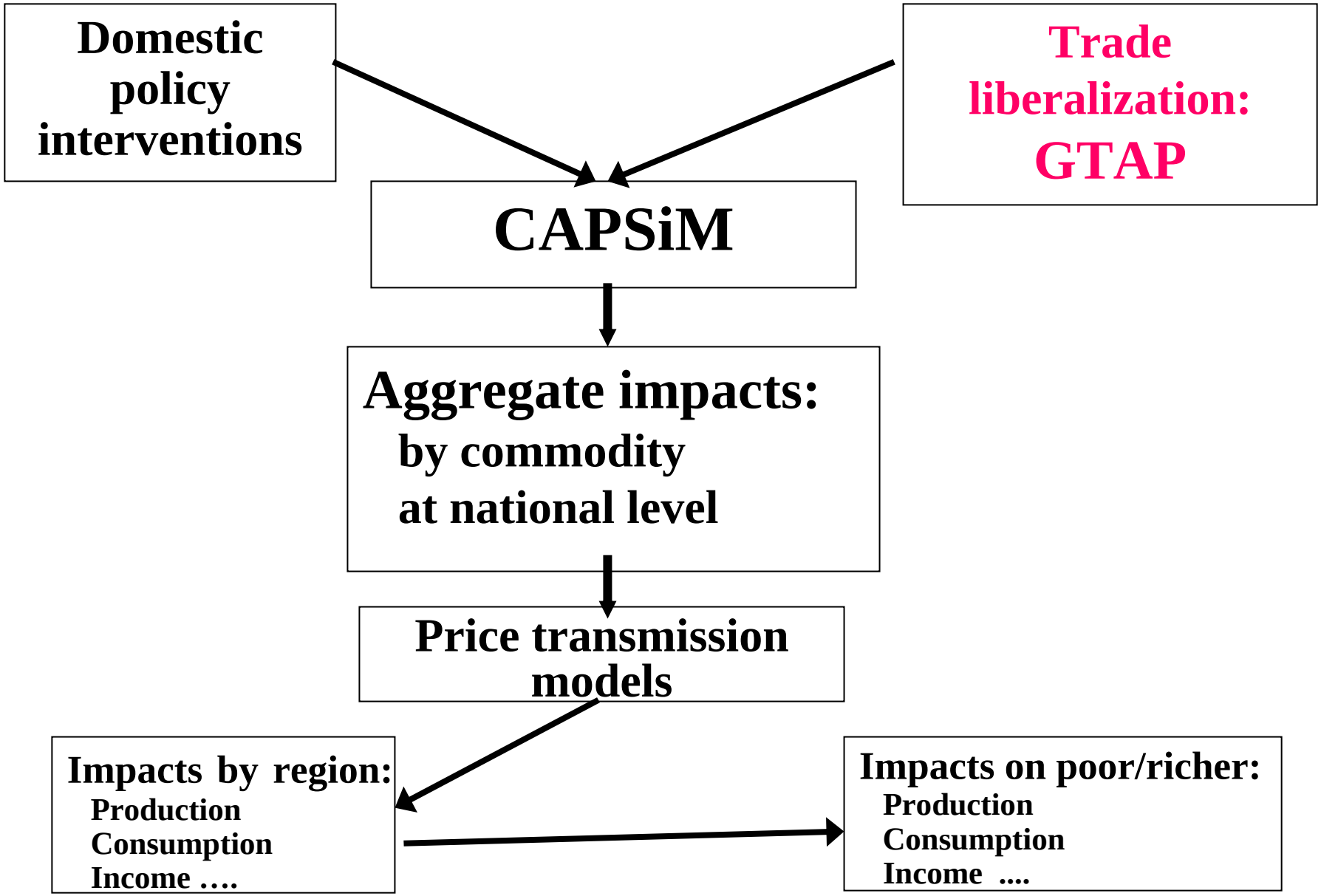


Enlarging income disparity between rural and urban

Annual growth rates of meat and fruit production (%)



Implications: rising demand for feed and shifting land from grain to other crops



A framework for regional model and policy interventions analysis

China – After Accession to WTO: Customer of Western Growers or Cutthroat Competitor?

Scott Rozelle

Professor and Chancellor's Fellow

Department of Agricultural and Resource Economics

UC Davis

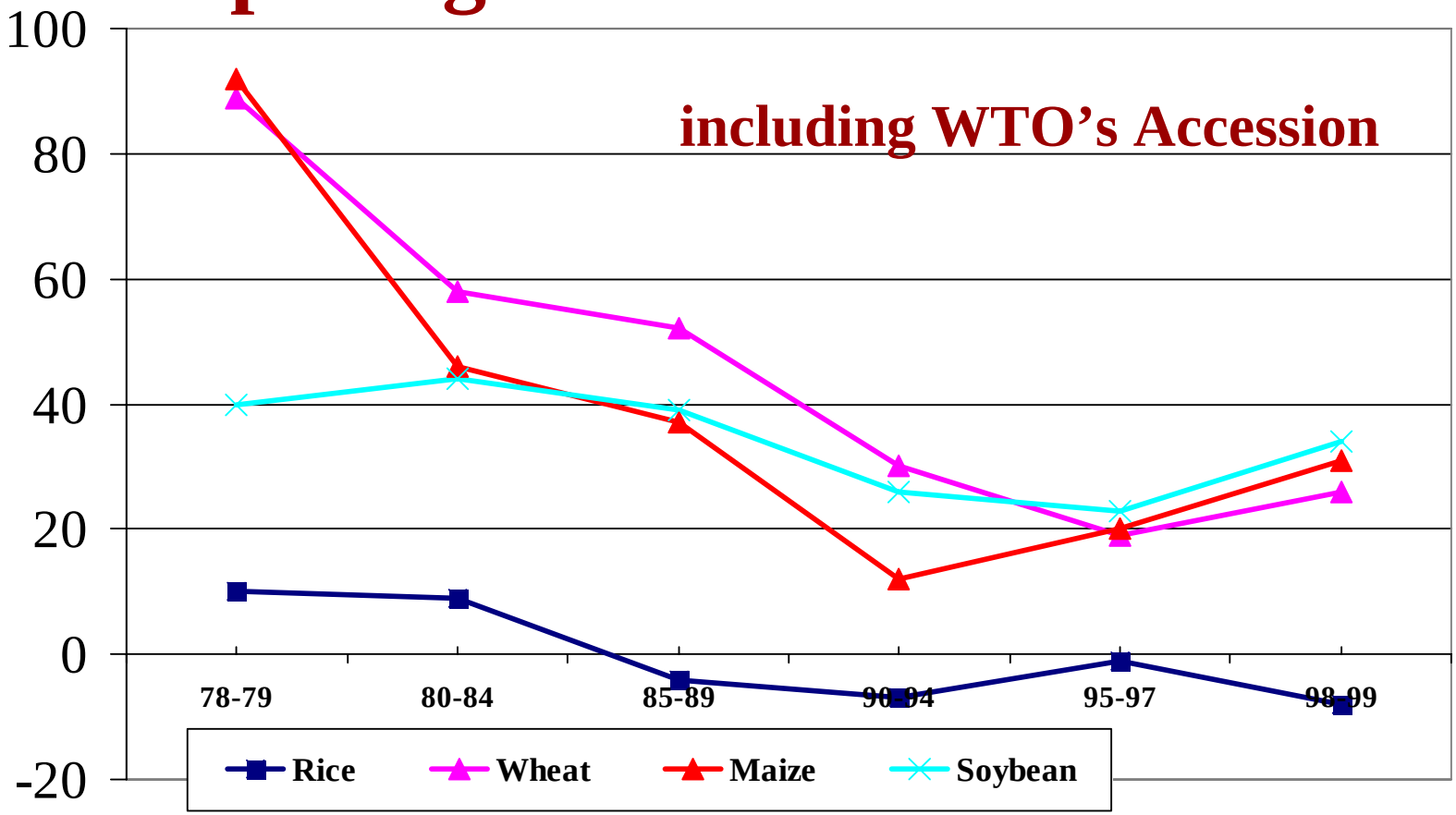
China's Emergence as a Horticulture Exporter and Impact on Horticulture Supply, Demand and Trade

- **Complicated**
- **Little work done in this area (most on major grains and other staple crops)**
- **Horticulture economy is changing as fast as China is …**

… because: Inside China, the nation is in the midst of wrenching changes

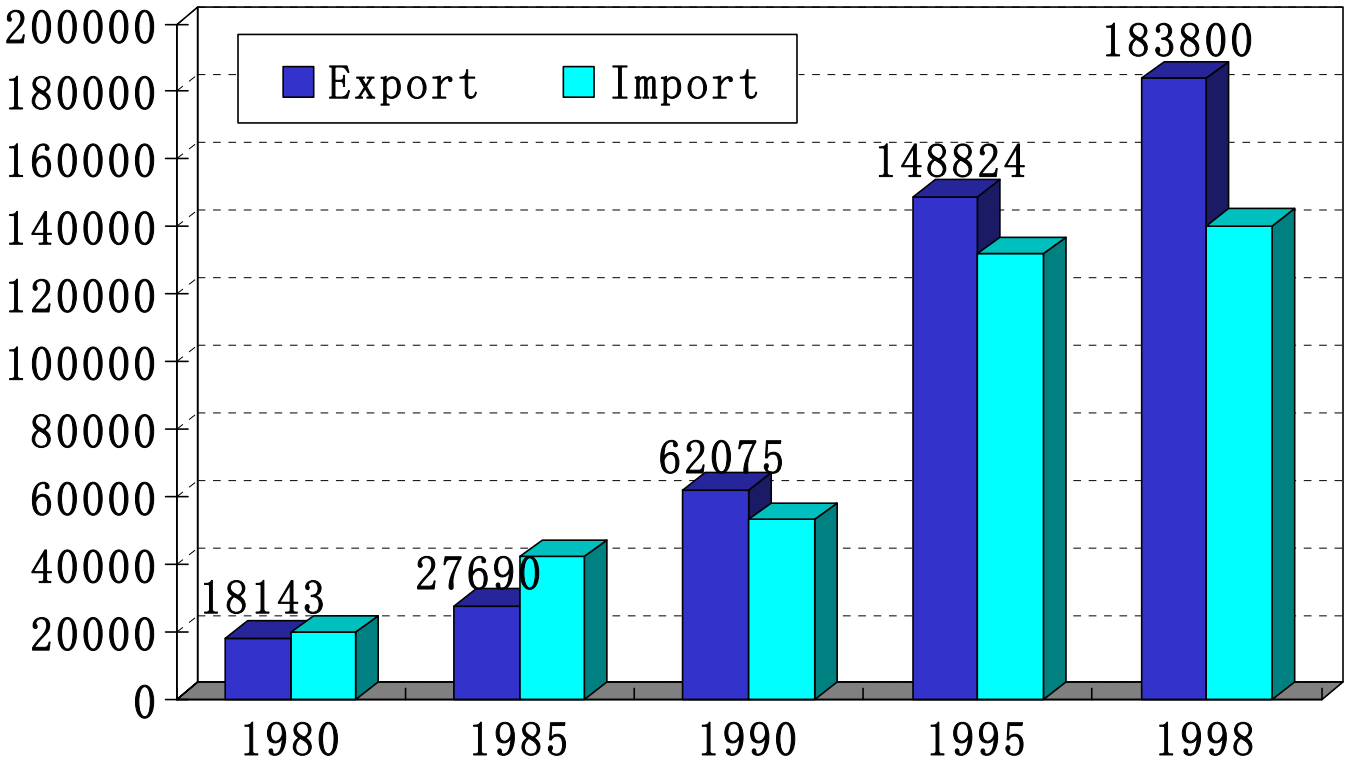
- **Industrializing**
- **Urbanizing**
- **Marketizing**
- **Becoming wealthier**
- **Western-izing**

… and: Falling Barriers and Opening to the Outside World

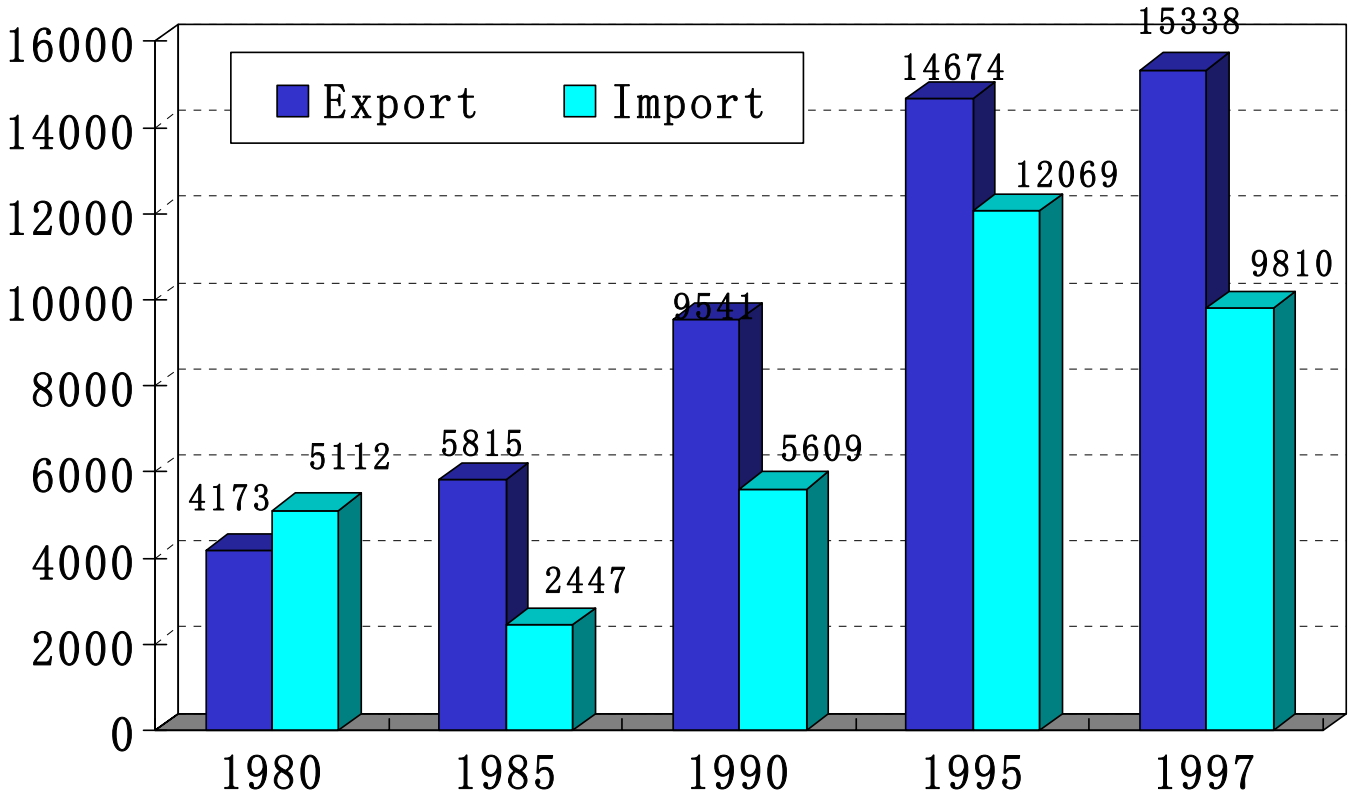


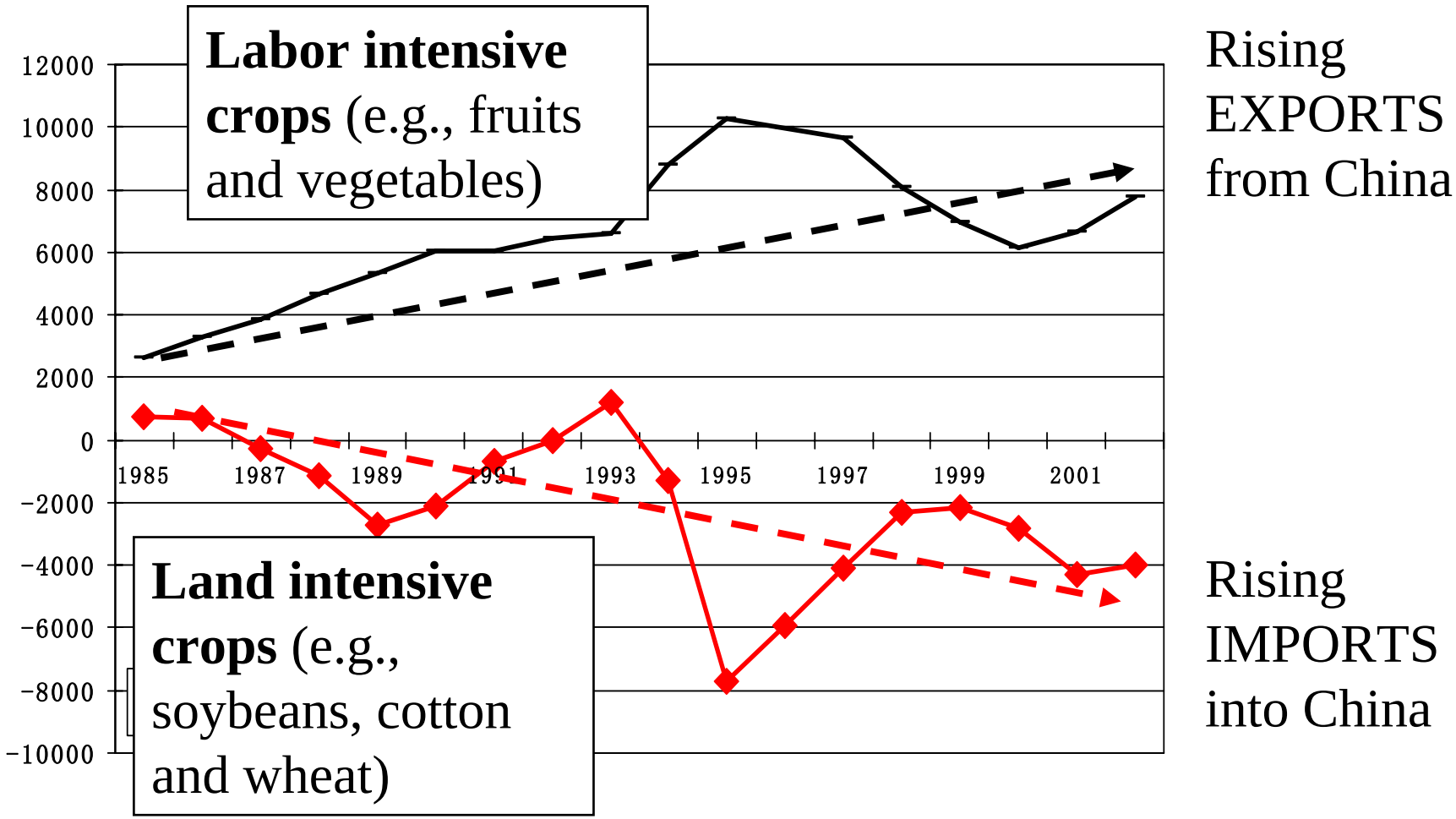
Huang, 2001

Total Trade (million US$)



Agricultural Trade (million US$)





Agricultural Trade Balance by Factor Intensity, 1984 to 2002 (mil US$)

Outline of Presentation

- **Horticulture Facts:**
  - **Supply**
  - **Demand**
  - **Prices**
  - **Trade**
- **Relative Competitiveness: China versus US**
- **What Can Western Growers Do?**

Horticulture Facts:

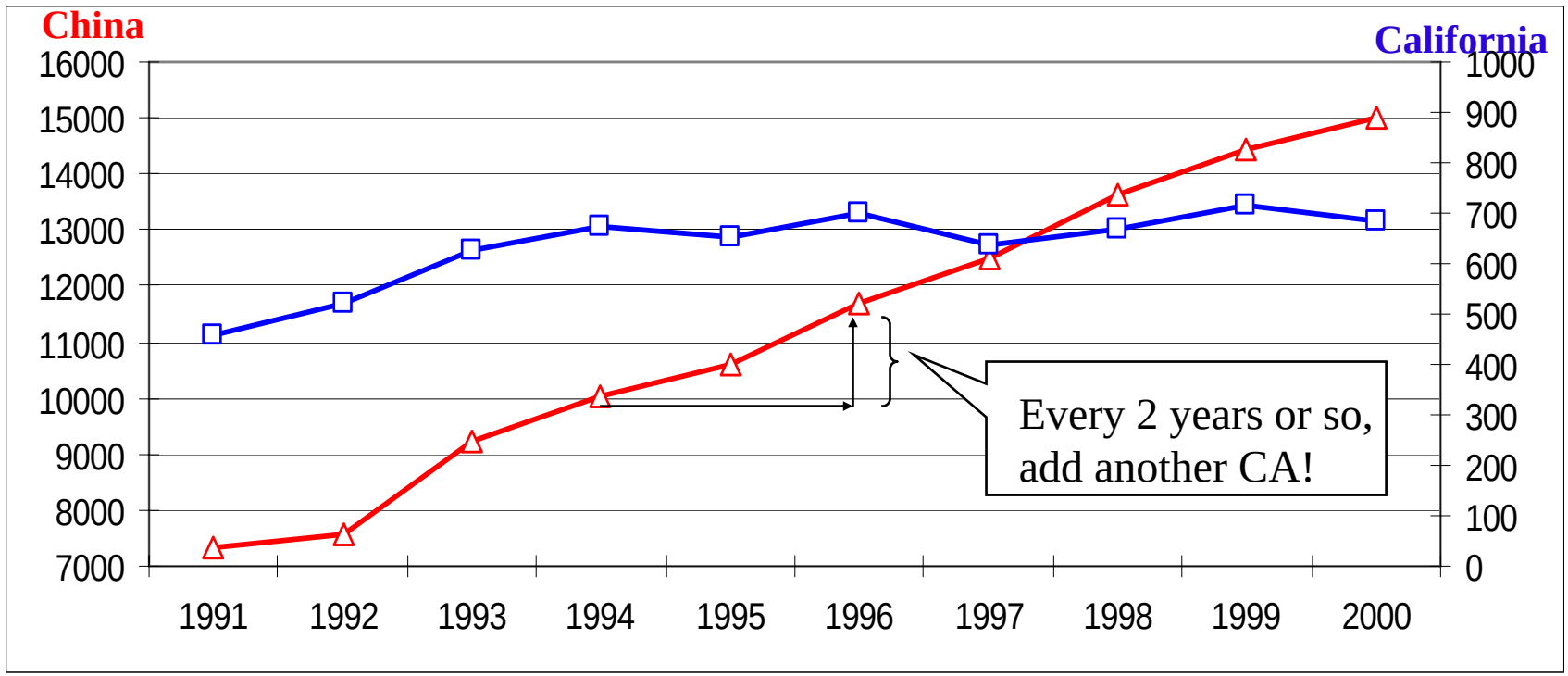
Supply, Demand, Prices and Trade

Think of trade as sort of a race between supply and demand

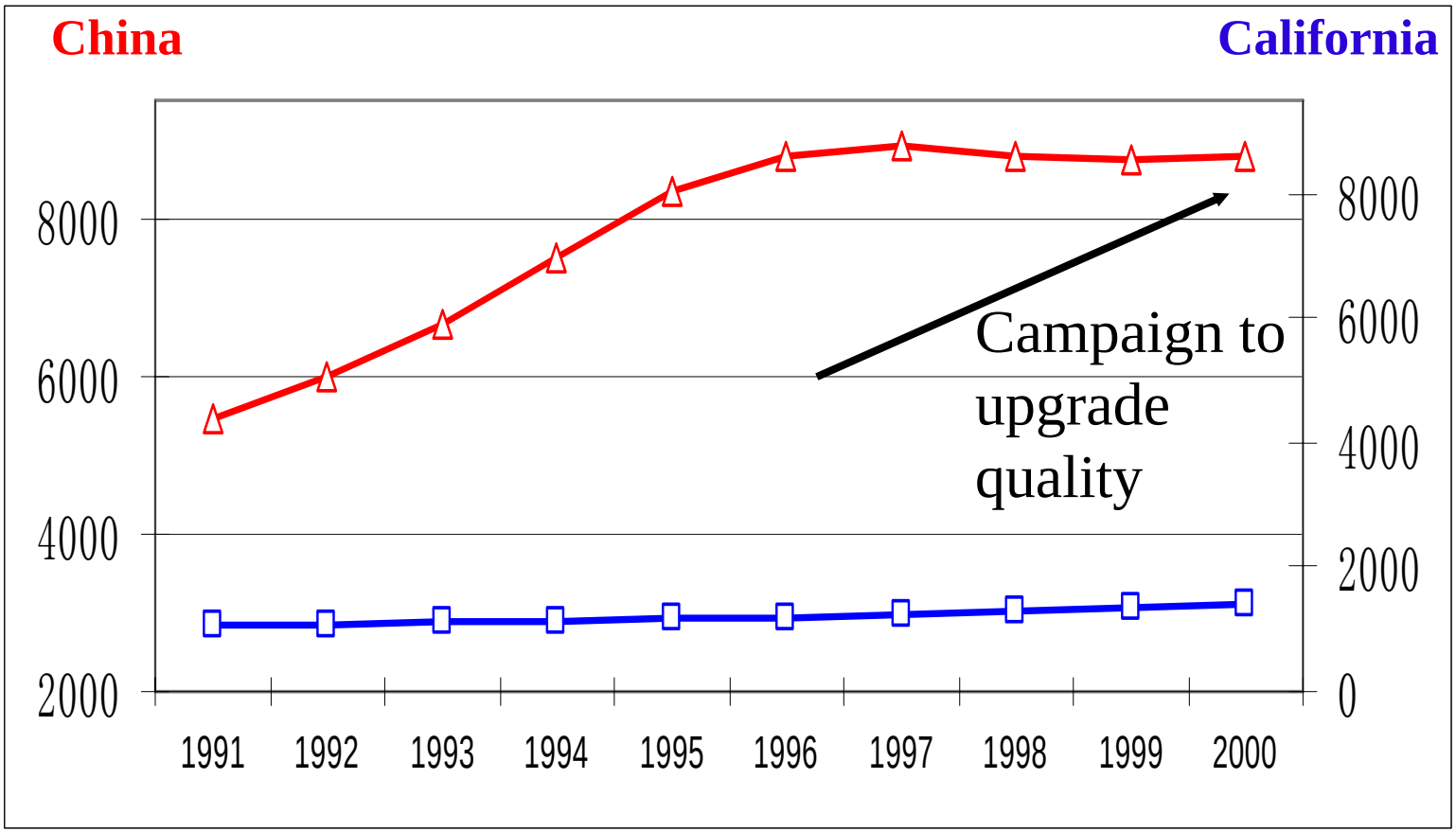
China’s Horticulture Supply

- First the bad news …

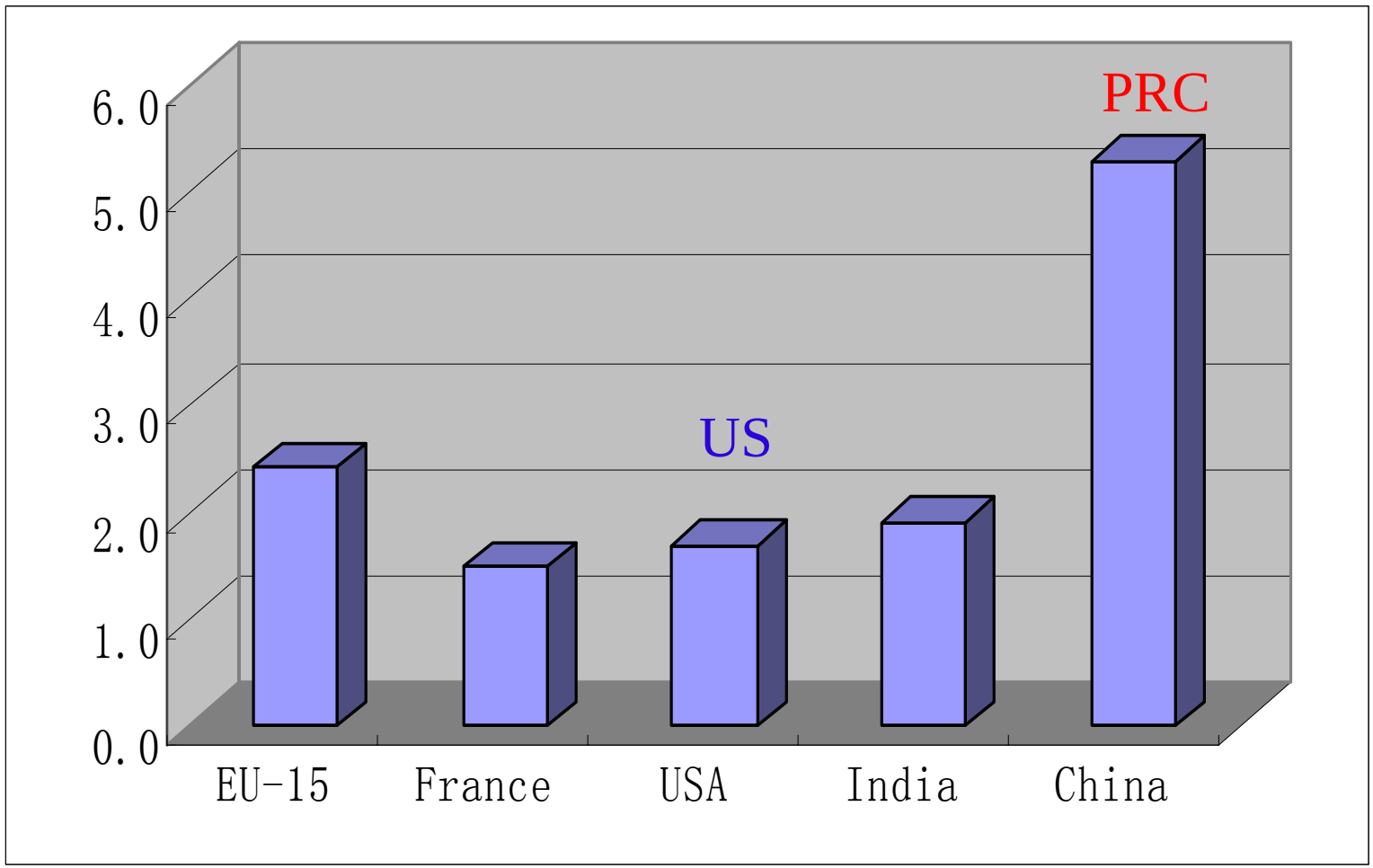
Increasing Sown Areas of Vegetables in China and California (1000 ha)



Trends of Cultivated Areas of Fruits and Nuts in China and California (1000 ha)



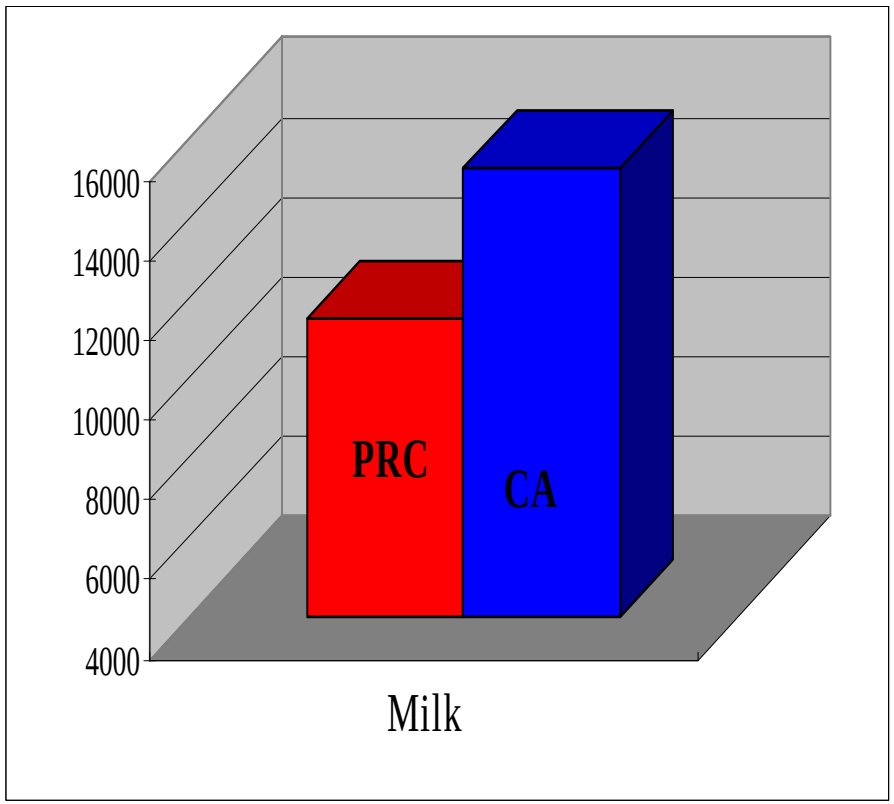
China has Higher Share of Land in Orchards than Most Other Countries

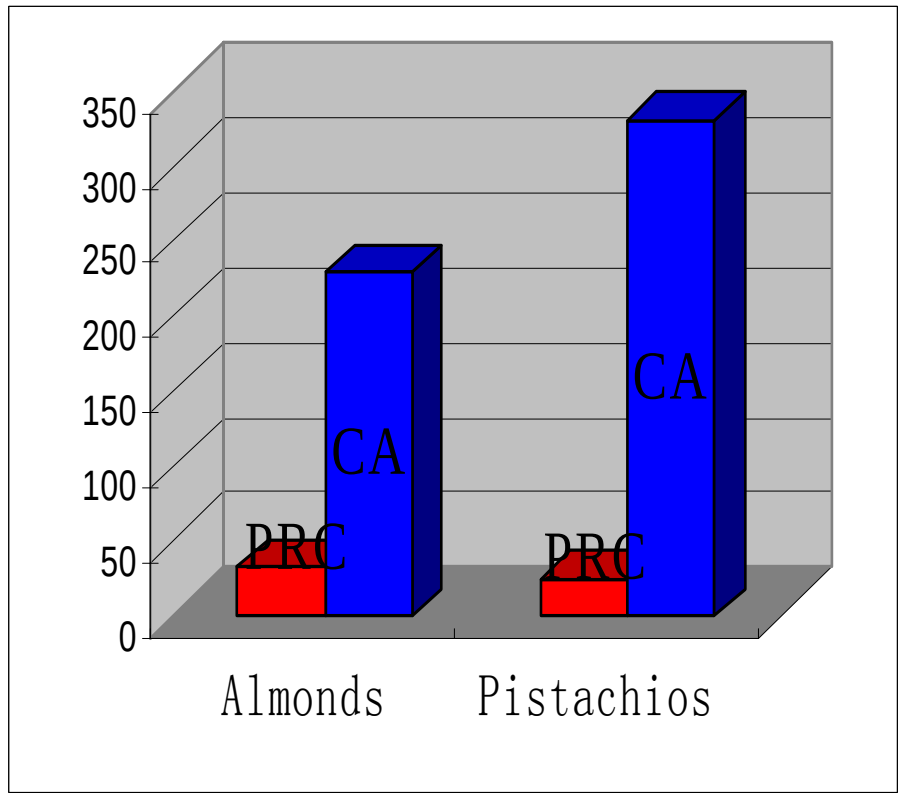


California's Top 20 Ag. Products vs. China

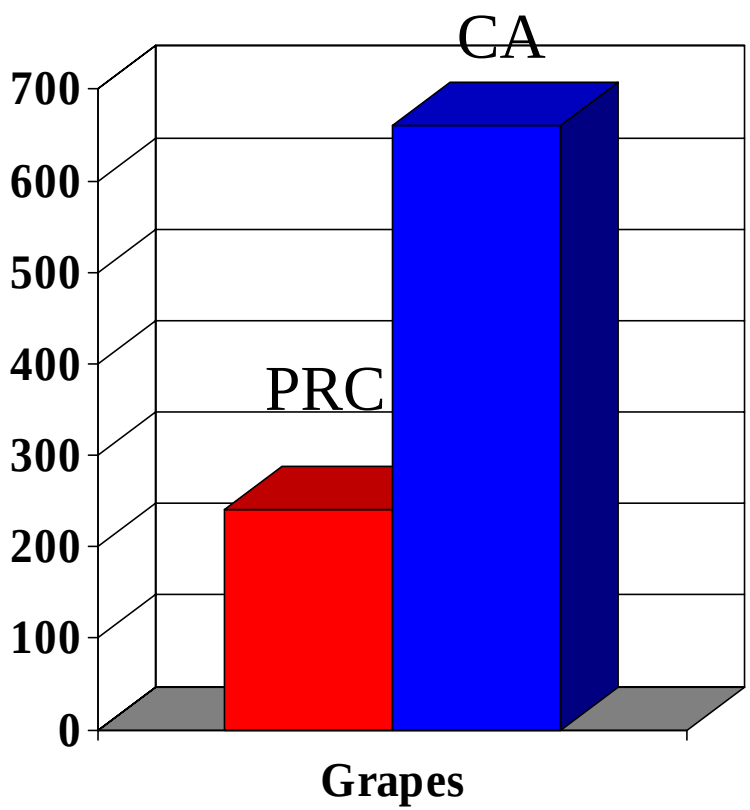
Products	$ Million	Rank	Products	$ Million	Rank
Almonds	3704	1	Lettuce	682	11
Cotton	2836	2	Raisins	537	12
Wine	2247	3	Plums, Dried	471	13
Grapes, Table	1484	4	Strawberries	362	14
Milk and Cream	1267	5	Tomatoes, fresh	347	15
Oranges	951	6	Broccoli	346	16
Tomatoes, processed	898	7	Peaches, etc	310	17

Milk, Almonds and Pistachios – Commodities Dominated by California, 2000 (1000 mt)



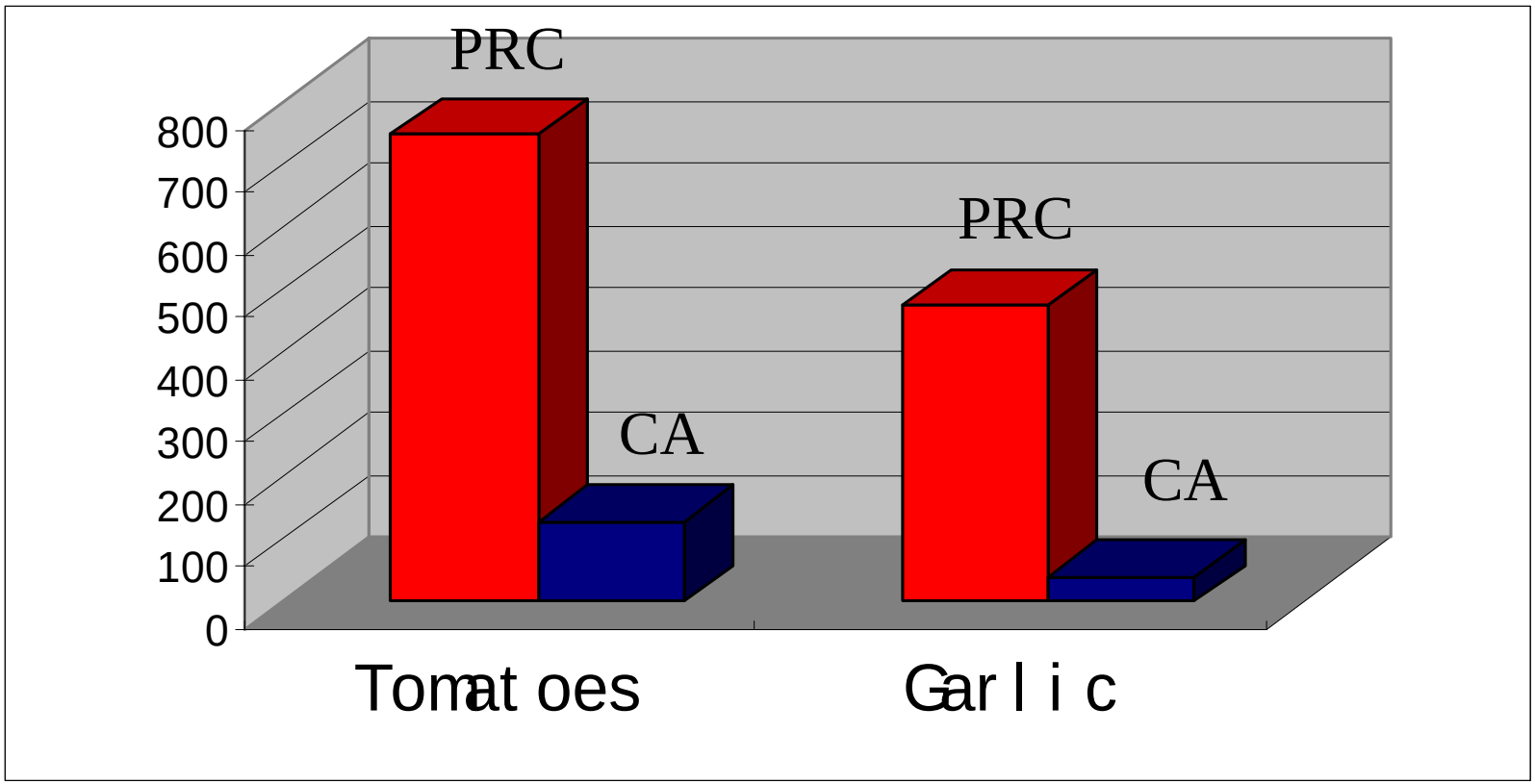


Grapes in China and California, (in 1000 ha), 2000

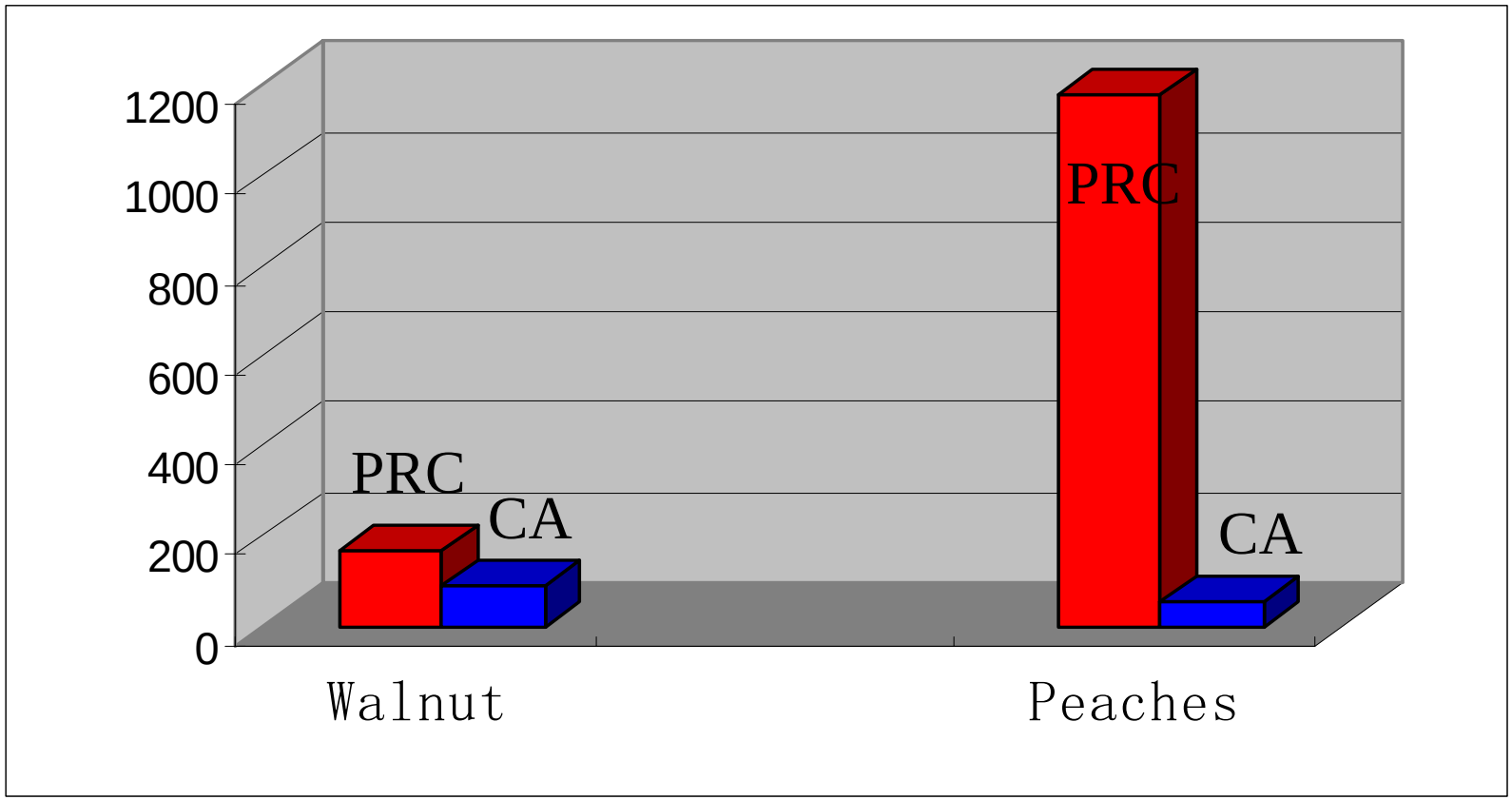


- But, currently Australia is in China on a large, state-backed push on the wine industry

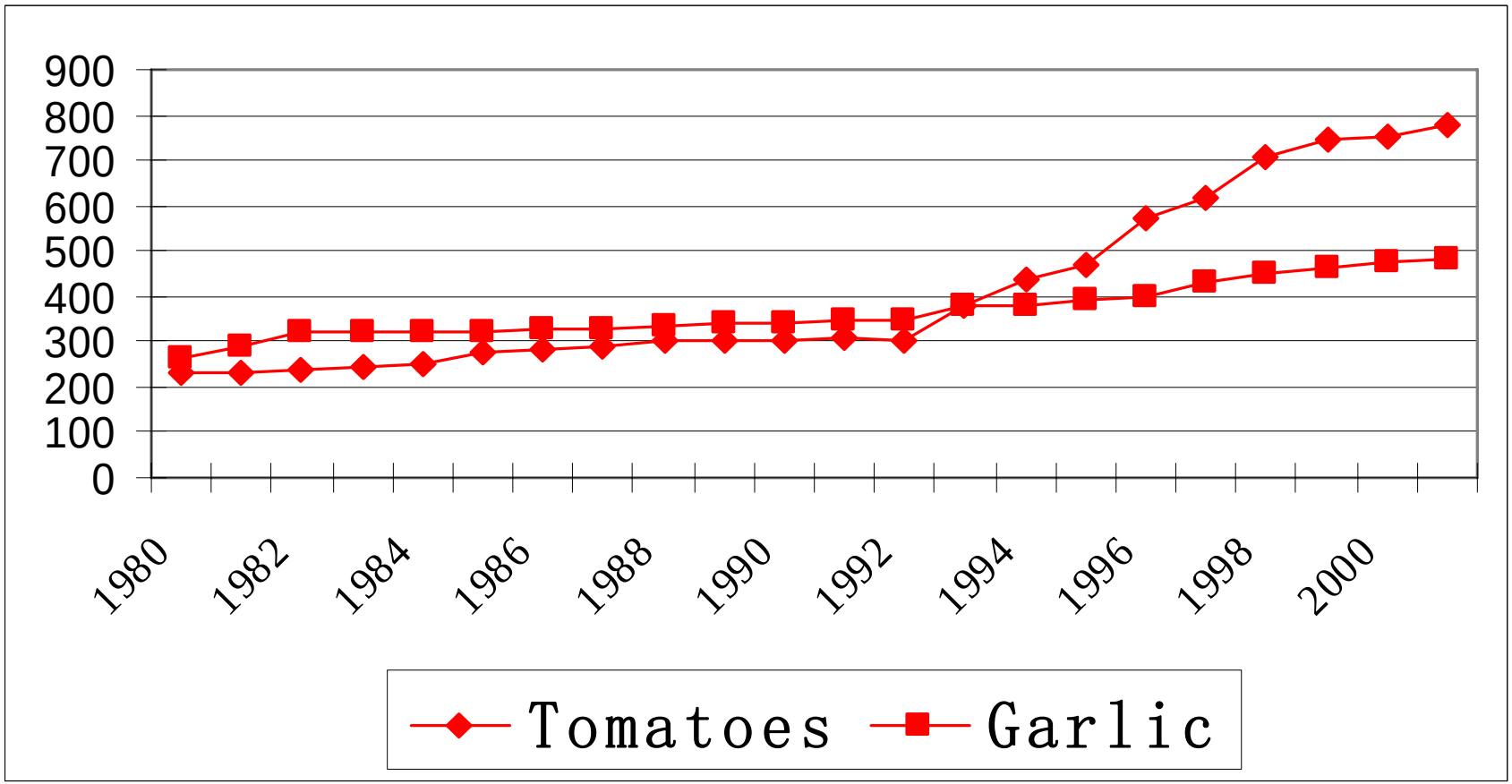
Tomatoes and Garlic – Commodities dominated by China, 2000 (1000 ha)



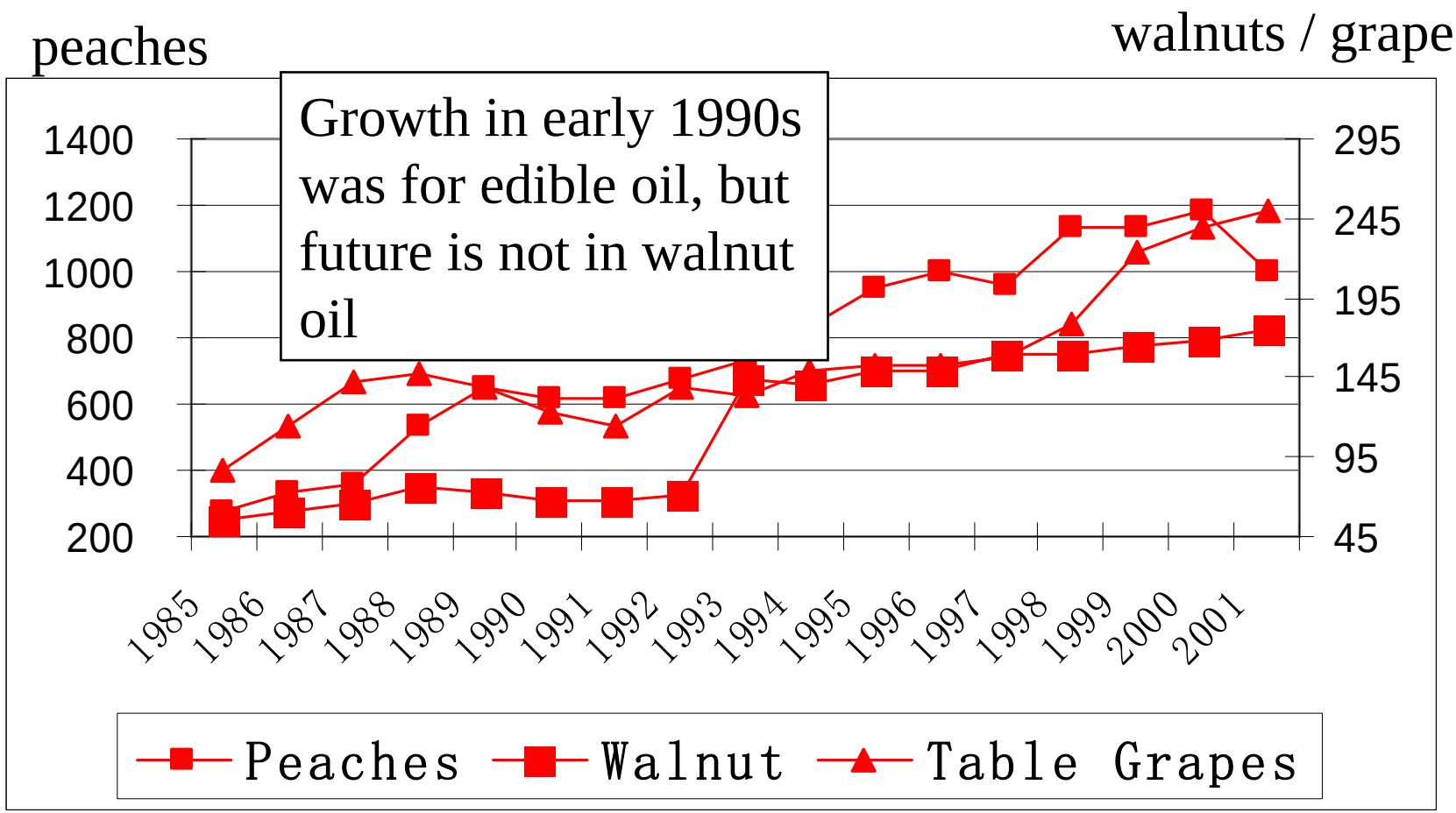
Walnuts and Peaches --
China and California, area (1000 ha) in 2000



Tomatoes and Garlic – China Area Trends, 1985-00 (1000 ha)



Walnut, Grapes and Peaches -- China Area Trends, 1985-00 (1000 ha)

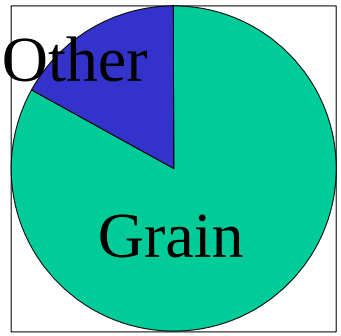


Production Environment in China is Changing Rapidly

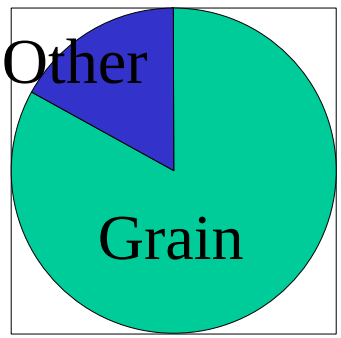
- From a policy of grain-first, food self sufficiency … to a policy targeting higher rural incomes and shift towards crops in which China has more an advantage in growing

- From a policy environment in which farmers were always the lowest priority … to one in which their interests are being considered …

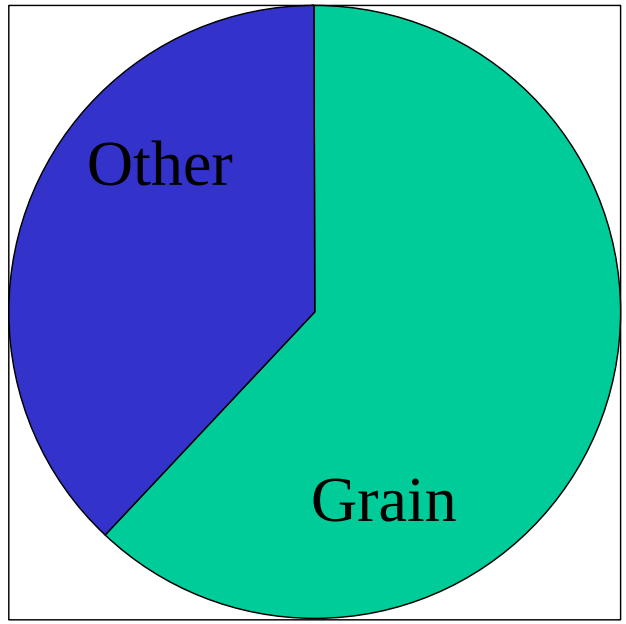
Percent Grain in Sown Area in China: 1950s, 1970s and 2003



1950s



1970s



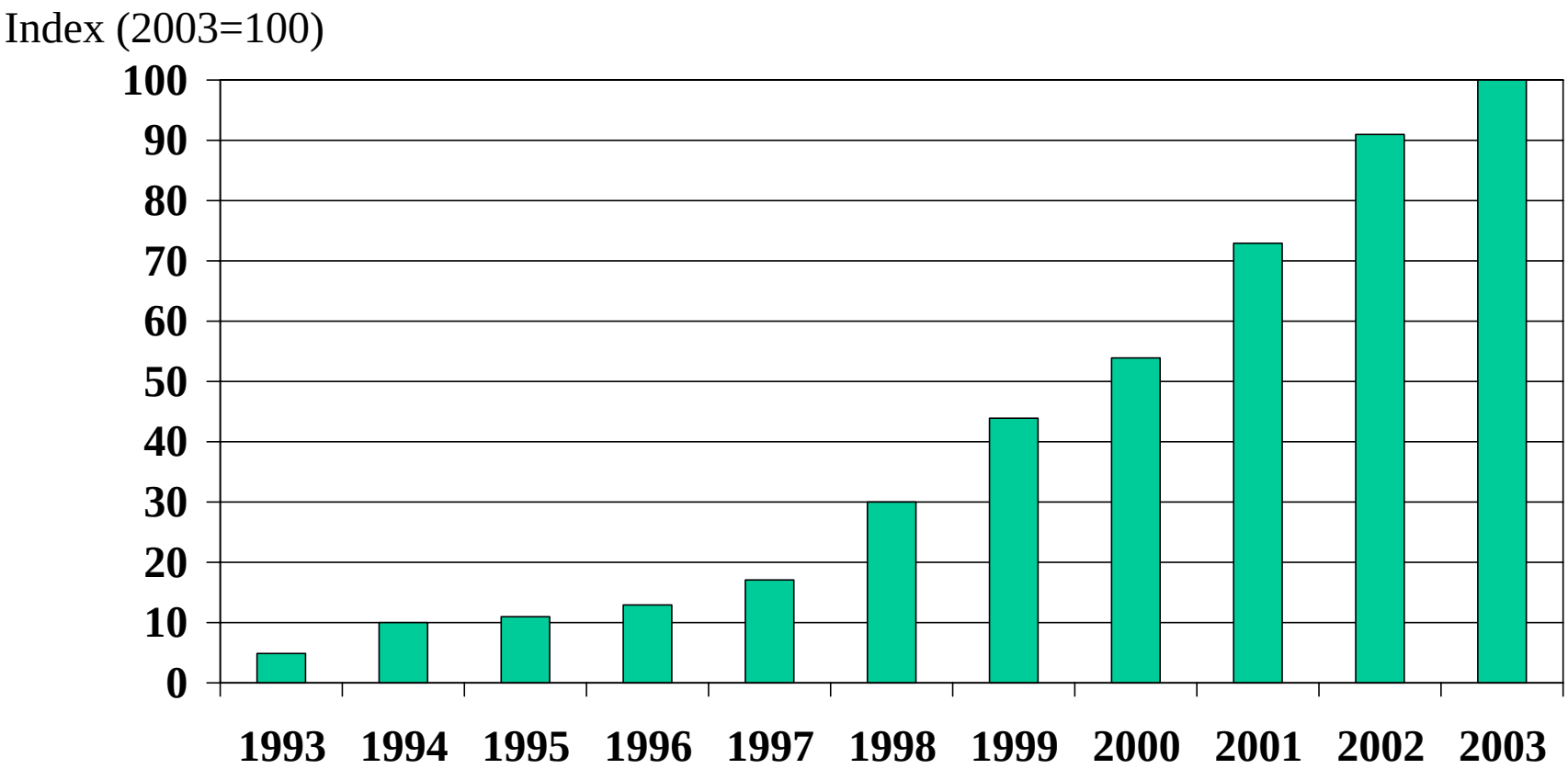
2003

Steady rise in cash crops / fruits / livestock / aquaculture

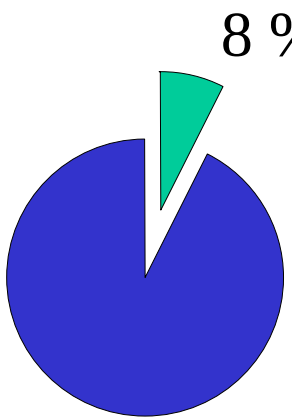
China's Farm Structure

- 200,000,000+ million farms
- Every rural resident (900,000,000 of them) has land
- Almost all farms are "family farms"
- Farm size: "1 mu per person"
- Average size of vegetable operation (about 1/3 of an acre … a big garden!)
- Historically (since HRS): little cooperation

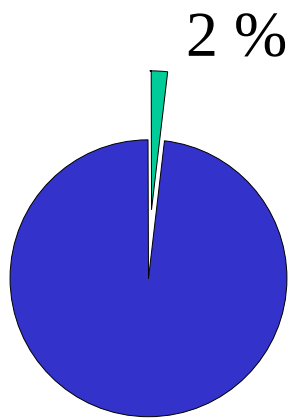
Growth of Cooperatives and Farmer Associations – Targeted mostly at provision of technology and inputs and marketing



But, cooperative movement still small



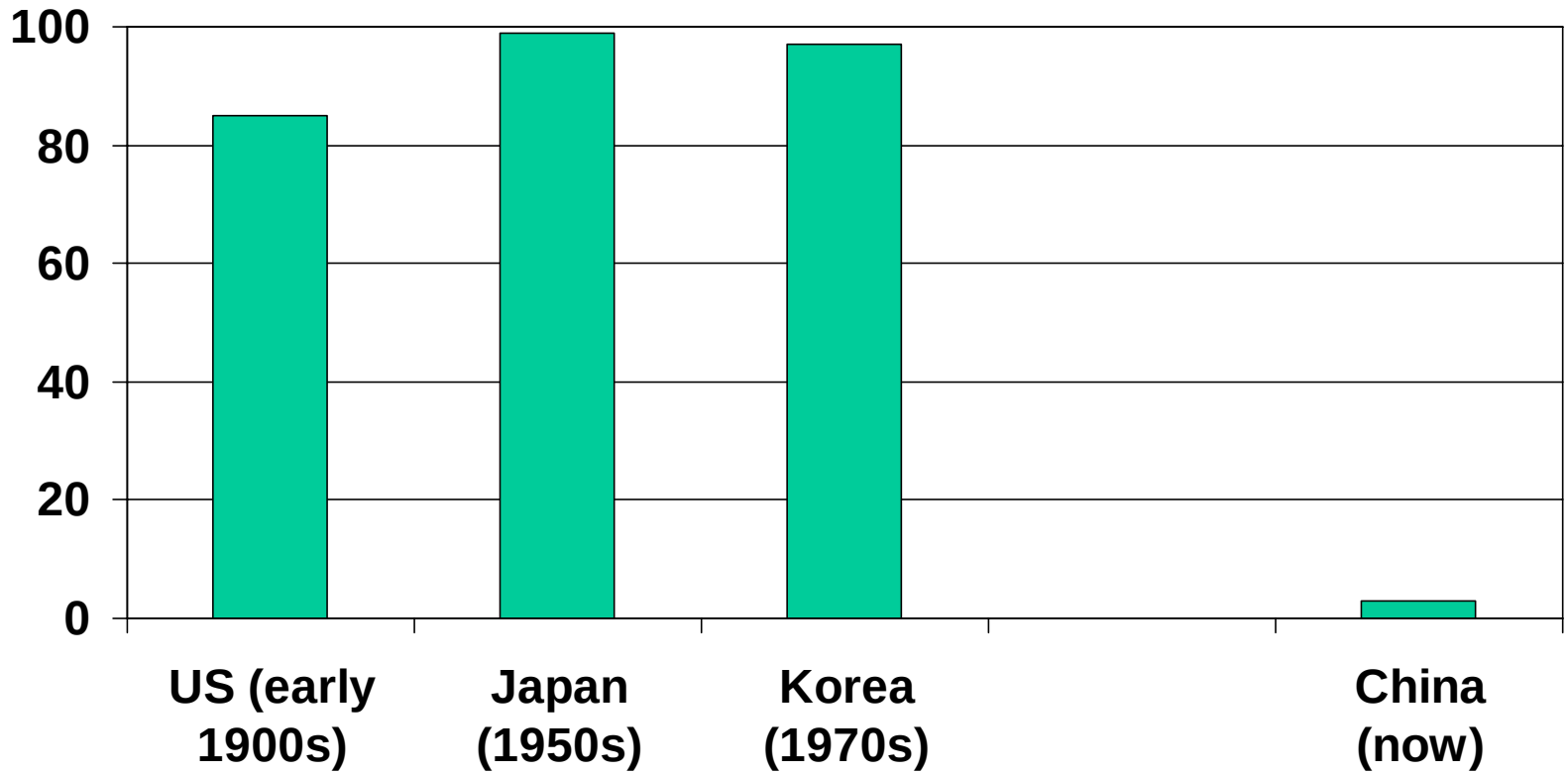
Percent of villages with Cooperatives / FAs



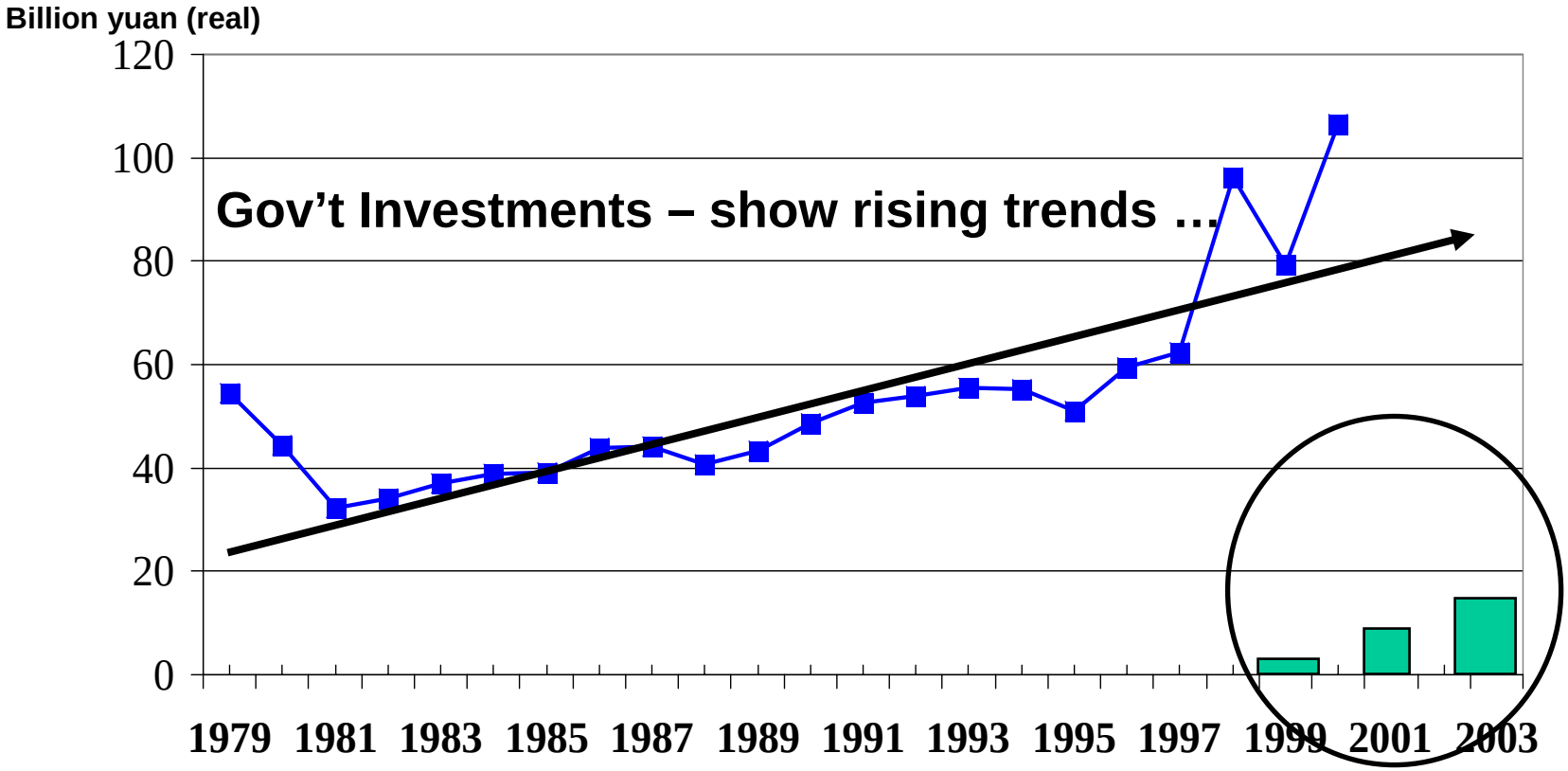
Percent of households that belong to Cooperatives / FAs

Most coops include members that produce livestock and horticulture crops

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

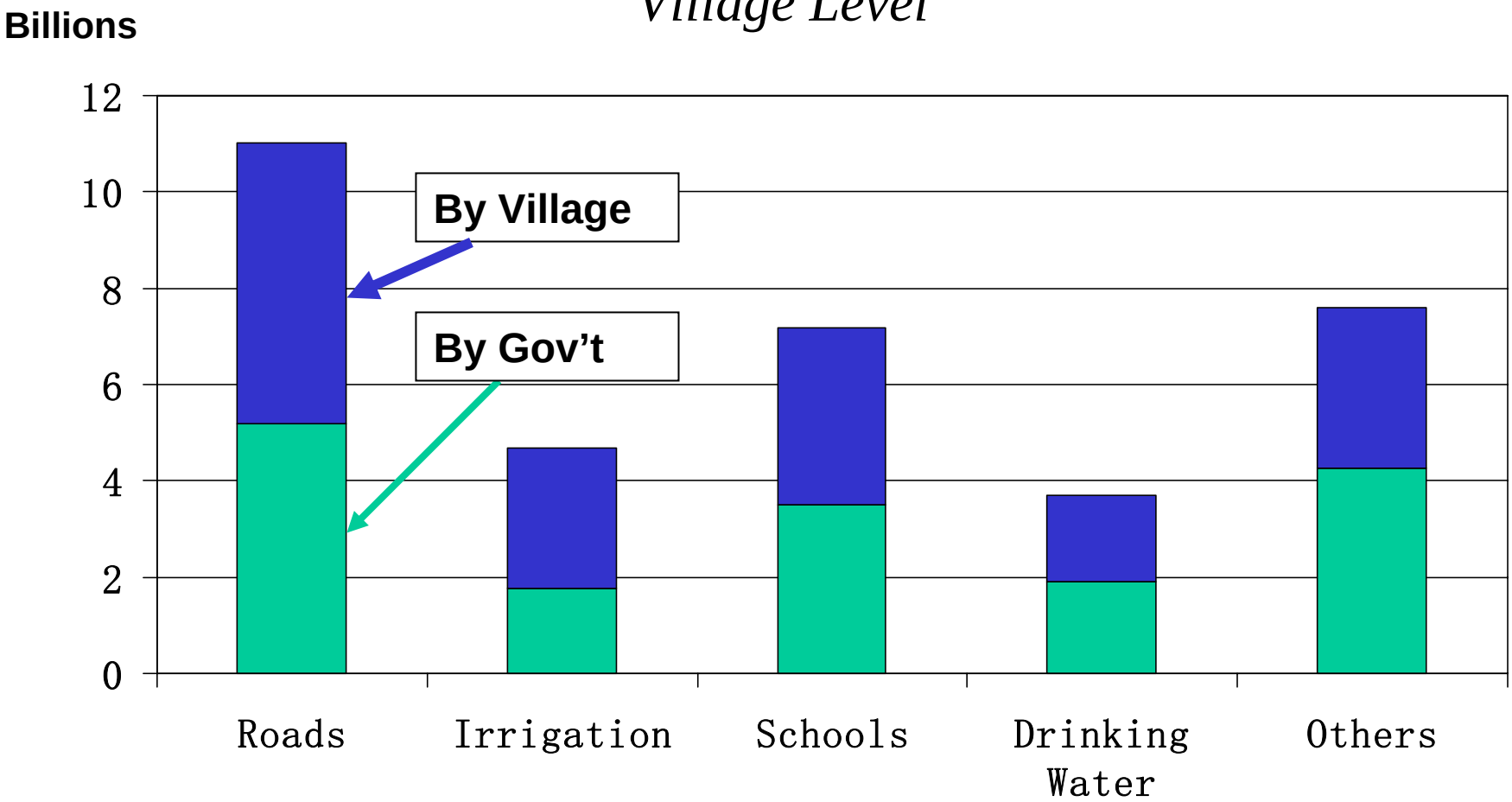


Investments into China's Agriculture



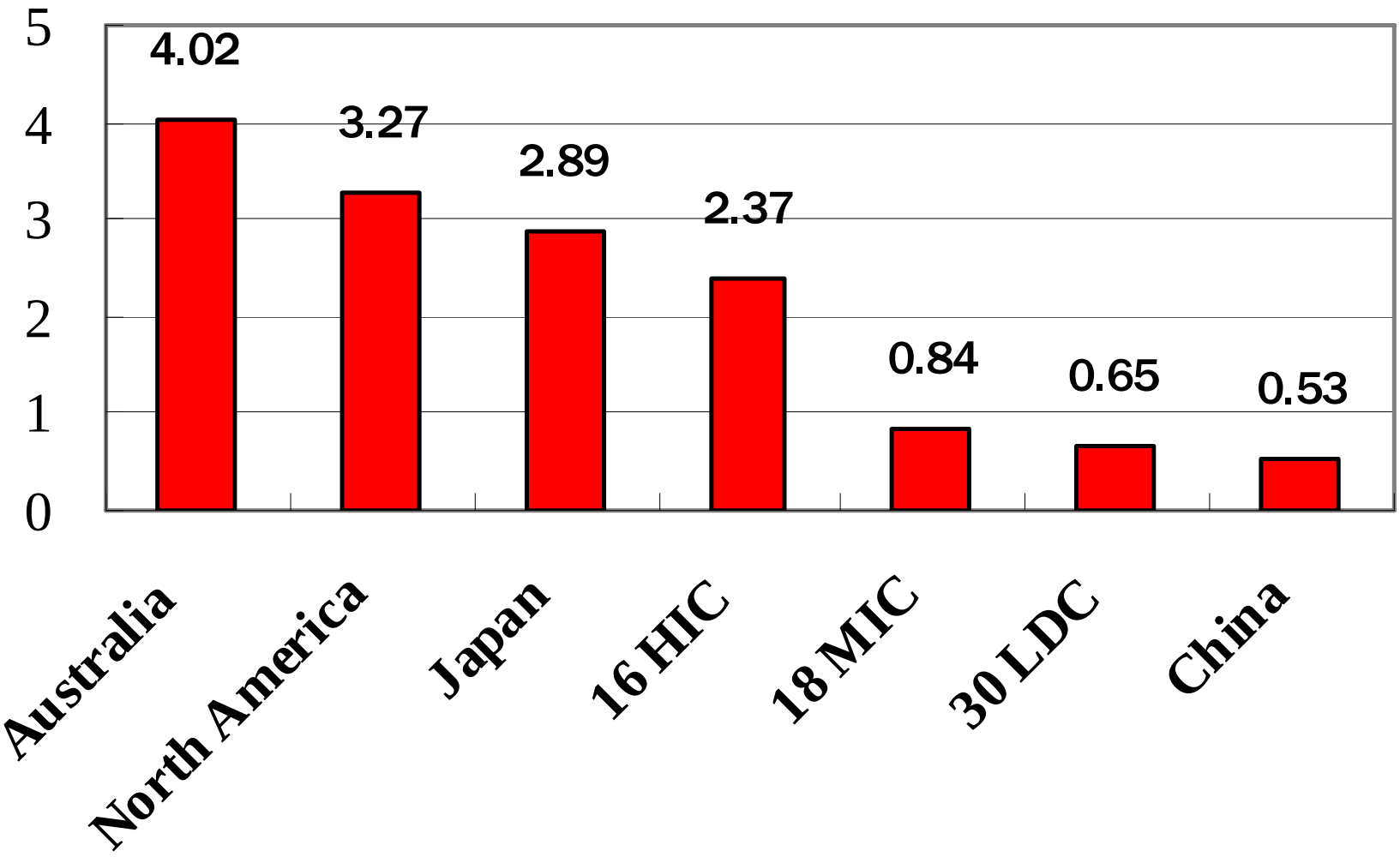
FDI in ag: mostly into horticulture sector (may pose biggest threat to US in short run!) … mostly by foreign investors that want to export to Japan and Korea

Total annual investment into rural China's infrastructure *at the Village Level*

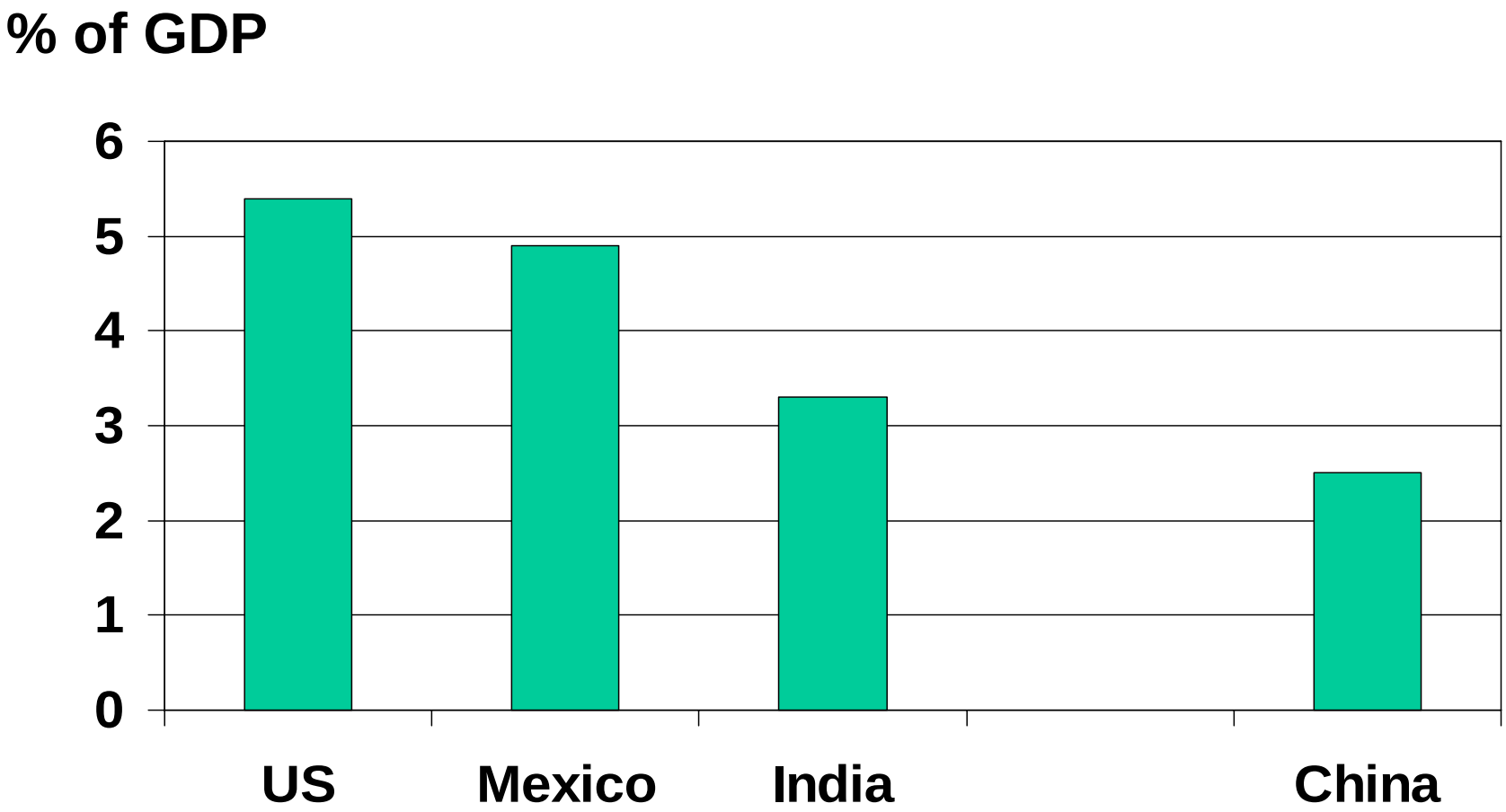


China also eliminated more than 2 to 3 billion US in exports subsidies … but these were replaced with US $5 billion in direct payment subsidies

Agricultural research investment intensity (%) in the late 1990s

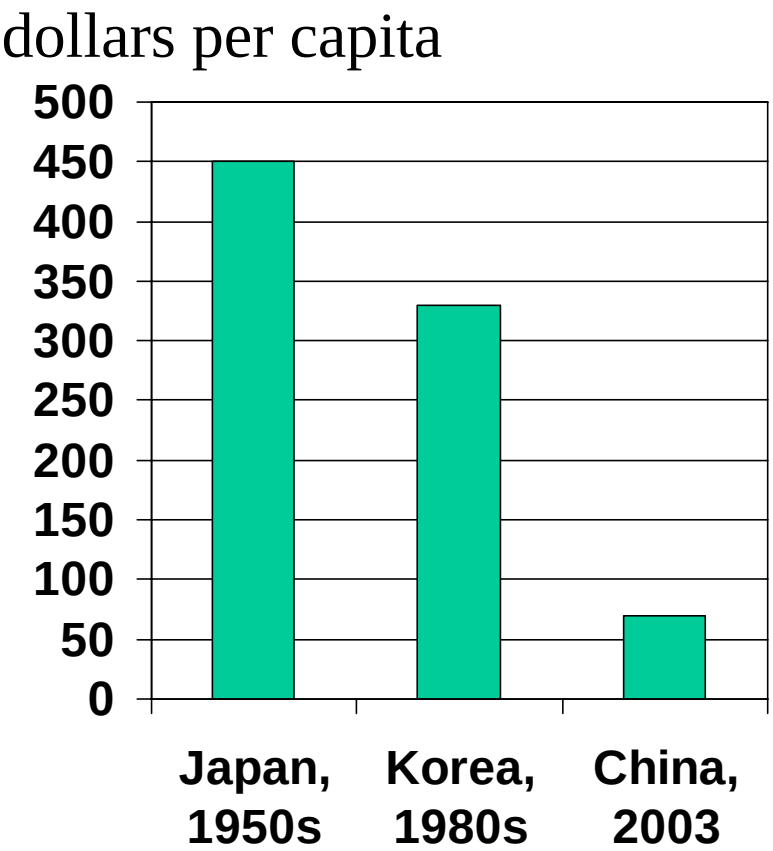


Education investment in late 1990s



Annual TOTAL Investments into Rural Areas

- Although comparisons are difficult, main point is that China still has a long way to go in making rural China into a modern economy



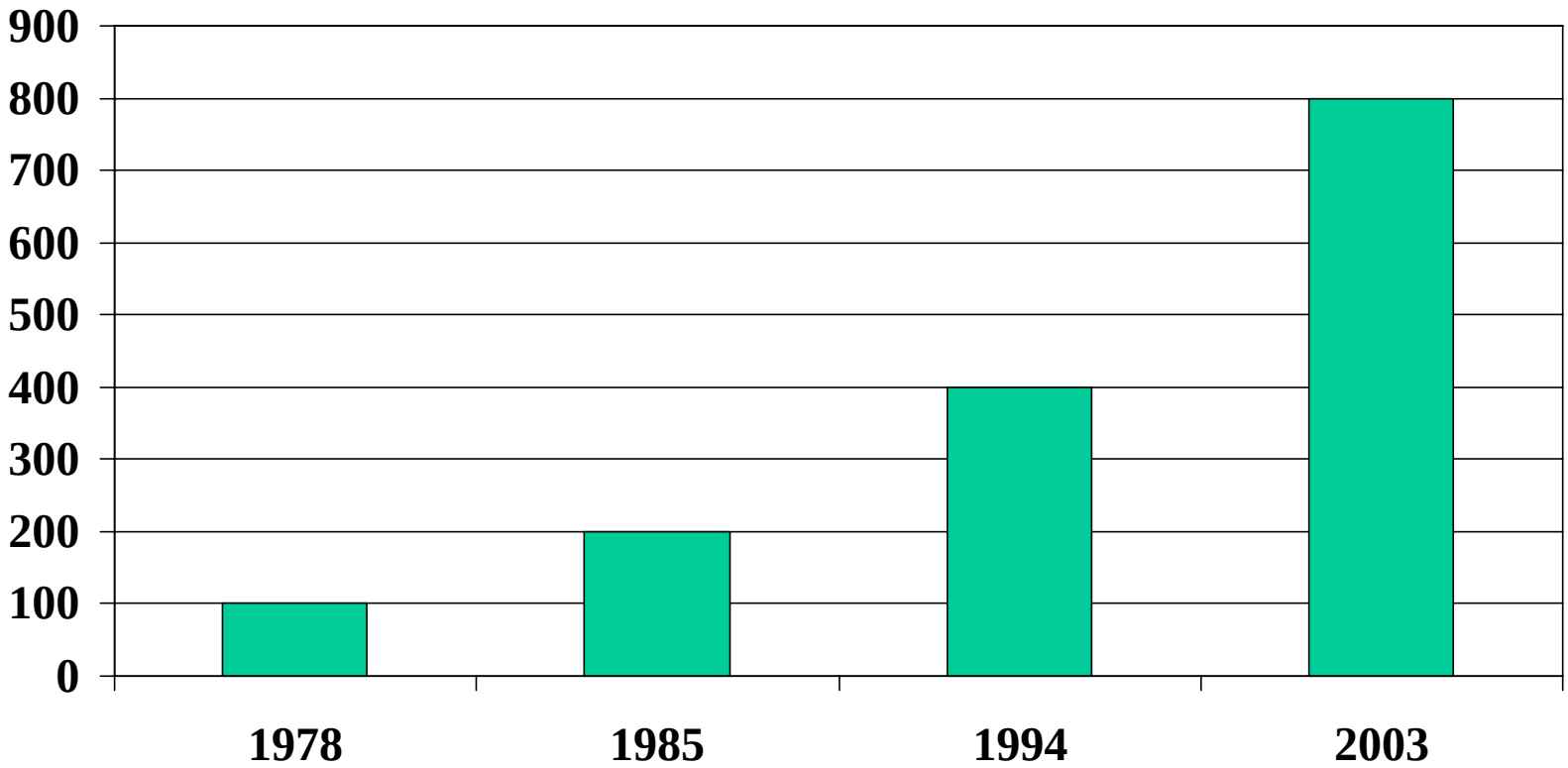
Demand

- The good news …
- Most fundamentally: Domestic demand is LARGE and is GROWING (in many dimensions)
- 1.3 billion consumers … and growing!

Rapid economic growth – nearly 10% per year for more than 25 years

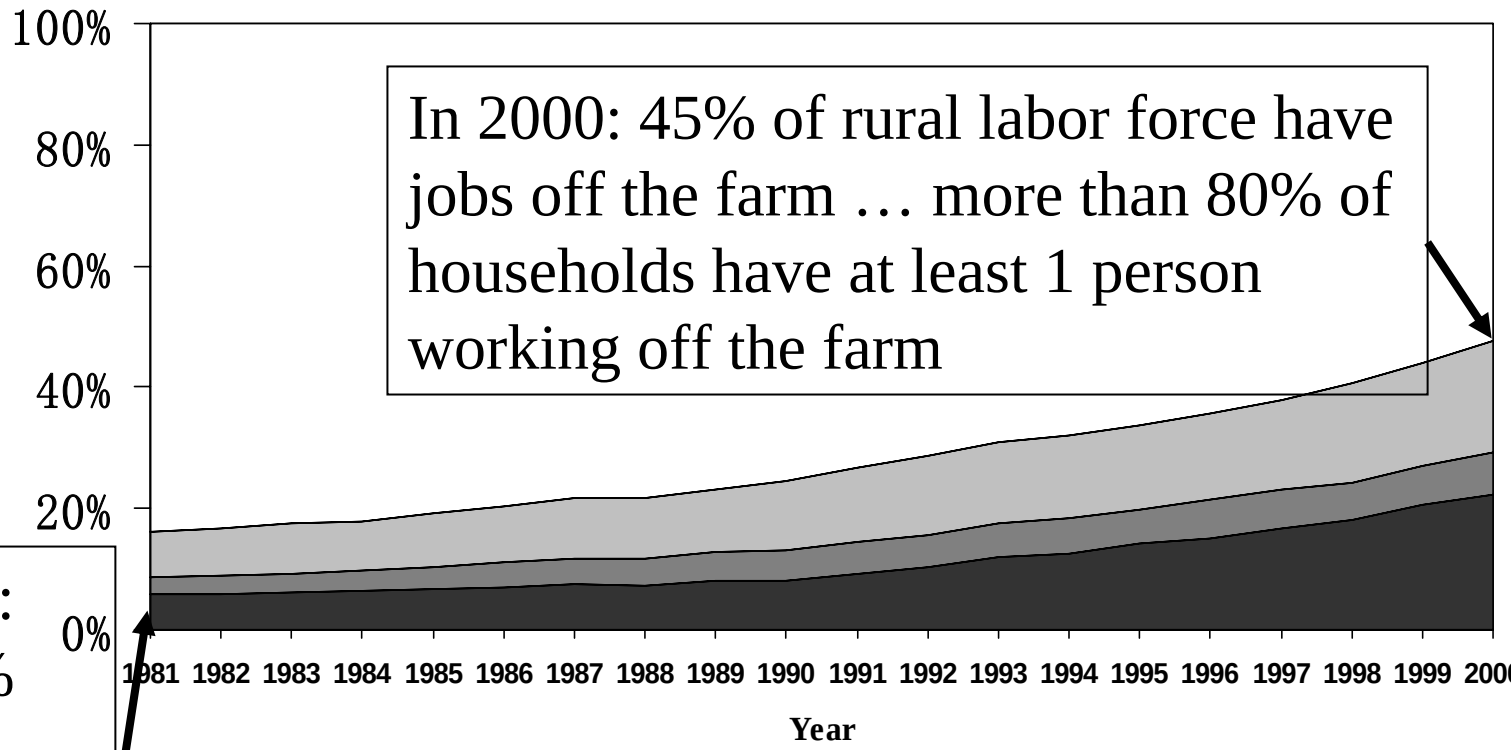
Index: Size of the economy

1978=100



Overall Increase in Off-farm Work

Rural labor force



In 2000: 45% of rural labor force have jobs off the farm … more than 80% of households have at least 1 person working off the farm

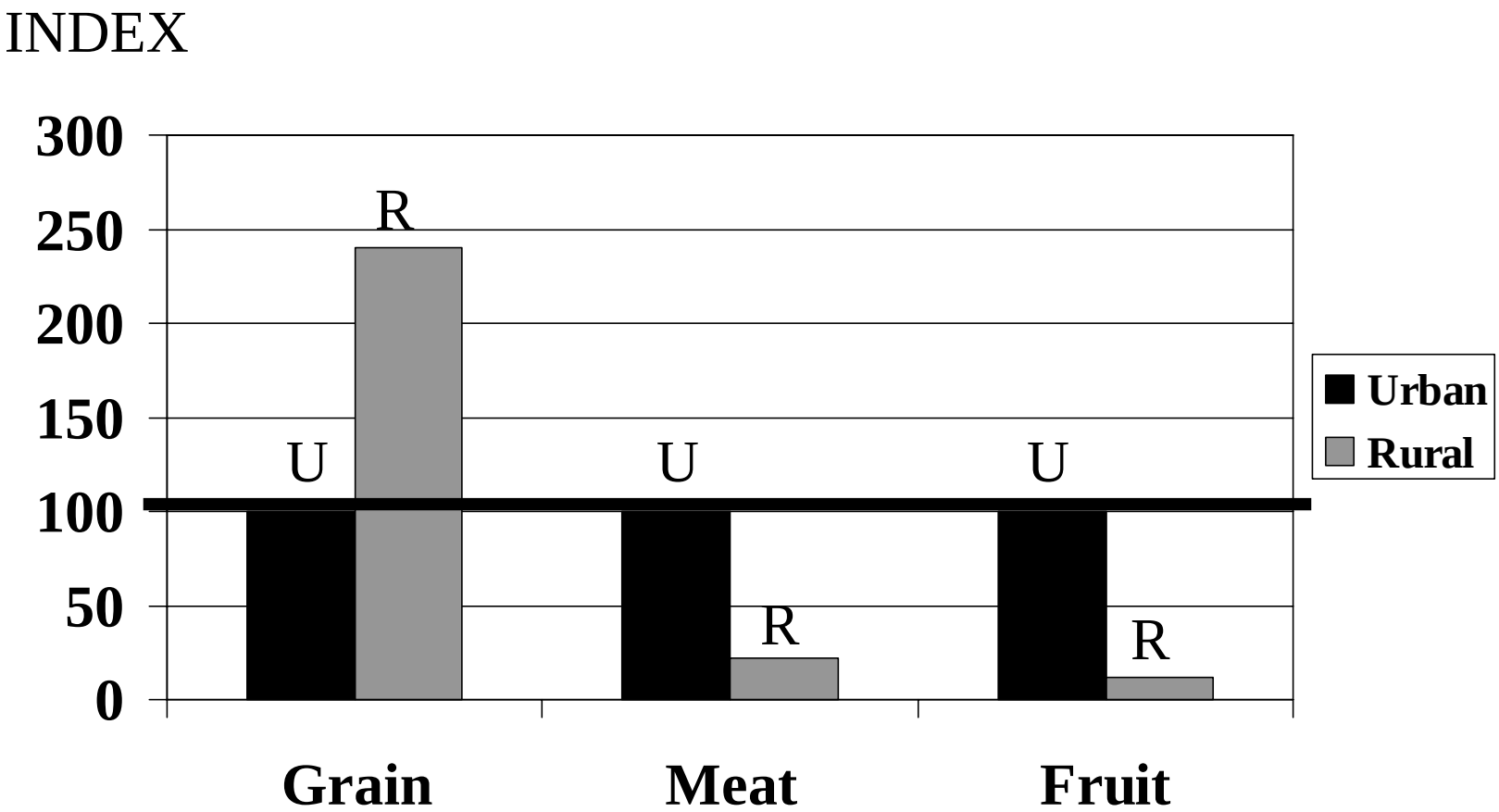
In 1980: only 4% worked full time off the farm

Increasingly new entrants to the off farm labor force are going to the city to work as a migrant

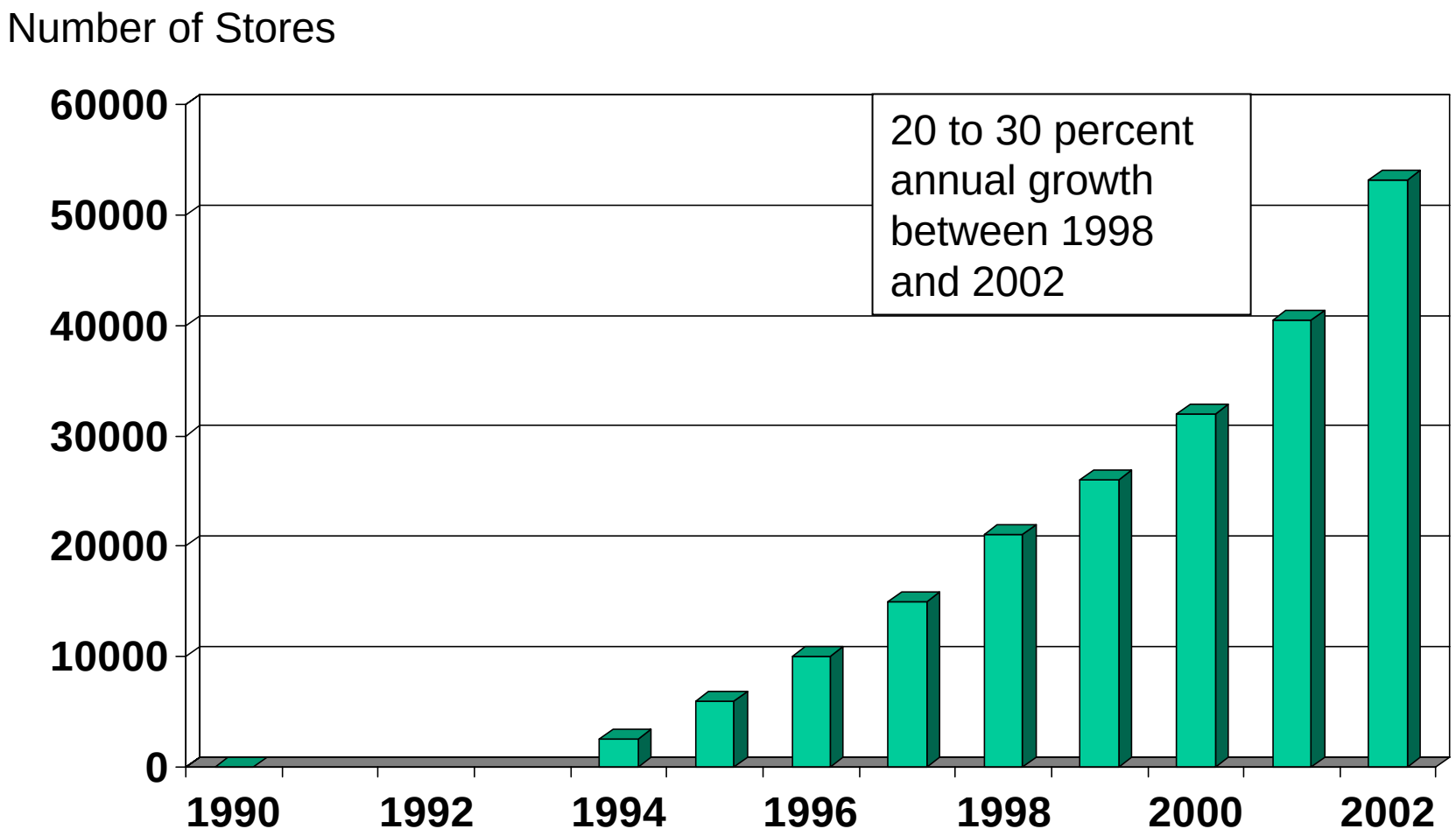
Percent of Workforce Off-farm, by Age Range

Age Range	1990	2000
16-20	23.7	75.8
21-25	33.6	67.2
26-30	28.8	52.5
31-35	26.9	47.6
36-40	20.5	43.3
41-50	20.8	37.6

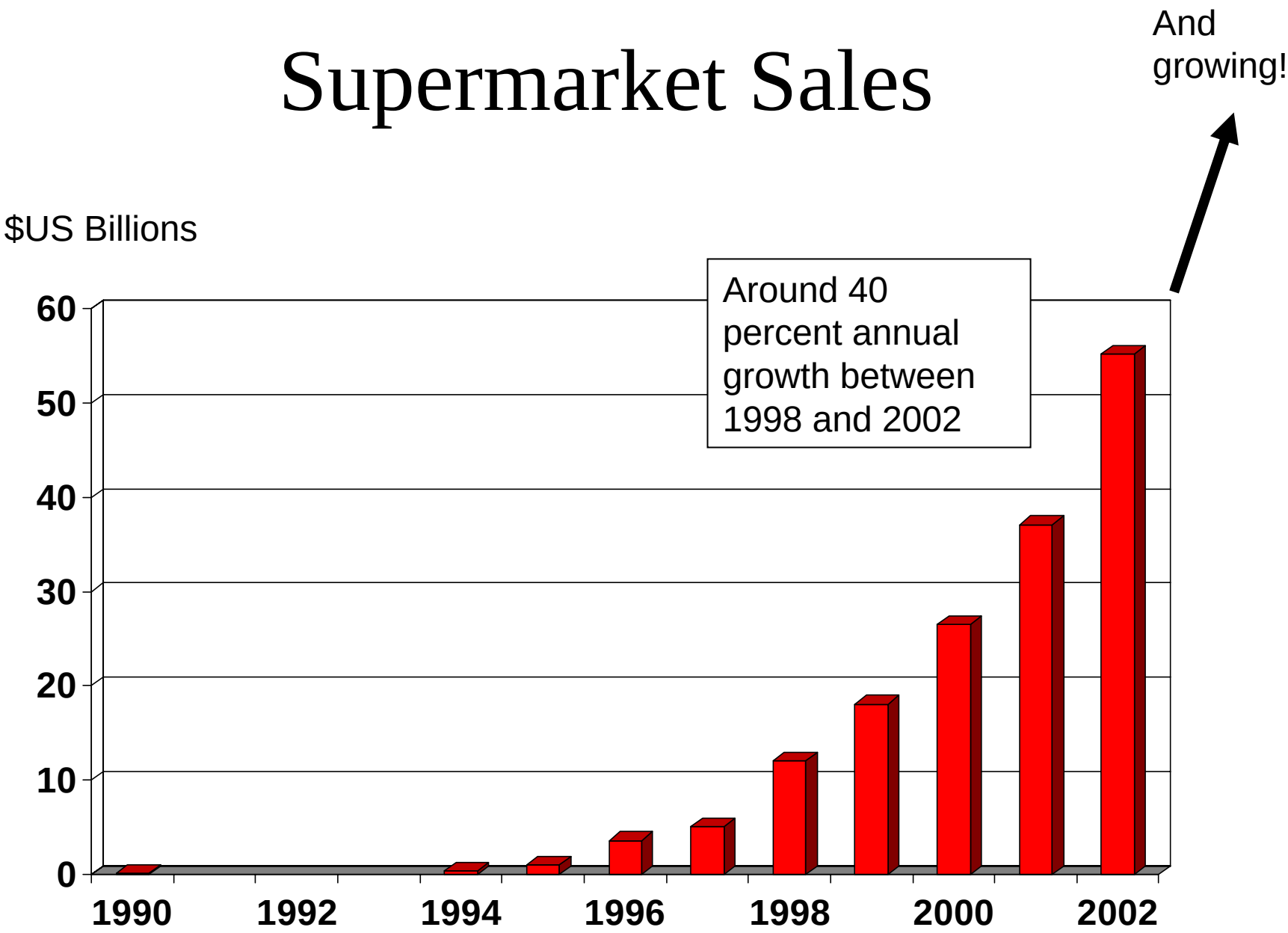
Consumption Consequences of Migration: less grain/more meat & fruit



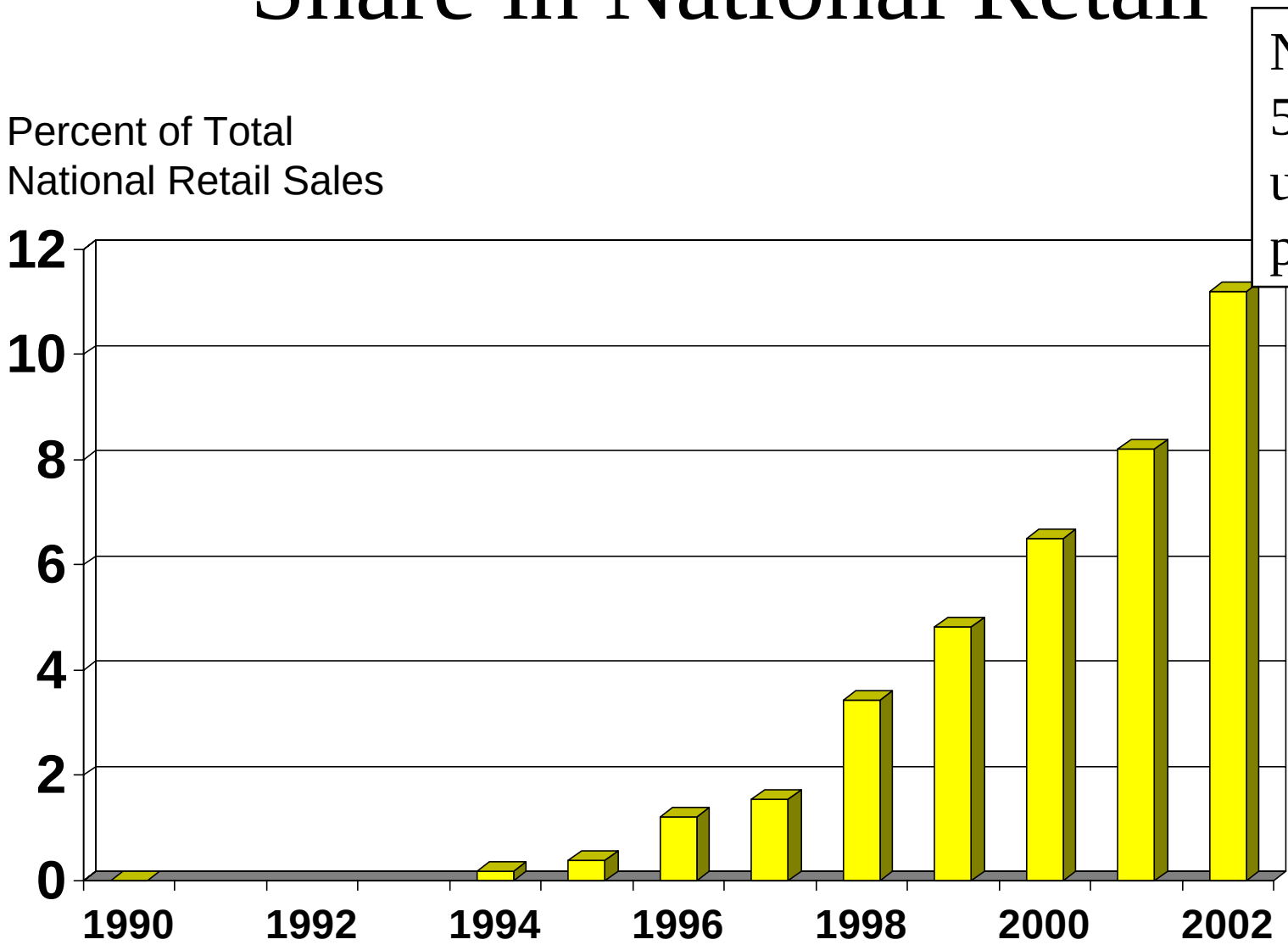
SUPERMARKET OLYMPICS: Increasing Store Units



Supermarket Sales



Share in National Retail

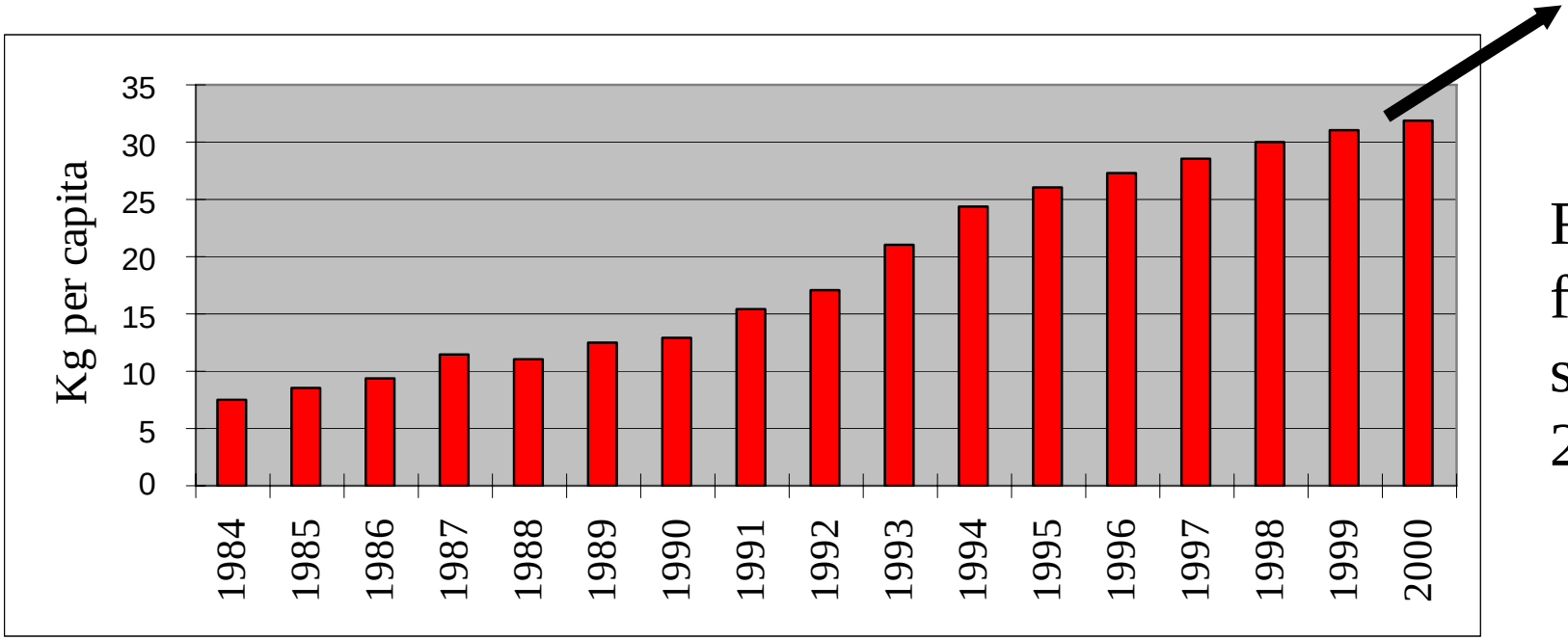


Nearly 50% of urban food purchases

Entry of MNCs

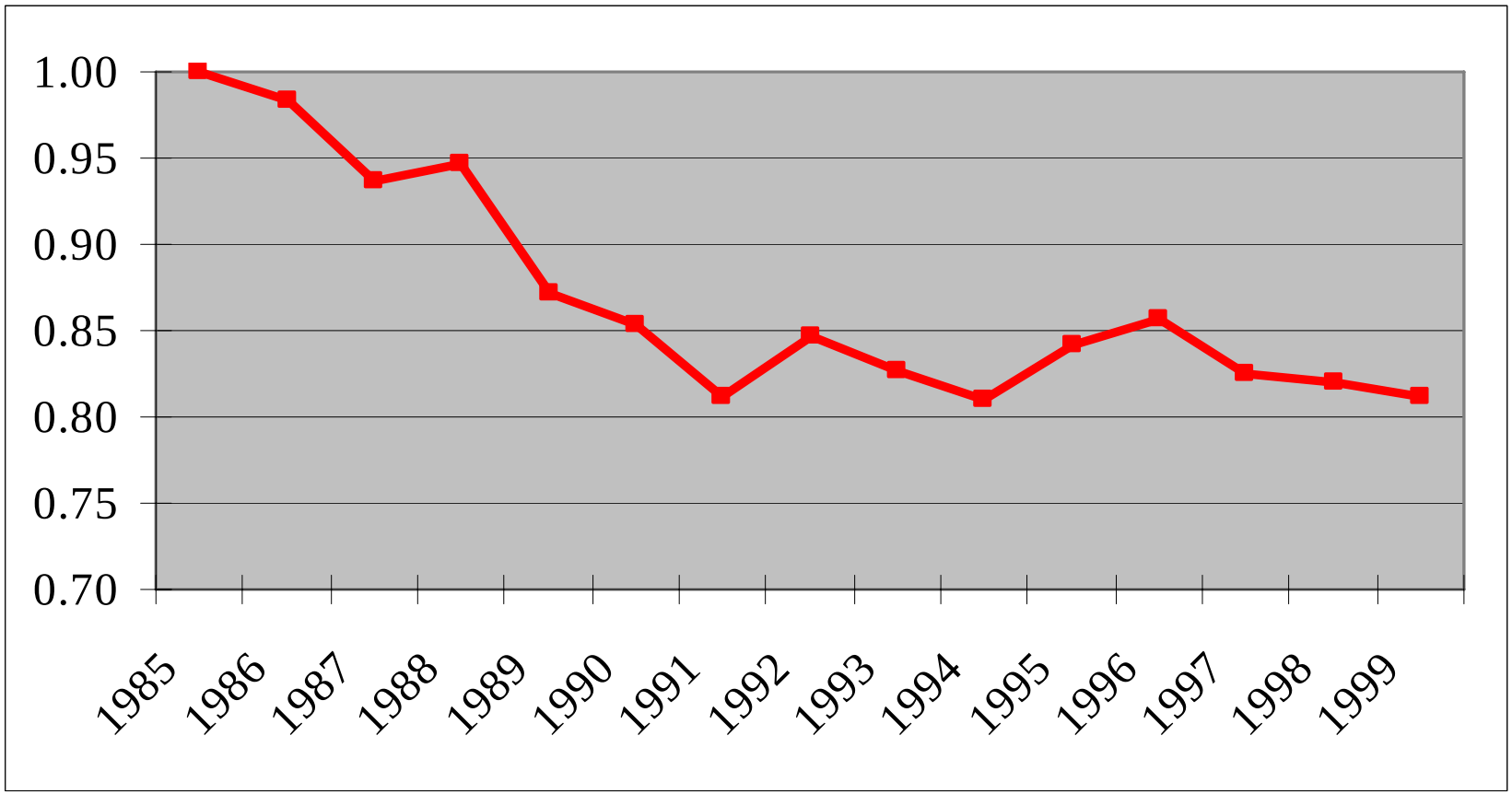
- Almost “everyone” is in China:
  - Wal-mart
  - Carrefour
  - Ahold
  - CRE Vanguard
  - And other chains from Japan; Thailand; Korea; Singapore; Hong Kong; France; Germany; UK; US
- PLUS many aggressive domestic chains from China
- **So much competition, World Banks calls it the “Retail Olympics”**

Urban Fruit/Nut Consumption in China

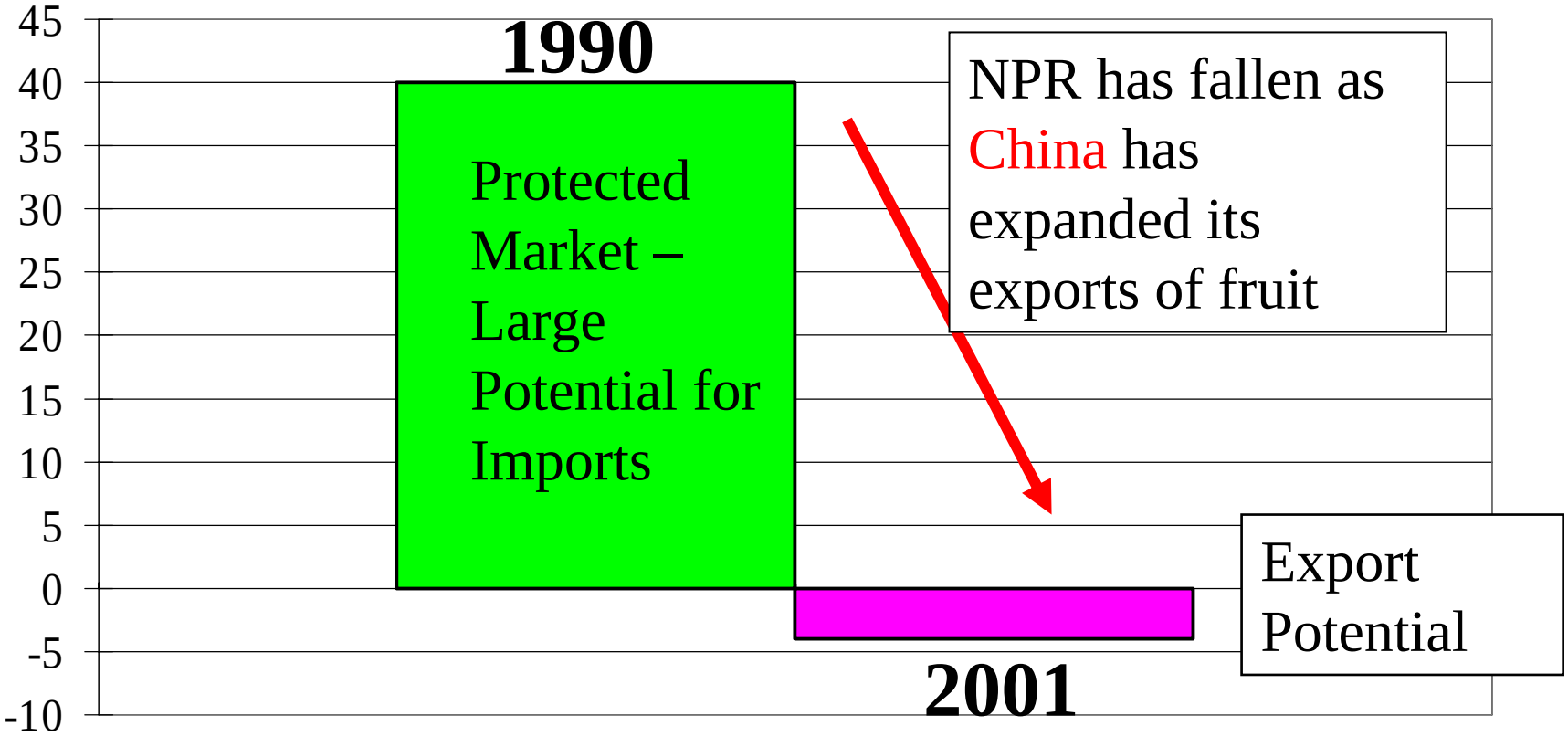


Rising faster since 2000!

Price of Fruit Relative to All Other Prices, China

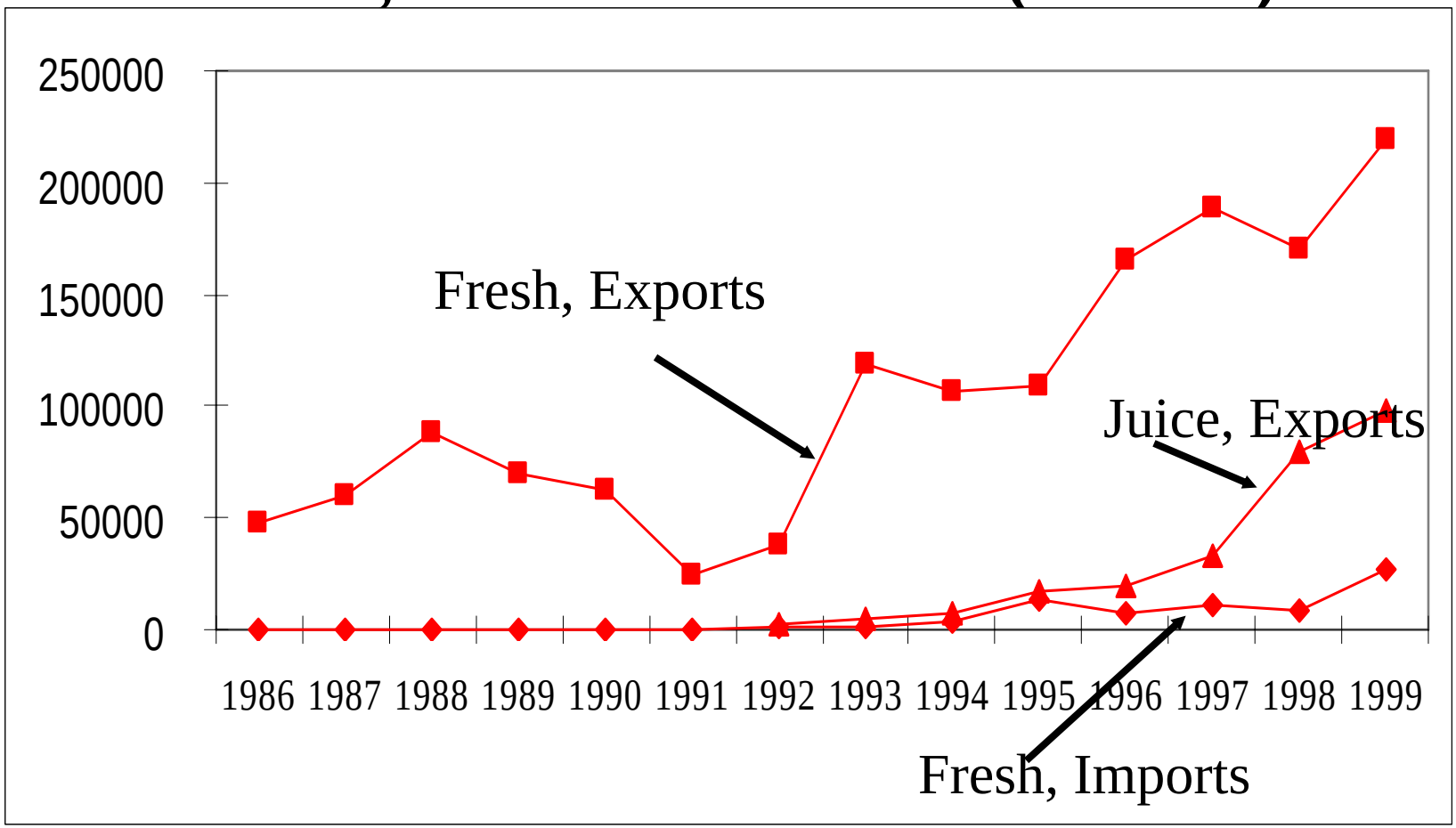


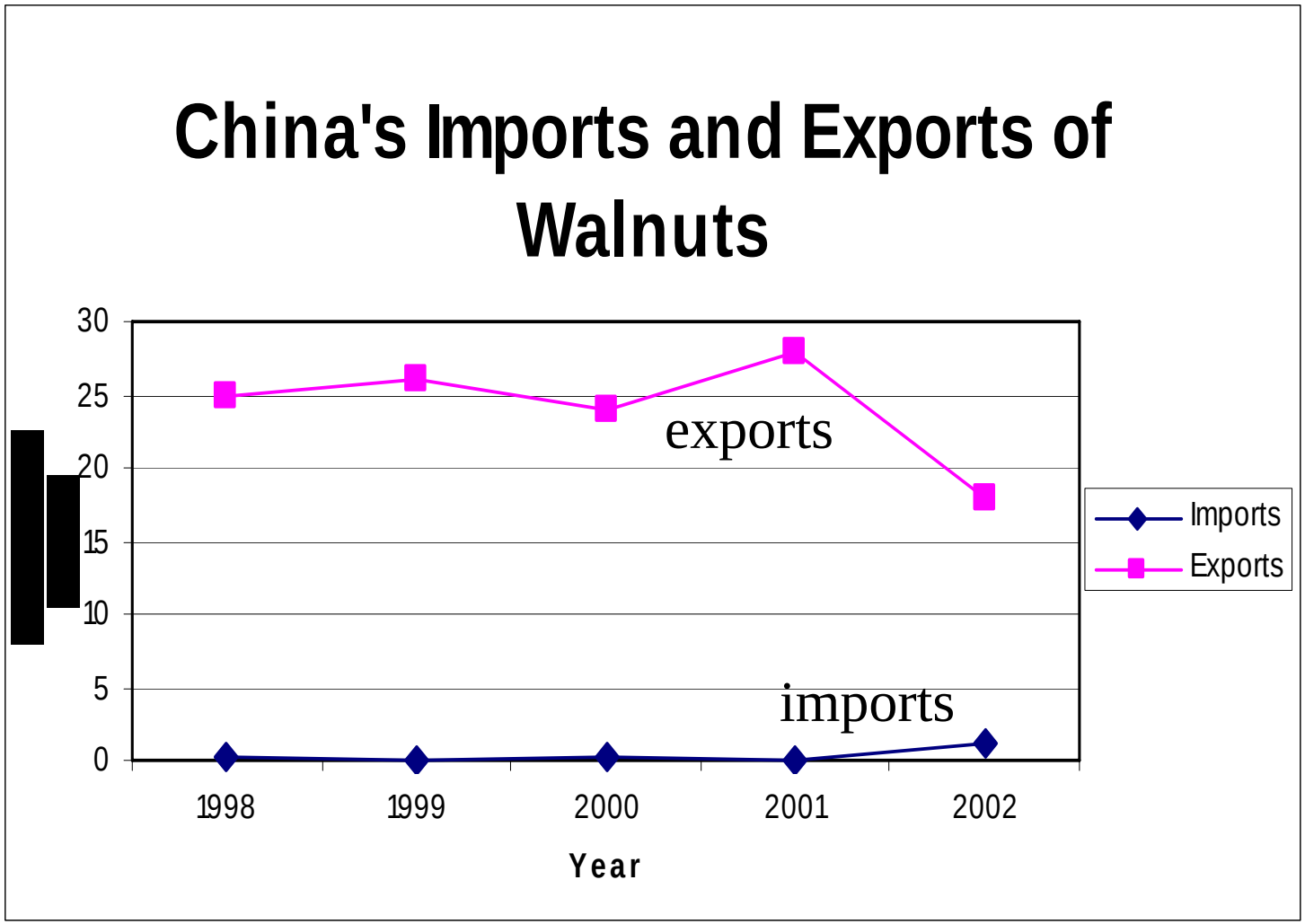
Rates of Protection (%)
Fruit in China



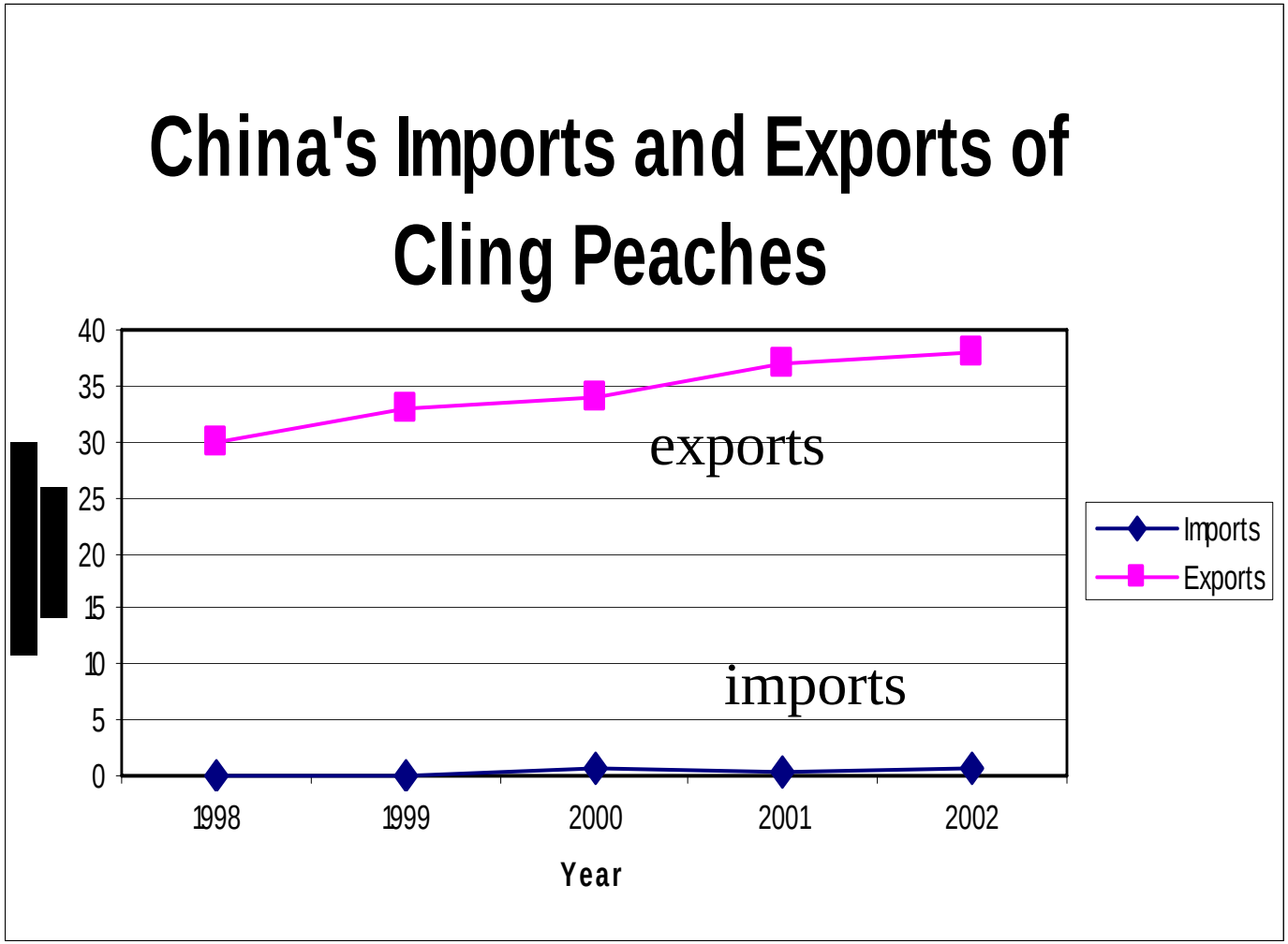
Trade for Horticulture Products

Apple Exports and Imports in China, 1986 to 1999 (Tons)

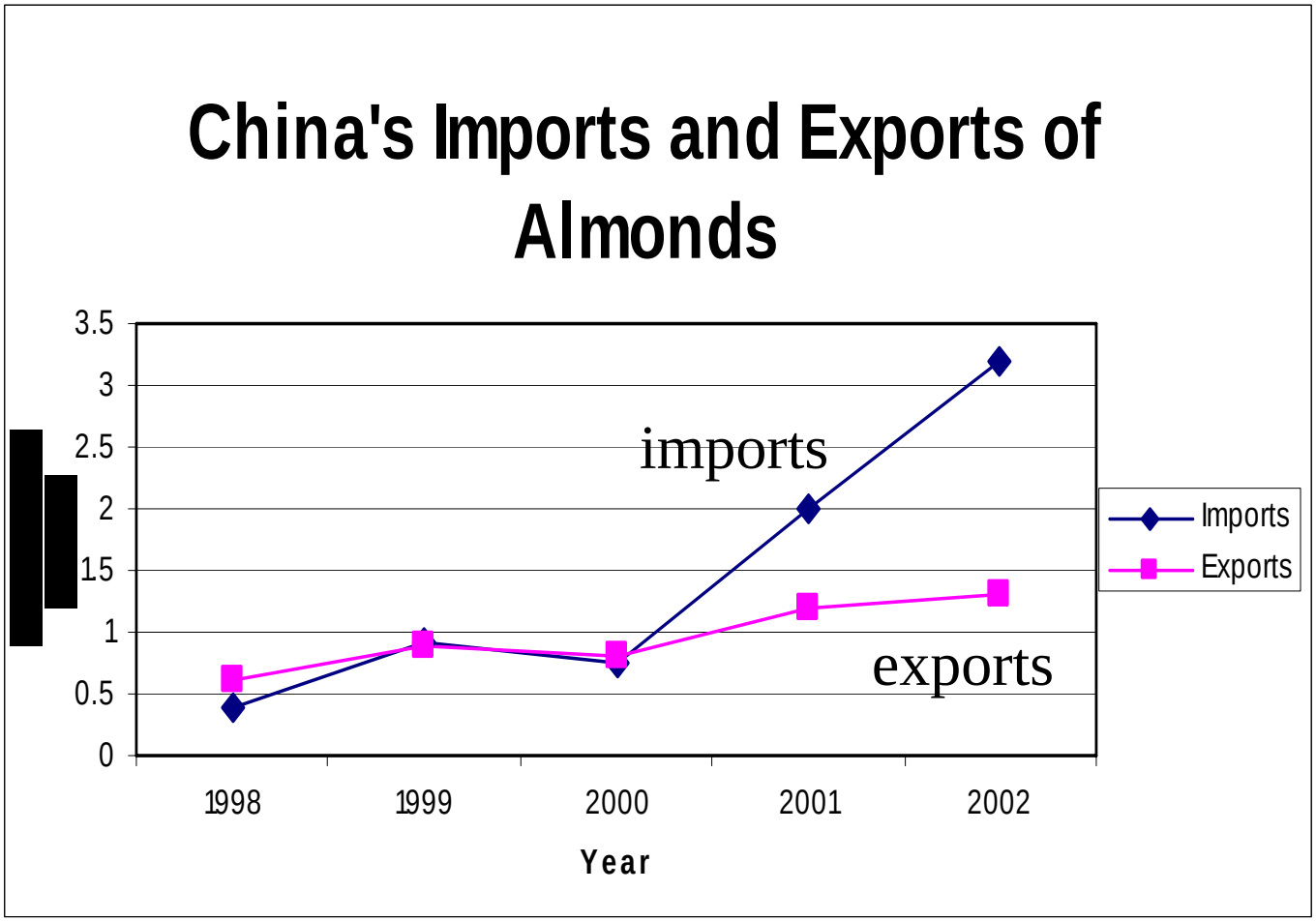




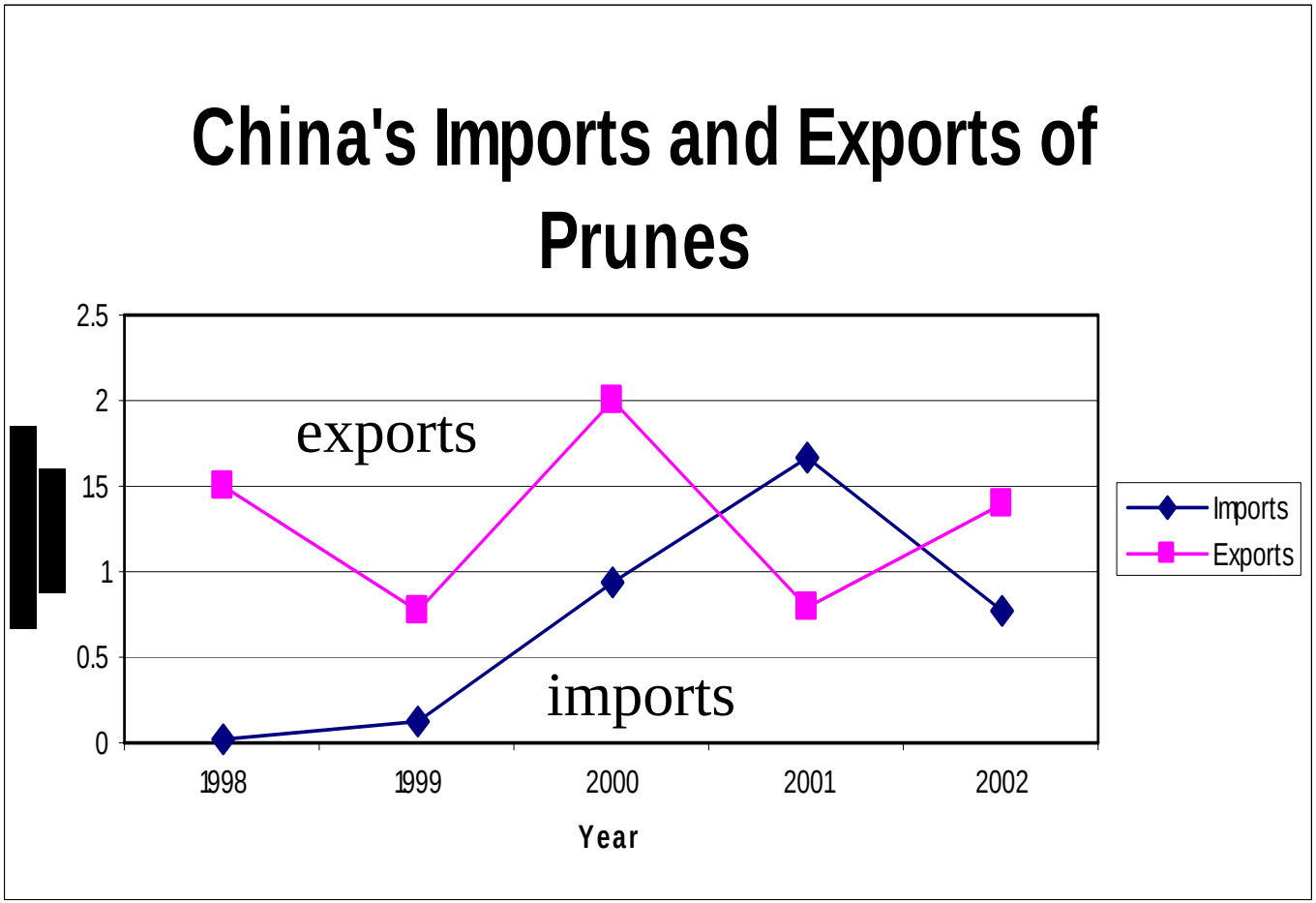
All imports from California



Most of imports from the US



Almost all imports from California



Almost all imports from California

Other good and bad news

- California wine imports into China … up GOOD
- Broccoli exports from China to Japan … up BAD
- What is coming: ???
  - Export-side … Frozen strawberries / fresh apples / fresh vegetables
  - Import-side … High quality fruits / foods ingredients for in-country food processing industry

SUMMARY

- Significant percentage of ag. land used in horticultural products (more than US)
- Rising sown area and production in many (not all) of horticultural products grown in Western US
- Although demand growing fast (lots of opportunity), production growing faster ➔ lower prices ➔ falling NPR ➔ growing exports
- What is future hold?
  - Keep watching the race: Supply vs. Demand!

Relative Competitiveness: China versus US (California)

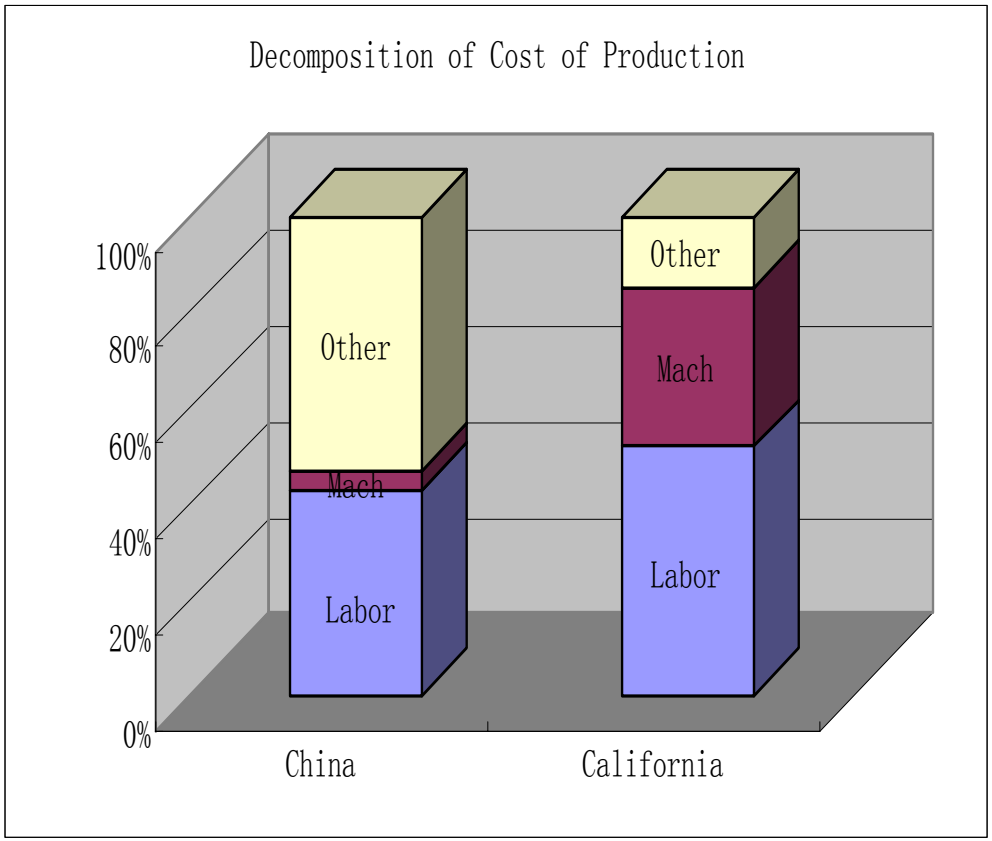
- Comparing the Level of Cost of Production of Major Agricultural Commodities in China and California

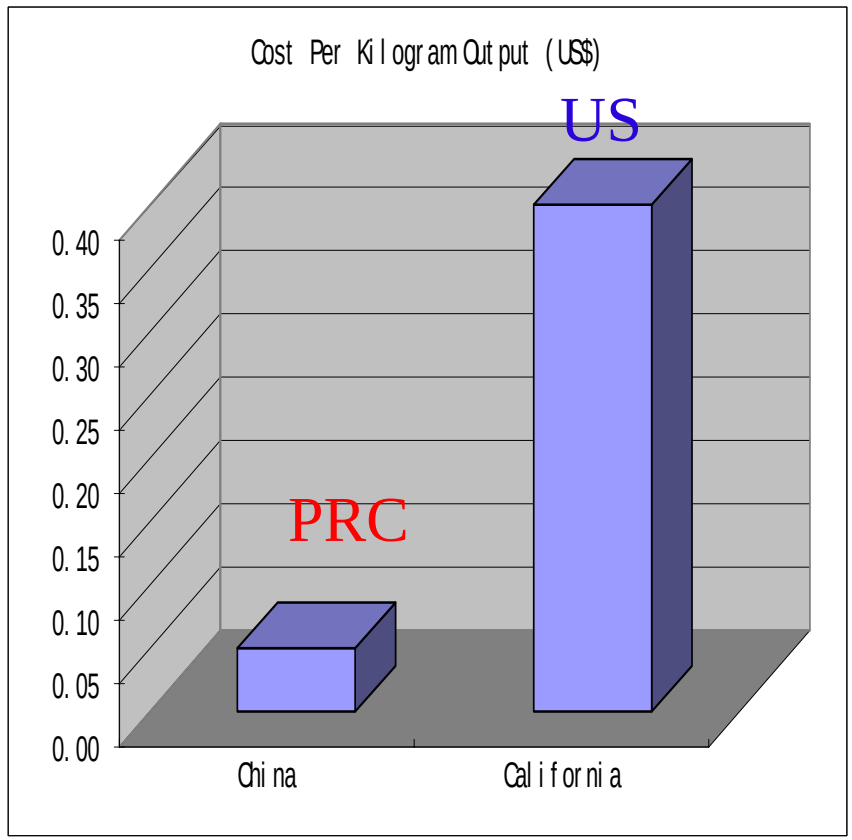
Cost of Production of *Fresh Tomatoes* in China & California, 2000 ($1=8.3 RMB)

Costs	China	California
Seeds	119	245
Fertilizer	502	210
Chemicals	284	326
Irrigation	72	304
Machinery Costs	44	3983
Labor Costs	1186	6254
Overhead & Management	77	17
Other Variable Costs	412	734
Fixed Cost	52	30
Total Costs Per Hectare	2748	12103
Per kilogram cost ($/kg)	**0.05**	**0.4**
% of labor cost in total	**43%**	**52%**
% of machinery cost in total	**4%**	**33%**

Cost of Production of *Fresh Tomatoes*

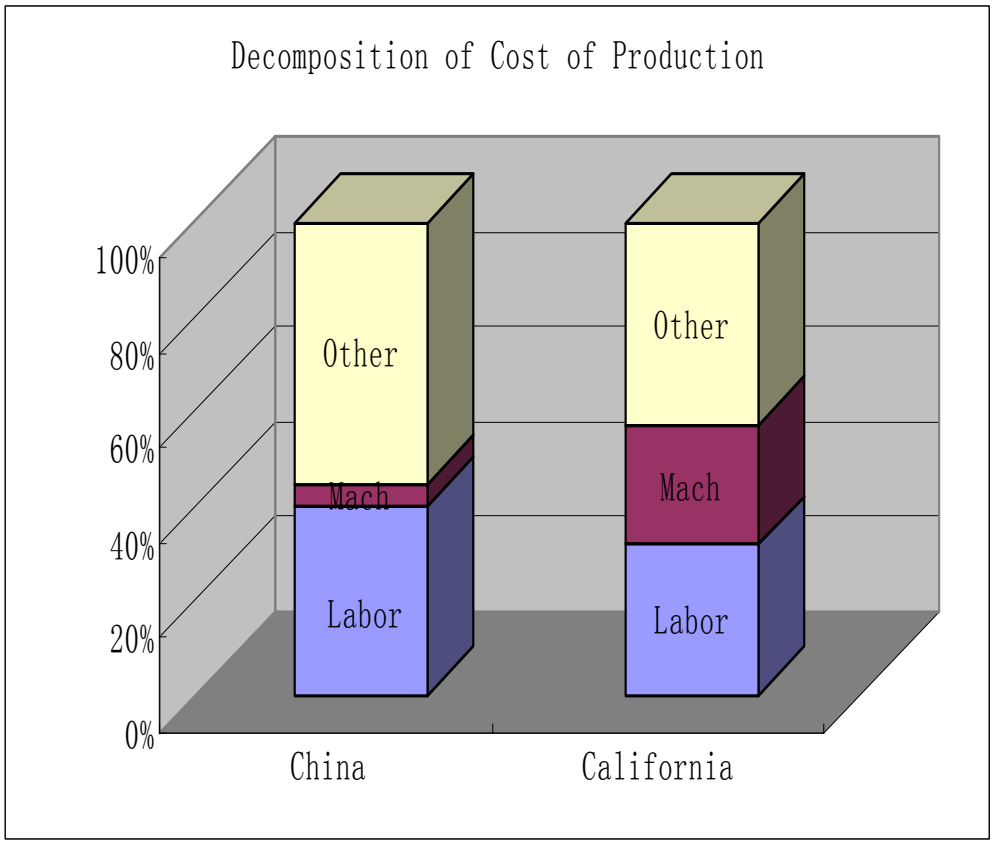
China and California

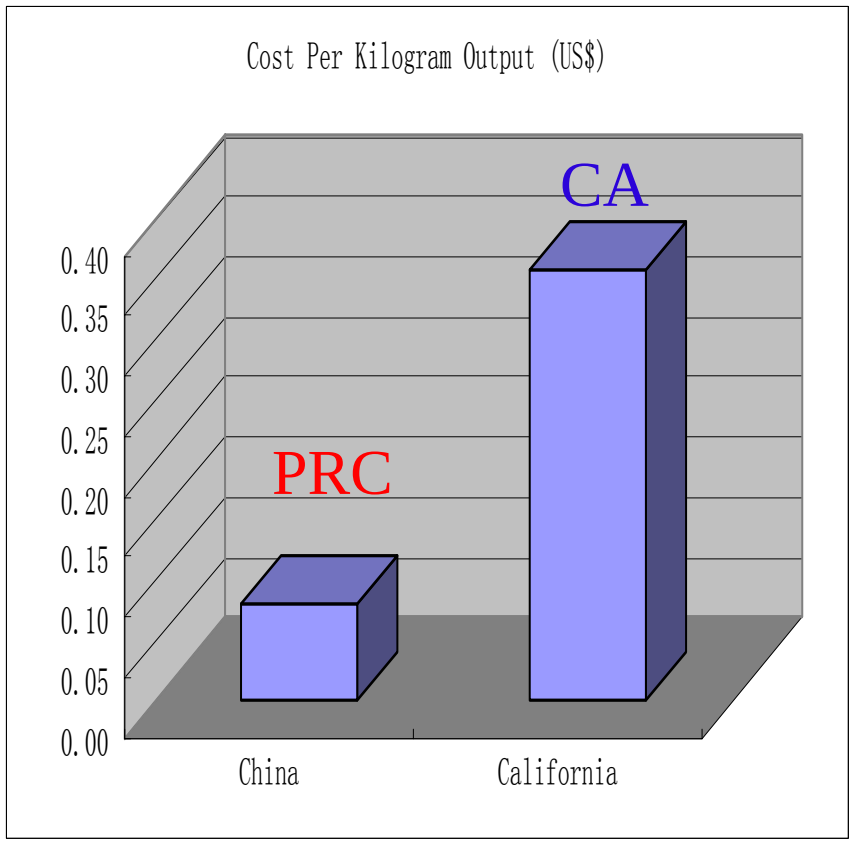




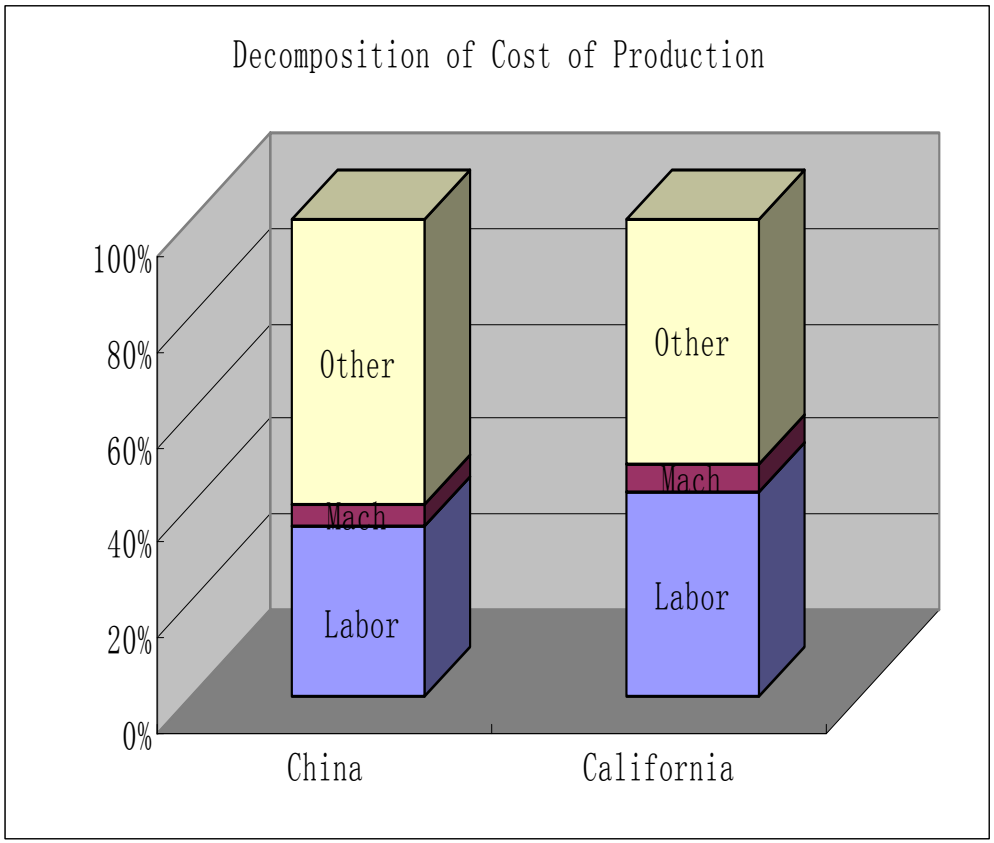
Cost of Production of *Peppers*

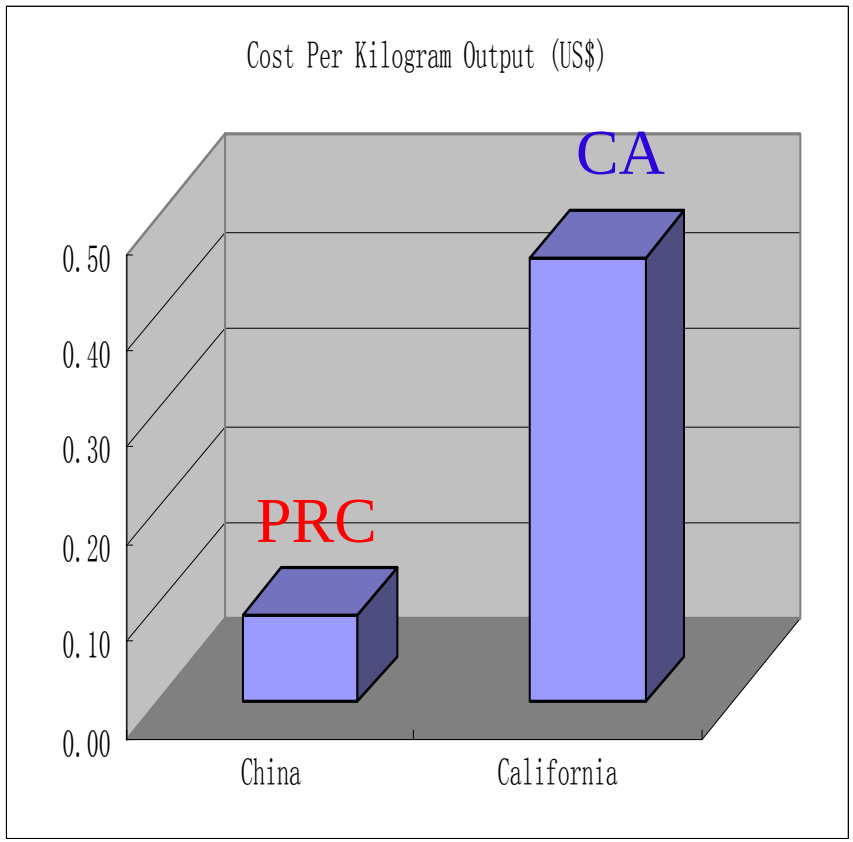
China and California





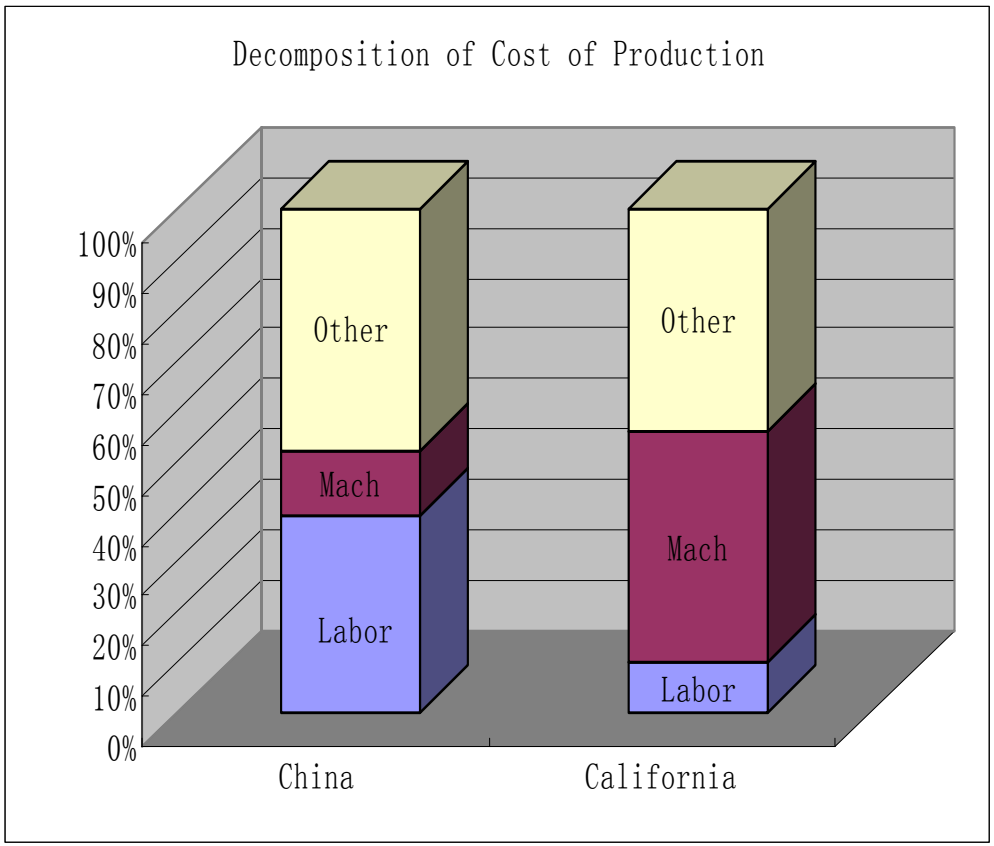
Cost of Production of *Oranges (Navels and Valencias)*: China and California

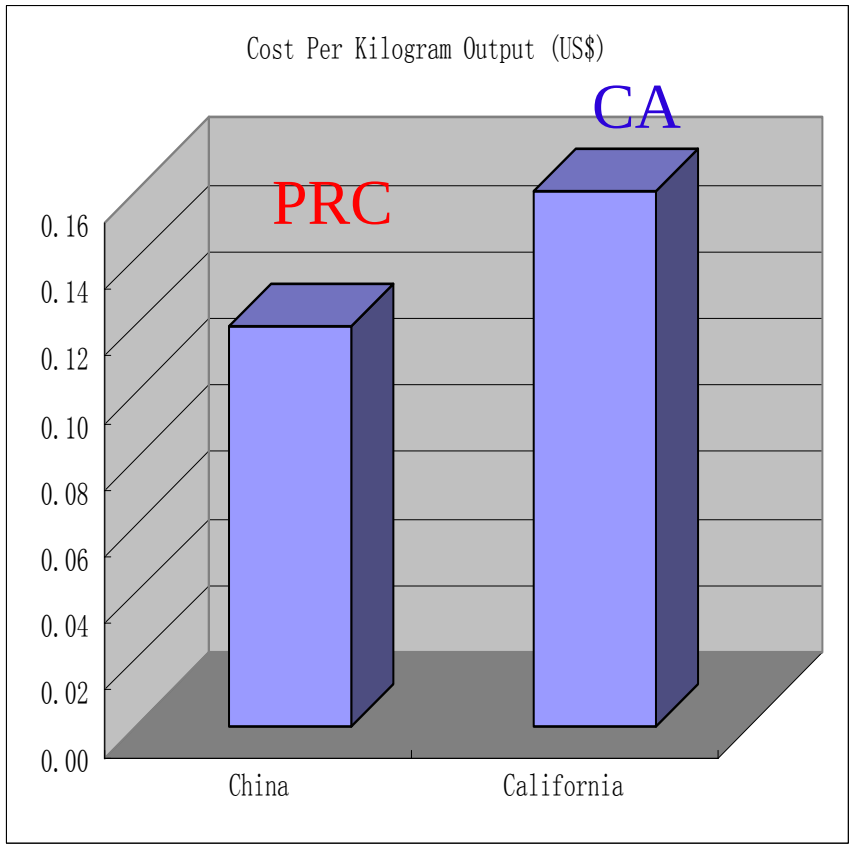




Cost of Production of *Japonica Rice*

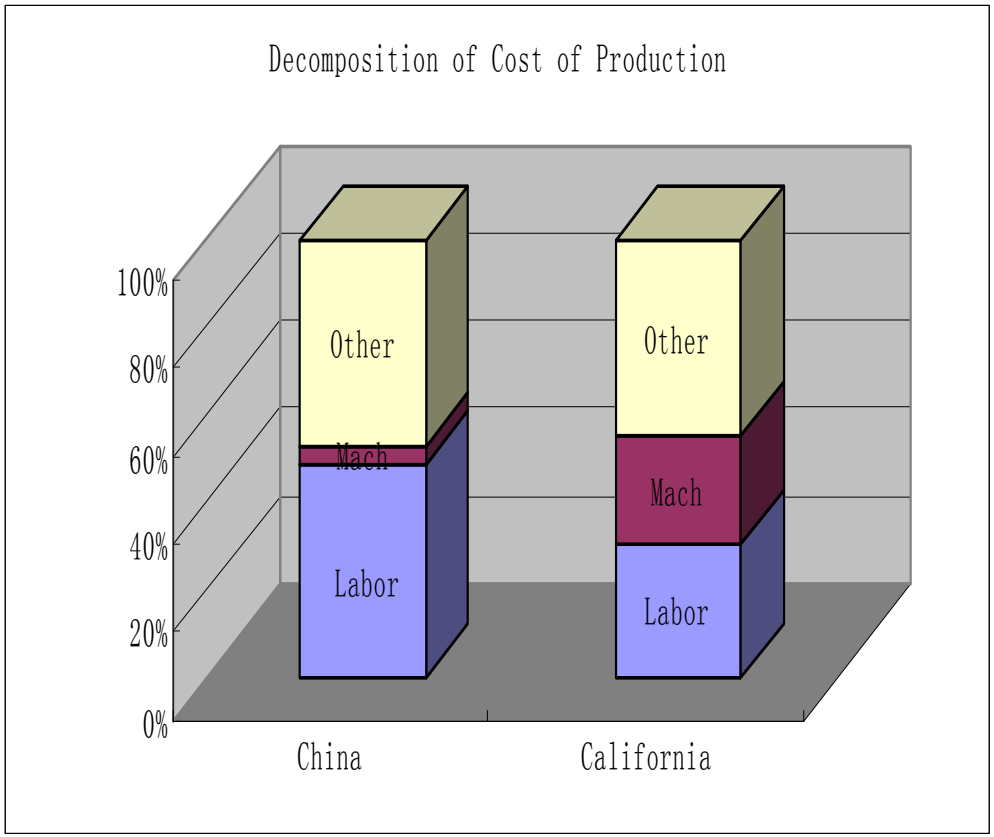
China and California

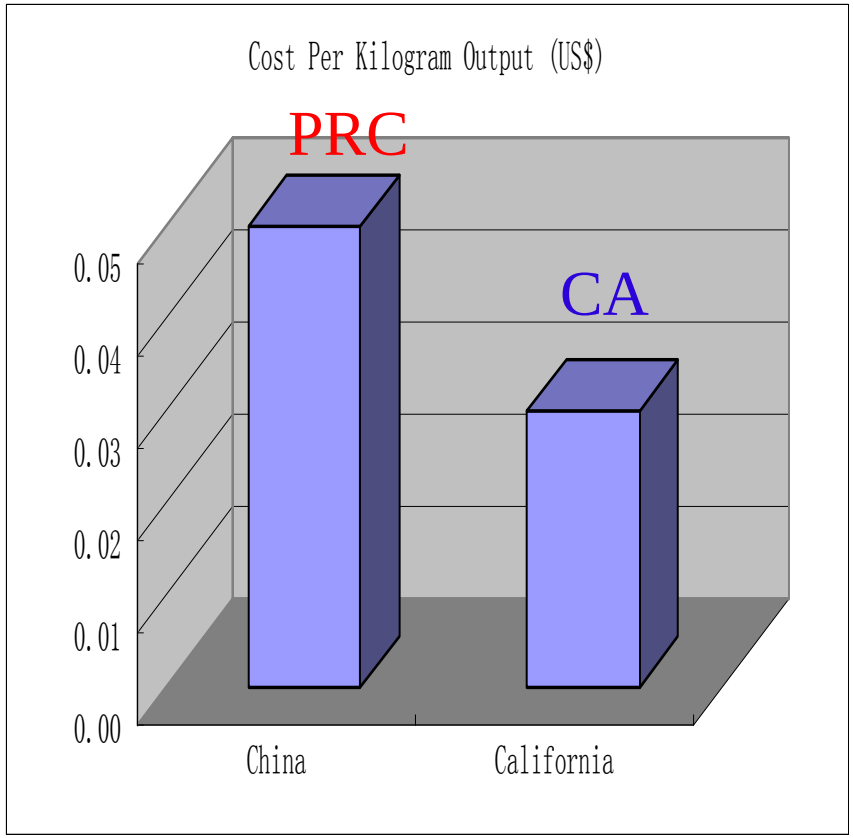




Cost of Production of *Processing Tomatoes*

China and California





Summary -- Competitiveness

- When labor can make up a large part of a crop in China, it has a huge cost advantage … these are some of the crops that have grown the fastest …

- When land (rice) or land and capital (processing tomatoes), costs are more similar … China is investing aggressively in technology and capital-intensive / logistic intensive research and infrastructure

Conclusions

- China's agriculture has been transforming at an incredible rate … more open; more towards comparative advantage; more efficient
- China has great potential to continue growing in this direction
- Biggest advantage in low production costs of labor intensive commodities

Conclusions

- US is due for tough competition for many crops
- Competition: first, in third markets (Japan; Hong Kong; Korea; Taiwan) … later, directly in CA(?)
- Extent of competition will depend on:

  -- rate of improvement of quality and marketing (but this is improving fast!)

  -- growth of China's domestic demand

  -- how US and other competitors or collaborators perform

What can Western Growers do?

- Strategy ONE: "Ignore what is going on"

  [but can only adopt this strategy if buy into 1 or more of several assumptions]

China is not a threat

-- today's presentation should be evidence this is not so on its own, China is developing VERY FAST … but there is time

-- China also has several important regulatory advantages (farmers in US have other advantages)

China will implode:

-- there are severe water problems

-- infrastructure is so poor, can not compete

What can Western Growers do?

- Strategy TWO: "Raise Protection"

  Because China is entering WTO as a "non-market economy," it is easy to file and win dumping cases …

  garlic

  honey

  apple juice concentrate

  But, these are almost surely a function of the way the laws are written … China typically is NOT dumping … in longer run, politics and WTO appeals will *probably* limit effectiveness of this strategy

What can Western Growers do?

- Strategy THREE: "Compete"

  -- Research

  -- Promote and Differentiate California's Products

  -- Invest and Become Partners

Got Milk? The Rapid Rise of China's Dairy Sector and Its Future Prospects

Frank Fuller*, Jikun Huang, Hengyun Ma and Scott Rozelle

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Abstract

This paper synthesizes recent research and new empirical findings to build a more comprehensive understanding of developments in China's dairy sector. China's tremendous rise in dairy demand has been driven by several mutually reinforcing factors: including rapid income growth, promotion by the government and dairy industry, changes in urban lifestyles, and the development of new, more sophisticated marketing channels. Domestic milk output has grown to satisfy rising demand largely by increasing the dairy herd. Substantial increases in productivity have been achieved through technology adoption, but there is evidence that the torrid growth has created inefficiencies because adaptations to marketing rules, infrastructure, and institutions have not kept pace with the changing environment. These results suggest there is ample room for future growth in both domestic milk production and dairy demand, but multinational firms and imported products will likely play and increasing role as China's dairy market continues to develop.

Got Milk? The Rapid Rise of China's Dairy Sector and Its Future Prospects

In the 1990s, during the second decade after China's emergence from its period of Socialist isolation, Garnaut and Ma (1993) noted that the nation's food consumption patterns were emerging in ways that were largely consistent with other East Asian nations—with one notable exception. Given China's income level, the demand for grain, most meat commodities, aquaculture products, fruits and vegetables were at or exceeded the expected levels of consumption. There was only one major commodity that China's consumers were under consuming: dairy. The average urban resident in 1992 only consumed a milk equivalent of 9.07 kilograms per capita of dairy products, only a fraction of level in many other nations.[1] While Garnaut and Ma (1993) postulated that "different tastes associated with historical contact with international consumption patterns" was the cause for the unusually low consumption of milk in China, we suggest below that historical preferences are only one of the factors influencing dairy demand.

Since the mid-1990s the lethargy of China's dairy sector has disappeared and a large literature has appeared trying to understand it. Demand, especially in urban areas, has exploded (Zhou, Tian, and Zhou, 2002). Dairy production has risen sharply. Internationally there is a scramble to understand the implications China's emerging dairy sector for world trade. While many papers have appeared recently that address the supply and demand for dairy products in China (Zhou, Tian, and Zhou, 2002; Fuller, Beghin, and Rozelle, 2004; Fuller et al., 2004), we believe that the literature still lacks research that systematically explains the recent emergence of China's dairy industry and its future demand and supply trends.

This paper sketches a more comprehensive picture of China's dairy sector and assesses the nature of the sector's development in the coming decades. In the first two sections, we draw upon the growing number of empirical studies to identify the factors underlying the explosion in China's dairy consumption and analyze milk supply by assessing the relative importance of herd expansion and improvements in efficiency to the overall growth of milk output. Based our analysis of both supply and demand, we conclude with our perspective on the future path of dairy supply, demand and trade in China.

Dairy Demand

Urban consumers in China have greatly altered their diets in the last 20 years, increasing the share of calories derived from animal fats and proteins, decreasing their intake of carbohydrates from grains, and increasing consumption of sugar and vegetable oils (Hsu, Chern, and Gale, 2001; Guo, Mroz, and Popkin, 2000). Despite rapid income growth throughout the late 1980s and early 1990s, fluid milk consumption in urban areas remained strangely stagnant from 1987 to 1997 at an average of 4.81 kg per person.[2] Since 1998, however, fluid milk consumption in urban China has grown annually at double digit rates.

According to data from official sources, Table 1 shows that dairy product consumption has increased at all income levels for the three product categories reported. On average, urban milk demand in China was roughly half of the level in Taiwan in 2003. Even households in the lowest 10 percent of the income distribution more than doubled their milk consumption in 7 years. Fresh product (primarily fluid milk) consumption increased nearly 300 percent or more for higher income groups. Although yogurt consumption was lower than milk powder consumption in 1996, yogurt purchases grew roughly 29 to 37 percent annually, while milk powder consumption grew less than 7 percent annually. The growth rate for milk powder consumption

decreased from low income to high, and milk powder consumption per capita for the highest income group grew just 6.7 percent over the entire 7-year period and actually declined in 2002 and 2003.

The growth in household incomes has played a major role in the rapid increase in dairy product consumption, but it cannot fully explain the changes that have occurred. The growth in dairy product consumption only loosely corresponds to growth in real incomes. While increases in real income generally match the pattern of dairy product consumption growth across incomes groups (i.e., larger changes in income generate greater growth in consumption), the increases in consumption for the lower income groups are much bigger than one would expect, even from a luxury food item.

Several recent studies using cross-sectional household data have attempted to estimate price and income elasticities for dairy products. One of the most striking observations is that all of the studies suggest that milk and other dairy products are not elastic with respect to total household income (Fuller, Beghin, and Rozelle, 2004; Wang, Zhou, and Yang, 2004; Liu and Chern, 2003). However, with respect to the household's allocation of food expenditures, dairy products typically represent one of the most elastic categories in the food basket (Liu and Chern, 2002; Gould and Dong, 2004). The income elasticity estimates in the studies were computed using data for single year, so the impacts of shifts in preferences over time on income elasticities are not captured.

Using panel data, Guo, Mroz, and Popkin (2000) found evidence that income elasticities in urban China changed from year to year, with elasticities for livestock products increasing and elasticities for grains decreasing. Similarly, Huang and Bouis (2001) found empirical support for the idea that dietary changes in Taiwan in the 1980s were driven by changing lifestyles,

occupations and marketing systems, as well as price and income factors. Without doubt, the rapid growth in household incomes has been necessary to make dairy products affordable for Chinese households, but the development of China's economy and the opening of society to the West over the last two decades have prompted several other transformations that facilitated growth in dairy product consumption. Although we are not able to precisely quantify the source of demand change, we believe the current literature and our observations in the field show that there are at least three important drivers for changes in urban dairy consumption: changes in a.) consumer perceptions of dairy products; b.) food purchasing behavior; and c.) dairy product marketing.

Historically, the majority of Chinese viewed milk as a nutrition supplement, particularly for infants and the elderly (Zhou, Tian, and Zhou, 2002), but it was not perceived as a food for regular consumption by the general populous. These traditional perceptions are being challenged on several fronts. Current government guidelines for food and nutrition include regular milk consumption in its dietary recommendations. In a survey conducted in 2001, Fuller et al. (2004) found that more than 25 percent of sample households in Beijing, Shanghai, and Guangzhou reported that a healthcare professional had recommended regular milk consumption. The expansion of television ownership has greatly increased the influence of the mass media and advertising on consumer perceptions. Advertisements extolling the convenience, good taste, and healthiness of regular milk and yogurt consumption have become commonplace on China's networks. In the same survey 93 percent of the sample reported seeing television advertisements for milk products, and 73 percent had seen billboards with dairy ads. Finally, the adoption of school milk programs in several large cities sends the message to families with young children that milk consumption is important for the health of China's youth. In short, inasmuch as the

growing awareness of dairy products fosters a culture of dairy consumption, we can expect a growing percentage of households in China integrate dairy products into their daily diets.

Economic prosperity in China also is gradually changing lifestyles among urban households, and this, in turn, is affecting purchasing behaviors. Social policies to slow population growth have reduced the number of children in modern urban families. With greater opportunities to find employment outside the home, the cost of spending time shopping and preparing food has risen, and an increasing number of China's households are willing to pay for prepared foods and packaging that increases shelf life and reduces shopping frequency. Young, educated, and wealthy consumers shop less frequently, eat outside the home more often, and frequently purchase processed and packaged foods (Veeck and Veeck, 2000). Most dairy products require refrigeration until they are consumed, and greater refrigerator ownership is having a positive impact on dairy product consumption (Lyon and Durham, 1999). There is also some evidence that shoppers with higher education levels tend to buy dairy products more frequently at supermarkets and purchase more ultra-high temperature pasteurized (UHT) milk (Fuller and Hu, 2005).

Studies of purchasing behaviors are interesting because they highlight the connection between income, education, product choices, and the variety of retail outlets in which China's consumers are shopping. These relationships are closely tied to the changes that can be observed in marketing of dairy products. Throughout the 1980s and into the 1990s, pasteurized milk was principally marketed through home distribution networks and specialized milk stores operated by the dominant local milk company (usually a state-owned processor). This situation began to change in the early 1990s, as foreign dairy processors began investing in production facilities near key cities and as UHT technology was adopted by dairy processors. Both of these

developments prompted the introduction of new brands and products in urban dairy markets, sharpening the competition faced by incumbent firms.

New entrants into local dairy markets could not use the established distribution networks because they were owned and operated by the local dairy company. Consequently, entering firms channeled their products to consumers through other food retail outlets: street vendors, small grocery stores, and the newly emerging supermarkets and convenience stores. While home delivery networks still play an important role in pasteurized milk markets, surveys indicate that supermarket sales account for the majority of yogurt and UHT milk sales and a growing proportion of pasteurized milk sales (Fuller, Beghin, and Rozelle, 2004; Fuller and Hu, 2005). Consumers benefit from the expanded selection of products and brands available at supermarkets and from the frequent promotional discounts (Fuller and Hu, 2005).

Also important has been the creation of nationally recognized brands. When China's dairy products markets were local and segregated, branding was not important because only one or two companies existed in the market. Farmers or small processors that sold their products directly to consumers could develop a relationship with their customers, and the relationship substituted for brand identification. As dairy companies expanded beyond their historical marketing regions into new markets, they needed to differentiate themselves from the local milk companies and to provide assurances of product quality and safety to consumers in the new markets. Unreliable quality and food safety concerns deterred some of China's consumers from purchasing milk in the past. Marketing through supermarkets and convenience store chains can reinforce brand equity to the extent that consumers believe supermarkets choose the brands they carry based on product quality and value.

In sum, the recent growth of dairy product consumption in China is driven by the convergence of several, mutually reinforcing factors. Rising incomes have prompted a shift in consumer preferences towards meat, vegetable oils, fruits, and dairy products. Information regarding the benefits of regular dairy product consumption provided by the government, the healthcare sector, and the dairy industry is convincing a growing number of China's consumers to integrate dairy products into their daily diets. At the same time, the hectic pace of the modern urban life promotes the consumption of prepared and packaged foods, including dairy products. Competition in China's dairy industry has forced dairy processors to adapt to the changing consumer environment by developing high-quality, branded dairy products that are made available to consumers in a wide array of retail outlets, including supermarkets and convenience stores. The development of nationally recognized brands and ubiquitous use of mass media advertising reduces the search cost for new consumers interested in adopting regular dairy consumption.

How will dairy product demand in China develop in the future? Consumption will likely continue to rise rapidly for a number of years, but much of the growth in milk and yogurt consumption in urban areas will come from the low and middle income segments of the population. As incomes continue to rise, consumption levels for these consumers should approach those of consumers in higher income brackets. High income urban consumers are rapidly approaching consumption levels for milk and yogurt that are comparable to other medium and high income Asian countries. Consequently, growth of milk demand in these consumer segments will likely slow. At the same, there is still room for those in the highest income categories to expand total dairy product consumption. For example, wealthy households in China consume much less cheese than consumers in Japan, Taiwan, or Korea; from this

perspective, cheese demand still has substantial growth potential. Cheese consumption in China occurs chiefly through consumption of western-style foods in restaurants (Fuller, Beghin, and Rozelle, 2004), and further development of cheese consumption will likely follow the sales trends of pizza and other cheese-intensive restaurant foods.

In smaller cities and rural areas, many of the same factors that contributed to the explosion of dairy consumption in large urban areas are relevant. School milk programs are being promoted in a greater number of regions each year. While the dairy revolution has not even begun or is just beginning for many demographic groups, consumers' diets in small cities and in rural areas are expected to shift toward greater consumption of livestock products as incomes rise (Huang and Bouis, 2001). Supermarkets and convenience stores are gradually moving from large to medium and small cities (Reardon et al., 2004). When these retail venues arrive, among other things, they bring with them the national dairy product brands, making quality dairy products accessible. The commercialization of the media as well as rising refrigerator and television ownership are giving households the ability and incentive to increase dairy consumption.

Finally, continued rural to urban migration will put upward pressure on the demand for all livestock commodities, including dairy. Although one of the greatest factors limiting growth of dairy product demand in China in the future will be income levels, as rural households begin to move into urban areas, dairy consumption will summarily rise. Even when their income is held constant, Huang and Bouis (2001) and Huang and Rozelle (1998) have shown that the newly arriving migrants begin to adopt the consumption patterns of their urban counterparts, including dairy demand.

Recent projections of China's dairy product consumption reported by Dong (forthcoming) are generally consistent with these expectations of future growth. Assuming 7.0 percent annual growth in real per capita expenditures in urban China, Dong (forthcoming) projects average urban fluid milk consumption will reach 32.04 kg per person in 2014, an annual rise of 5.1 percent. Total dairy product demand in China is anticipated to grow by 50 percent in milk equivalent terms. Meeting the additional demand projected by Dong (forthcoming) with domestic milk would require production in China to increase 11.2 million metric tons over the 2003 level. In the next section, we seek to understand the dynamics of how producers have been able to satisfy rising consumption in the past and how well China's dairy sector is positioned to meet the expected rise in demand.

Producing Dairy Products in China

China's dairy production was only about 1 million tons per year in 1980. During the following 15 years, output increased steadily by about 14 percent annually. However, because China was starting from such a low base, total dairy production was only 6 to 7 million tons by the mid-1990s, a level that placed China about 20th in overall milk production internationally. After the mid-1990s, however, there was structural break (Figure 1). Between 1997 and 2003, the growth of dairy production accelerated to nearly 20 percent annually. Aggregate production rose to more than 18 million tons in 2003, a level that ranked China 7th in the world.

Expanding Production, Expanding Herd Size

Milk production is implicitly the product of the number of dairy cows and the productivity per cow, so growth in milk production is the result of changes in these two components. By far, the most prominent source of growth of milk production in China has been the expansion the dairy herd. In 1980, there were only about 640,000 dairy cows in China.

Between 1980 and 2000, China's dairy cow herd grew at a rate of about 11 percent annually, just under that of milk production. By 2000, there were 4.88 million dairy cows in China. China's dairy cow herd also increased 20 percent annually after 2000, matching the growth of milk production. By 2004, there were 8.93 million dairy cows in China.

Productivity Gains: Technology and/or Efficiencies or Not?

Productivity per cow is the second component of milk production. The analysis and data required to study the productivity of China's dairy sector, however, is not trivial, and relying on standard indicators can create an ambiguous picture. The sector is dynamic and constantly changing. Milk production technology is extremely heterogeneous, ranging from farmers in remote, mountainous villages with one or two dairy cows to state-of-the-art dairy operations with hundreds of cows. New technologies and high quality genetics are increasingly available, but it is unclear to what extent China's small farmers have been able and willing to use them. Complicating matters further, the China National Bureau of Statistics (CNBS) does not collect information on many key statistics that are critical to understanding some of the sector's most fundamental elements.

Based on information available to the authors, the partial productivity and cost data shown in Table 2 also fail to provide clear results.[3] Milk output per cow in both the specialized household and commercial/collective/state-owned farm sectors rose. Although low by international standards, milk yields for specialized dairy households rose steadily during the 1990s and are above the national average of roughly 2600 kg/cow. Output per man-day also has risen, partly due to rising yields and partly to a reduction in annual man-days/cow. At the same time, the total cost per ton of milk has risen. Hence, until a multivariate analysis is performed, it is unclear whether productivity has increased. Moreover, even if we could ascertain that

productivity growth has occurred, it is important to understanding whether the growth was generated by adoption of new technologies or increased efficiency in the use of current technologies. The answer to that question has bearing on expectations of potential for future growth.

Potential for Gains from Technical Change

There is little doubt that China's dairy technology has improved since the pre-reform era. Before 1980 there were almost no genetically improved dairy cows, and most of the dairy cows were owned and managed by state farms and collectives that used extremely labor intensive methods and poor quality rations. Feed mixes rarely included any concentrates, vitamins or other supplements.

Since 1980 improved genetic material, feeding regimes, and milking and handling equipment have become available, partly as a result of several large and sustained government-to-government development aid efforts. More recently China's government has relaxed restrictions on the import of dairy technology, and greater numbers of private and quasi-private enterprises are introducing new genetics and feeding technologies. Since 1995 the number of imported breeding cows and amount of bull semen have risen sharply (China Customs Statistical Yearbook, 2003). With such an effort, it likely that productivity should have increased due to technological change.

However, an industry that is characterized by hundreds of thousands of small producers, there are many possible barriers to the adoption of new technologies. For example, credits constraints arising from a banking system that is unfriendly to producers could prevent farmers from investing in new technologies (Findlay et al., 2003). The lack of either a strong extension or

viable cooperative system hinders the spread of new technologies, especially among a poorly educated farm population.

Changes in Efficiency

Possession of advanced technology does not imply efficient production. Efficiencies can be achieved through specialization along lines of comparative advantage or through exploitation of scale economies. However, these gains can be offset by market and information inefficiencies associated with a swiftly changing market environment and institutions that struggle to adjust. There is anecdotal evidence that China's dairy sector may be experiencing both efficiency gains and losses.

Specialization and Concentration of Dairy Production. National production data are clear that the rise of milk production from 1996 to 2003 has not occurred evenly across China. In fact, the data show a tendency for production to specialize in two dimensions. First, the bulk of the rise in milk production during this period took place in North China (including all provinces that are north of the Yangtze River). Second, within north China, there has been substantial geographic concentration of dairy cows at the provincial level in Xinjiang and in the dairy belt that runs from Heilongjiang and eastern Inner Mongolia in the north to Hebei and Shandong on the North China Plain. Xinjiang and the four emerging dairy belt provinces fully account for 70 percent of the rise in China's dairy herd.

Scale Effects. Even through the mid-1990s the scale of the average Chinese dairy producer was extremely small. According to the 1997 census of agriculture, more than three-quarters of the dairy heard was owned by individual farmers; the average dairy farmer in 1996 owned only 3 cows (Zhou, Tian, and Zhou, 2002). At that time a commercial dairy sector was emerging, but in many cases the firms were state- or collective-owned. Given the lack of

systematic data, it is difficult to gauge what has happened to the average dairy herd size since the mid-1990s, but some evidence suggests there has been little change. Small-scale household production in other livestock sectors thrived in the late 1990s, as improvements in transportation infrastructure lowered the costs of moving feedstuffs into and products out of poorer inland areas (Chen, 2002). In addition, many regionally-supported dairy programs established in recent years use small bank loans to help farmers that are new to the dairy industry purchase one to three dairy cows. A survey conducted in 2000 by the Center for Chinese Agricultural Policy found that sample households raising dairy cows owned an average of four cows, a level that was statistically indistinguishable from the three cows per household found in the 1997 census.

Despite the apparent small scale of production, there are strong incentives for processing firms to promote larger scale dairies that make effective use of technologies which increase the quality of the milk and reduce costs. Indeed, there is some evidence that the commercial sector may be expanding and that a healthy "specialized household" sector is increasing its share of the national herd (Wang, 2002). More importantly, dairy processors are playing a strategic role in developing unique institutional structures in some regions to capture scale economies with household production. For example, in Inner Mongolia we observed several processor-run milking stations where farmers can bring their cows to be milked using the processor's milking machine. The milk goes directly into the processor's bulk cooling tank, and farmers receive the market price. In Yunnan and Sichuan, farmers can buy or rent stalls in a commercial milking shed, where they house and milk their cows. The farmer is responsible for feeding and providing care for the cow, while the milking shed manager keeps the milking and cooling equipment operating and coordinates deliveries and payments with the processors. It is unclear how

common such arrangements are; nevertheless, their existence demonstrates the importance that processors place on increasing the scale and sophistication of milk production.

Disequilibria From Expansion and Institutional Change. While increasing concentration and scale expansion may be generating efficiency gains, it is certainly possible that the torrid pace of development in the dairy industry is creating so much change and disequilibria that measured efficiency (at least temporarily) is falling on aggregate. With the herd size growing by 20 percent per year, the number of cows in China doubles every four years. New producers are entering. Experienced producers are changing their genetics and upgrading their milking facilities. Commercial operations are changing management incentive plans and control-rights regimes, and they are altering the way they interact with small producers, processors, and local governments. It is well recognized in the economics literature that high adjustment costs often leads to inefficiencies as firms and whole industries make new investments.

Our observations in production areas reveal that there may be inefficiencies related to industry growth, especially in the ways that processors interact with producers during periods of supply expansion in a locality. According to one major Shanghai dairy processor, more processing plant capacity has been built in China during the past 5 years than during the entire history of milk production in China. Successfully establishing a new plant requires the processor to develop reliable links with raw milk suppliers and to provide a set of production, collection, and pricing rules. However, industry participants make it clear that establishing raw milk supplies for a new processing plant entails more than simply providing an orderly marketing structure for farmers. In many locations the construction of a new processing plant has sparked a series of local dairy wars. As soon as a new plant becomes operational, there is immediate pressure to operate at full capacity to reduce average costs. In most cases, the new plants are

unwilling to invest the time and effort to fully develop their raw milk supply base from scratch. Instead, they often opt, at least in part, to induce producers in the area to switch from their current buyer to the new processing firm. Even when milk producers are bound by a written contract to supply a particular processor (which is rare), processors have few legal remedies to prevent another firm from poaching its raw milk supplies. We have encountered producers that have switched buyers every several months for a period of years. This confusion and uncertainty can prompt temporary declines in the industry's efficiency.

An Empirical Analysis of Productivity, Technical Change and Efficiency Shifts

It is clear from the discussion above that a large share of the rise of China's dairy production can be attributed to the increase in the dairy herd; however, empirical evidence is lacking concerning the direction, magnitude, and source of any changes in productivity. In this section, we briefly present results from estimation of a stochastic production frontier for China's dairy sector. The model provides estimates of total factor productivity (TFP) growth from 1991 to 2001 for a panel data set. We decompose the estimated productivity growth into components resulting from technical change and from shifts in productive efficiency. The methods, data and empirical approach used for this analysis are discussed in detail in Rae et al. (2005)

Results

Due to the unbalanced nature of our panel data, some clarification of the procedures used in constructing the results reported in Table 3 is required. First, while average productivity growth rates are presented for the entire 1991-2001 period, there are insufficient degrees of freedom to allow us to present results for the early 1990s and the 2000-2001 period. Second, individual provincial results are included in growth rate calculations, provided that at least six provincial observations were available within the relevant time period. Third, provincial results

are averaged to the regional level using output shares as weights. Finally, overall average productivity results are obtained by averaging the output-weighted regional results.[4]

Milk production over the 1990s on specialized and commercial farms grew annually around 9 percent and 5 percent, respectively. Hence, compared with the overall production rates of growth reported in official statistics for the entire 1990 to 2001 period, the rates in Table 3 are somewhat lower. Adjustments made to output levels in preparing the data preparation for analysis are partially responsible for the difference; however, it may also indicate that small-scale producers have contributed more to output growth than specialized households and commercial operators.

Rising TFP accounts for only a portion of the robust output growth. Just 0.48 percent of growth in the specialized household sector and 1.31 percent of growth in the commercial sector stems from rising TFP. Thus, input augmentation—heifer purchases, feed concentrates, equipment, and other inputs—generates much of the output growth. Compared to a similar decomposition of China's other livestock sectors reported in Rae et al. (2005), TFP's contribution to output growth is lower for milk production than all other livestock sectors, except backyard hog production.

Interestingly, while TFP growth for dairy was low compared to other livestock sectors, the contribution of technology is among the highest. Overall, technical change (TC) generated a 6.58 percent annually increase in productivity in the specialized household sector and 4.57 percent increase in the commercial sector. Indeed, most of the productivity growth in the specialized and commercial dairy sectors appears to be the result of adopting improved genetics, better milking processes, and superior management practices. Following this logic, the backyard household sector accounts for the bulk of the dairy cows added to the herd in recent years.

Modest TFP growth and high TC implies that there has been a decline in efficiency of the sector during the 1990 to 2001 study period. Columns 3 and 7 in Table 3 show that, had it not been for the decline in efficiency, output growth would have risen by 6.09 percent more in the specialized household sector and 3.26 percent in the commercial sector. Falling scale economies are not responsible for the loss of efficiency. Although the results are not reported, our analysis did find very small gains in scale economies. Likewise, rising concentration in the industry suggests that a lack of specialization at the regional level is not the cause. Assuming specialization at the community level has not declined, the main cause of the fall in efficiency may be a disequilibria effect arising from the very high rates of growth during the study period. If this inference is correct, the future of China's milk production may be fairly bright, assuming industry growth moderates and processors begin to rationalize their supply bases.

Looking Ahead

Looking back, the story of China's dairy industry over the past decade has been a simple one: Demand has risen rapidly. In addition to greater purchasing power, shifting preferences prompted by a new awareness of the health benefits of milk have greatly increased demand. Indeed, in recent years milk is being consumed by a broad cross section of China's population. Where did most of the supply come to meet the new demand? By far the greatest fraction has come from China's emerging domestic dairy industry. Driven primarily by increases in the dairy herd and adoption of new technologies, domestic supply has risen as fast as demand. There is evidence that considerable inefficiencies remain in the dairy sector, and there is potential for future improvements in productivity per cow. Consequently, there is good reason to believe that production can continue to rise in the future.

Looking ahead, there are many reasons to believe the rapid growth in demand for dairy products will continue unabated in China. Incomes are forecast to continue to rise. If China is successful in modernizing, there will be hundreds of millions of new urban residents. As the dairy processing industry matures and becomes even more competent, it is likely the media attention, advertising and promotion of dairy products will accelerate. All of these factors will contribute to a growing number of households that adopt regular dairy consumption. Most importantly, as today's generation grows up in an environment that increasingly accepts dairy products, these attitudes become entrenched and are passed from parent to child. It is likely that the growth in dairy demand observed in the last decade is just the start of long, sustained expansion of China's dairy consumption.

With more consumers seeking to buy dairy products in the future, who will ensure that they can get milk? Will China's dairy industry be able to satisfy the growing demand or will imports play a greater role? The answer to that question hinges critically on the ability of China's dairy sector to continue to increase productivity and begin to improve efficiency over time. Certainly, China's dairy herd will continue to expand. However, if the domestic dairy industry is to be successful at keeping pace with rising consumption, it will have to actualize the tremendous potential for scale economies in milk production, collection, and processing through innovative organizational structures of rural households. Likewise, output per cow must rise. With appropriate investments, milk production could double at the current herd size. Of course, expanding cow numbers and raising productivity may significantly increase the dairy industry's competition with other livestock sectors for feed grains, quality forages, and protein feeds. Finally, institutions within the industry or within the government need to develop constructive methods for coordinating expansion of raw milk production and processing. The inefficiencies

and confusion induced by struggles over milk supplies are symptoms of larger problems associated with inadequacies in contract law and enforcement, agricultural lending and capital markets, and market information channels.

China's role in international dairy markets has grown significantly in the last 15 years and has accelerated recently. In 1990, China ranked 14th in volume and 15th in value terms in world dairy trade. Although it did not change from 1990 to 1995, since 1995, China's dairy import volume has grown at roughly double the rate of global trade, and China ranked 7th in the world in volume terms in 2003. With the domestic processing industry focusing on increasing production of fluid and fresh products, most of the imports have been powders and processed products. Multinational firms have already entered dairy markets in China, and with the relaxation of import barriers and constraints on foreign investment under China's WTO commitments, competition from abroad will only increase. In the last year, a number of large multinational dairy companies have increased or made plans to increase their investments in Chinese dairy companies. These investments are likely to facilitate the technology transfer and adoption needed for the domestic industry to meet the supply challenges that lay ahead.

Dong (forthcoming) projects a short-term rise in milk powder imports, but a gradual decline as domestic milk production rises. Cheese imports are projected to double over the next decade, but volumes remain under 50 thousand metric tons. These are plausible outcomes that are consistent with the analysis in this paper. In particular, the greatest growth in dairy demand is expected to continue to be in fluid and fresh products; though, cheese demand will rise among high income consumers, leading to some additional imports. Thus, the actual product mix and trade volumes will ultimately depend on the ability of China's domestic dairy suppliers to answer the growing number of consumers asking, "Got milk?"

Endnotes

1. Fluid milk equivalent of fluid milk consumption reported in the CNBS Urban Household Income and Expenditure Survey and total dairy consumption data reported in Zhou (2001). Total dairy consumption of 6.32 kg contains 5.52 kg of fluid milk and an estimated 0.43 kg milk powder and 0.37 kg yogurt. Milk powder is converted at a rate of 7.4:1 to fluid milk and yogurt is converted at a rate of 1:1. Rural per capita consumption is estimated by subtracting urban consumption from total milk production. Zhou (2001) cites an average of 1.46 kg of dairy products for rural residents in 1992, which is equivalent to 1.25 kg of fluid products and 0.21 kg of milk powder.

2. Fluid milk consumption does not include the milk equivalent of other dairy product consumption.

3. The cost data are collected by the Price Bureau and the National Economic Development Commission and were provided to the authors for use in this paper. Available upon request to the authors.

4. In the TFP decompositions we do not present the scale effects as they were minor compared with the technical change and efficiency components. We also do not calculate the allocative inefficiency components due to incomplete price data. To save space, we do not report the stochastic frontier production parameter estimates. They are available upon request to the authors.

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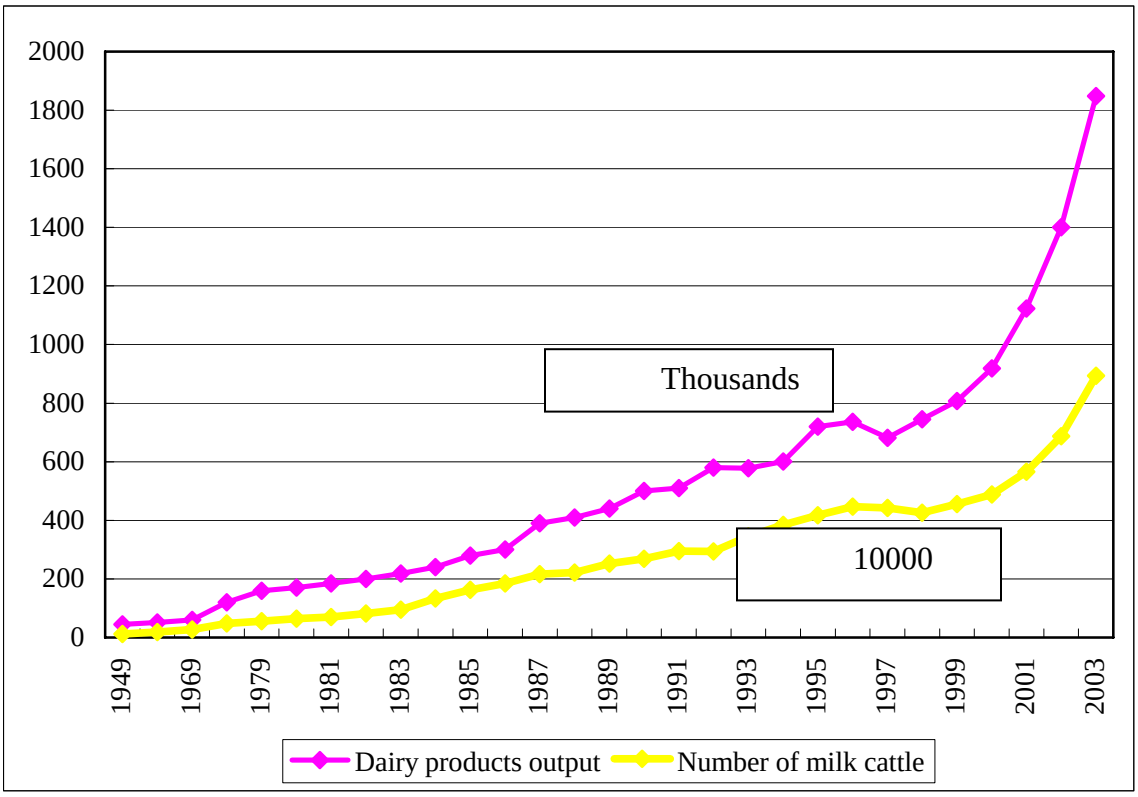

Figure 1. The Growth of China's Milk Sector, 1949-2003

Data Sources: Wang (2002) for data before 2003 and CNBS for 2003 and 2004.

Table 1. Annual Urban Dairy Product Consumption Per Capita by Income Group

	1996	1997	1998	1999	2000	2001	2002	2003
Fresh Products				Kilograms per person				
Lowest 10%	2.52	2.62	2.87	3.34	4.59	5.61	4.83	6.71
Third Quintile	4.84	4.97	6.17	7.62	9.83	11.78	15.79	18.94
Top 10%	7.91	9.02	10.66	13.78	17.52	19.60	26.46	28.29
Average	4.83	5.07	6.18	7.88	9.94	11.90	15.72	18.62
Yogurt								
Lowest 10%	0.11	0.15	0.28	0.39	0.51	0.55	0.51	0.68
Third Quintile	0.33	0.44	0.57	0.80	1.09	1.30	1.76	2.57
Top 10%	0.56	0.78	1.16	1.47	1.47	2.27	3.31	4.33
Average	0.32	0.44	0.64	0.87	1.12	1.36	1.80	2.53
Milk Powder								
Lowest 10%	0.22	0.23	0.24	0.25	0.26	0.29	0.34	0.31
Third Quintile	0.42	0.40	0.43	0.47	0.52	0.52	0.58	0.61
Top 10%	0.59	0.61	0.6	0.62	0.7	0.74	0.65	0.63
Average	0.41	0.41	0.43	0.44	0.49	0.50	0.60	0.56
Average Total in	8.18	8.54	10.00	12.00	14.67	16.96	21.96	25.29

Milk Equivalent

Source: CNBS. Milk powder converted to milk equivalent at a rate of 7.4:1.

Table 2. Milk Yield, Output per Man-day of Labor and Production Costs in China, 1992-2003.

Year	Yield (kg/Cow)	Milk Output of Per Labor Man-day (kg)	Cost (Yuan/ton)
	(1)	(2)	(3)
Specialized Household Dairy Farms			
1992	4335	42.2	680
1993	4234	32.4	837
1994	5159	48.5	924
1995	4998	41.1	1236
1996	4705	64.9	1292
1997	5071	60.4	1559
1998	4602	65.7	1304
1999	4421	67.1	1261
2000	5032	64.4	1186
2001	5121	78.4	1244
2002	5226	68.4	1349
2003	5342	88.4	1329
1992-97	4750	48.3	1103
1998-03	4957	72.1	1280
State and Collective Dairy Farms			
1992	4744	35.9	844

1993	4736	49.0	983
1994	4477	47.8	1348
1995	4757	60.9	1726
1996	5139	55.1	1917
1997	5155	63.8	1816
1998	5435	86.9	1718
1999	5889	89.9	1619
2000	6019	92.9	1674
2001	6000	93.5	1671
2002	6032	93.7	1665
2003	6091	97.6	1774
1992-97	4835	52.1	1452
1998-03	5911	92.4	1687

Data Source: National Agricultural Production Cost and Return Survey.

Note: Total revenue is equal to total milk output multiplying farm gate sale price. All value terms are calculated at present price.

Table 3. Annual Growth (%) in Milk Total Factor Productivity (TFP) and Decomposition into Technical Efficiency (TE) and Technical Change (TC)

Region [a]	Specialized Households				Commercial Operations			
	Output	TFP	TE	TC	Output	TFP	TE	TC
1990s:								
North	4.75	2.87	-5.25	8.13	2.84	-0.60	-5.60	5.01
Central	14.82	0.02	-7.31	7.33	12.18	-0.87	-6.99	6.12
South	-4.55	8.93	-7.99	16.92	-1.99	6.37	-0.58	6.96
Southwest	n.a.	n.a.	n.a.	n.a.	-2.73	9.05	-8.83	17.88
West	11.48	-2.50	-6.45	3.95	10.47	1.15	-0.35	1.50
Mean	8.81	0.48	-6.09	6.58	5.25	1.31	-3.26	4.57

[a] For specialized households: North: Tianjin, Mongolia, Liaoning, Jilin and Heilongjiang; Central: Hebei, Shandong and Henan; South: Anhui and Fujian;

West: Shaanxi and Xinjiang.

For commercial operations: North: Beijing, Tianjin, Mongolia, Liaoning and Jilin; Central: Hebei, Shandong, Henan and Hubei; South: Shanghai, Jiangsu, Anhui, Fujian, Hunan, Guangdong; Southwest: Guangxi and Chongqing; West: Shaanxi, Gansu and Xinjiang.

In total, these provinces accounted for 59% and 57% of specialized household and commercial farm output in 1999-2001.

n.a. = data unavailable.

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Farmer's Professional Associations in Rural China: State Dominated or New State-Society Partnerships?

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Farmer's Professional Associations in Rural China:
State Domination or New State-Society Partnerships?

Two decades of economic reform have changed the economic landscape of China. Per capita grain output has reached developed country levels; many farmers shifted into higher valued crops, making decisions increasingly on market-oriented principles; the research system has helped push up productivity by almost double the rate of population growth, and the nation has by far the most sophisticated agricultural biotechnology program in the developing world—indeed many of its breakthroughs are of global importance (Huang et al, 2002). Rising food exports demonstrate that China's farmers are now able to compete in international markets. Off the farm, more than 40 percent of rural residents have employment; and about 100 million of them have moved to urban areas for employment (deBrauw et al., 2002). Rural incomes have risen dramatically and hundreds of million of people have escaped poverty during this time (World Bank, 2001). Growth in agriculture, non-farm employment and rural industry and the transformation of domestic and international markets have changed the face of rural China and are playing key roles in the nation's modernization.

While the new landscape should fill leaders with optimism, there are still great challenges ahead. With the transition from planning in the rural economy mostly complete, China's main challenge has shifted to one of development (Nyberg and Rozelle, 1999). In China's new environment the main metric of success will be the extent to which the rural economy can become an integral part of the nation's push towards modernization. For China to successfully modernize, the nation's economy will

have to experience a fundamental transformation—from rural to urban and from agriculture to industry and services.

To effect such a transformation, one of the main challenges of the reformers relies on a shift in the role of the state and development of new partnerships with citizen groups to carry out efficient and equitable growth (World Bank, 2003). Although the Government moves out of the direct provision of many goods and services, it needs to be redirected to providing public goods, overcoming market failure and providing useful services that the private sector is unlikely to find profitable. To effect these changes, the main task of leaders is to comprehensively redefine the role of government and make explicit to various levels of governments, bureaus and individual leaders what they should and should not be doing. Also, as the government gets of direct production, it will be in a better position to create, implement and coordinate policies that involve conflicting goals. An example is the poverty alleviation policy to raise livestock (goats, sheep) in unsuitable areas resulting in serious environmental damage. Some sub-national governments have taken drastic but effective measures to manage natural resources while still helping the poor, but others need better guidance.

In a modern society which is dominated by markets and assets and information are mostly in the hands of private individuals and enterprises, the government needs partners to carry out its tasks (Trewin, 2003). As such it is important at this point of its development that China begins to encourage the development of truly independent non-state organization, including those organizations that will act as information networks, business support groups, marketing systems and credit cooperatives. In looking at the experience of Japan, Korea and Taiwan, the rural economy in China is in need of the

emergence of active and strong Farmer's Professional Association (FPAs) to help the rural population carry out a number of the productive and consumption-oriented activities that are needed for rapid growth.

Surprisingly, although the role of FPAs in rural China is beginning to be discussed again in academic and policy making circles, such institutions in China are still relatively low profile and little is known about them. It has been stated that there are more than 100,000 farmer associations in China (World Bank, 2003). The Ministry of Agriculture claims that the current association includes 4 to 5 percent of all farmers (Zhou, 2003). The source of these numbers, however, is unclear. Any numbers that are reported also have to be treated with caution since the structure of most is still ill-defined and there are no standards on which reports from FPAs are based..

To overcome the absence of information on such a key part of China's future development process, the main goal of our paper is to report on the results of a survey designed to provide a picture of the current status of FPAs in China. In the report we will have three objectives. First, we try to establish a baseline of the size of the FPA movement in China, its rate of growth and the scope of their activities. Second, we identify when, where and what FPAs are emerging, examining our data by province, by income category and by several other indicators. Finally, we seek to find what factors are inducing the emergence of FPAs.

Data

At the heart of our analysis is our data set. We use a unique set of data on the institutions and development investments in rural China collected by the authors in 2003.

The authors and several Chinese and foreign collaborators designed the sampling procedure and final survey instrument with the village as the unit of analysis. The field work team, made up of the three authors and 30 graduate students and research fellows from Chinese and North American educational institutions (all with PRC citizenship and an average education level higher than a masters degree), chose the sample and implemented the survey in 6 provinces and 36 counties in a nearly nationally representative sample. The sample provinces were each randomly selected from each of China's major agro-ecological zones.[1]

The sample villages were selected by a process that the survey teams implemented uniformly in each of the sample provinces. Six counties were selected from each province, two from each tercile of a list of counties arranged in descending order of gross value of industrial output (GVIO). GVIO was used on the basis of the conclusions of Rozelle (1996) that GVIO is one of the best predictors of standard of living and development potential and is often more reliable than net rural per capita income. Within each county, we also chose six townships, following the same procedure as the county selection. When our enumerator teams visited each of the 216 townships (6 provinces x 6 counties x 6 townships) officials asked each village to send two representatives (typically the village leader and accountant) to a meeting in the township. On average, enumerators

[1] The sample villages come from six representative provinces. Jiangsu represents the eastern coastal areas (Jiangsu, Shandong; Shanhai, Zhejiang, Fujian and Guangdong); Sichuan represents the southwestern provinces (Sichuan, Guizhou and Yunnan) plus Guangxi; Shaanxi represents the provinces on the Loess Plateau (Shaanxi and Shanxi) and neighboring Inner Mongolia; Gansu represents the rest of the provinces in the northwest (Gansu, Ningxia; Qinghai and Xinjiang); Hebei represents the north and central provinces (Hebei; Henan; Anhui; Hubei; Jiangxi; and Hunan); and Jilin represents the northeastern provinces (Jilin, Liaoning and Heilongjiang). While we recognize that we have deviated from the standard definition of China's agoecological zones, the realities of survey work justified our compromises. Pretests in Guangdong demonstrated that data collection was extraordinarily expensive and the attrition rate high. One of our funding agencies demanded that we choose at least two provinces in the northwest. Our budget did not allow us to add another central province (e.g., Hunan or Hubei) to the sample.

surveyed around 11 villages in each township. The number of villages per township ranged from 2 to 29.[2]

After answering questions about the economic, political and demographic conditions of their villages in 1997 and 2003, the respondents answered a set of 25 questions about the activities of FPAs (if there were any) that were operating in or around their villages. The questionnaire was designed to elicit information about the size of the association, its coverage, its main functions, information about its charter, registration rules and internal organization. The survey also included a section that attempted to understand how the actions of government agencies affected the start up of the associations.

Farmer's Professional Associations in China

To meet our first objective, in this section we will examine the number of villages that report to have any sort of FPA, regardless of the characteristics. We then will use information to identify those FPAs that have met a number of criteria (e.g., having a certification or being officially chartered) that are thought to typically define a *formal association*. We also will identify those FPAs that have characteristics (e.g., they are not registered as a commercial entity at the Market Administration Bureau or those associations in which government officials do not have decision making authority) that

[2] On average, the attrition rate was only 6 percent. In no case, did we leave a township until at least 80 percent of the villages had been enumerated. In order to examine if the villages that were not enumerated (due to attrition) were systematically different from those that participated, we collected a set of variables about no-show villages from the township and ran a probit regression with the dependent variable represented as an indicator variable where the variable equaled one if the village did not come and zero otherwise. There were no variables that were significant. If a village had more than 25 villages, we randomly selected 25 of them. This only affected less than 5 townships.

make them appear to be a *functional association*. In most of the report, we will examine the nature of FPAs according to both of these definitions.

When leaders from the 2459 sample villages were asked the *unqualified* question, "Are any farmers in your village currently participating in an FPA?" only a small fraction of the respondents responded affirmatively. According to our data, 251 villages reported that their farmers participated in some form of FPA. Since some villages had farmers in more than one FPA (2 village reported activity in 4 FPAs; 3 villages reported activity in 3 FPAs; 23 village reported activity in 2 villages), in total during the course of our survey enumerators discovered 290 FPAs were at least present in the sample villages.

Although the sample size was relatively small (only 0.35 percent of China's villages), with a number of assumptions the random nature of our sample allows us to make an estimate of total FPA activity in China. If it is assumed that all villages have equal probability of being observed and are of equal size, our survey finds that 10.21 percent (250/2459) of China's villages have FPAs (not shown in Table 1). When we account for the probability of observing each of our villages according to their population proportion (that is weighting our descriptive statistics by the sizes of the population of township, county and region of each observation), our survey finds that 10.21 percent of China's villages have FPAs (Table 1, column 1, row 1). Using the weighted statistics (*as we do in the rest of the report*) and extrapolating from our sample to the rest of China, we estimate by about 75 thousand villages at least nominally have FPAs (row 2). Moreover, according to our data on average 28.5% of the households in each village is part of the village's FPA. Hence, our data suggest that about 2.91 of China's farm households, or about 6.93 million households, nominally have an association with an FPA (rows 3 and

4). Interestingly, these numbers of unqualified FPAs are surprisingly close to the figures reported by the Ministry of Agriculture which has reported during various speeches and interviews that about 100,000 villages had FPAs, which includes 4 to 5 percent of China's households. In short, although as a percentage of all of villages only a small share of China's village have FPAs, but in total we do find that there is a large absolute level of FPA activity in China.

When more carefully categorizing the reported FPAs into those that follow more *formal* rules (without regard to how they function); those that *function* according to standard definitions of associations (as opposed to commercial units or government programs); and those that are only nominally FPAs (or those that are merely FPAs in name), we produce what we believe are more informative estimates of FPA activity in China. In the FPA block of the survey, we included two sections of questions designed to understand how FPAs operate. The first set included four questions that measure the formality of FPAs. Specifically, we asked: a.) if the FPA was formally registered (and where); b.) if the FPA had a written charter; c.) if there was a process by which individuals established their formal membership; and d.) if participants were required to pay dues or an annual membership fee. Although somewhat ad hoc, we decided to designate those associations that had two or more of the characteristics as *formal FPAs*.

Using our information on FPA formality, we find that most, but not all, FPAs follow internationally established procedures and can be counted at formal FPAs (Table 2). For example, 74 percent of FPAs formally register with one of several government bureaus (row 1). Slightly more (82 percent) have written charters, which typically are documents that specify the rules and regulations governing FPA activities (row 3). A bit

less than three-quarters (72 percent—although not exactly the same FPAs) have procedures in which they admit formal members (row 2). In these villages members must fill out an application and membership is not automatically conveyed on them merely because they are in the village. Finally, some FPAs, though a much lower proportion (14 percent) have annual membership fee requirements that mandate that active members pay dues to the FPA. By examining the presence or absence of the formality characteristics in the sample FPAs, we find that 2 percent have zero of the four formality characteristics and 15 percent (cumulative) of reported FPAs have only one or zero (rows 5 and 6). The rest or 84 percent of FPAs (33+41+10) meet at least two of the formality criteria and are counted as formal FPAs.[3] According to the formality criteria, in total there were 233 FPAs, which would mean that there are 7.49 percent of China's villages with formal FPAs (Table 1, column 2, row 1). Moreover, according to our assumptions, about 55 thousand villages and 1.76 percent of China's farm households, or 4.19 million households, are in formal FPAs (Table 1, column 2, rows 2 to 4).

It is interesting that such a small number of FPAs have annual membership fee requirements (as seen above, only 14%). In interviews we were often told that fewer farmers would join if there was a required annual membership fee. Instead, we find that in most FPAs there are assessments that are made which fund the expenses of the association. Instead of annual fees, they are usually collected for a specific purpose right at the time the service is being provided. In this way, the leaders of FPAs have told us they spend a lot of time in organizing even relatively small scale activities.

In our data we also collected detailed information on the operation of the sample FPAs in order to establish how many were truly *functioning FPAs*. The main idea was to

[3] It should be noted through out the paper that in many case numbers do not add to 100 due to rounding.

remove from the list of total reported FPAs three types of so-called association: a.) entities that were operating as (or nearly as) a commercial firms; b.) those that were (or nearly were) empty shells; and c.) organizations that, in fact, are leader-organized / leader-run development projects. In other words, we are trying to generate an estimated count of those FPAs that are really behaving as organizations that are representing the interests of farmers, primarily through the participation of farmers. In order to establish whether or not an FPA was functioning or not, the survey asked farmers three questions.[4] First, we asked whether or not the association was registered with the Market Administration Bureau. If so, we assume that the organization was a commercial entity and not a functioning FPA. Second, the questionnaire included a question about whether or not the primary function of the organization was to operate a commercial enterprise. If so, we assume this is not a functioning FPA. Finally, we asked whether or not a township or village official made all of the decisions for the organization. If so, we assume that the reported FPA was not a functioning one. In other words, if the reported FPA was not registered with the Market Administration Bureau *and* if the primary activity of the FPA was not running a commercial enterprise *and* if the government officials did not hold monopoly power over the decision making authority with regards to FPA matters, we assume the FPA was a functioning FPA.

In the same way that most (but not all) FPAs are formal, it also is true that most, but not all FPAs are functioning (Table 2, rows 10 to 17). For example, only 6 percent of FPAs registered with the Market Administration Bureau (column 2, row 10). Clearly,

[4] We also asked a fourth question that would have made the criteria for being a functioning FPA even more stringent. We asked if the FPA made major decisions according to a one-household / one-vote principal. In asking such a question we were trying to understand if FPAs were being dominated by 1 or more individuals--

from this criterion, only a small number of FPAs are excluded from the functioning FPA list. Likewise, only a small percentage of FPAs (19 percent) consider their main activity to be running a commercial firm. We believe that many of the FPAs that report their primary activity to be the operation of a commercial firm, in fact, are firms that for a variety of reasons (e.g., tax benefits; or lending priorities) set themselves up nominally as an association. Finally, in 10 percent of FPAs the respondents reported that a government official made all decisions for the operations of the FPA. When taken together, we find that 31 percent of FPAs, according to our criteria, are not functional; 69 percent are. In other words, although some FPAs are, in fact, either commercial entities or government-run organizations, most are not. In our entire sample, we find 194 villages with functional FPAs, a figure that implies that 7.50 percent of China's villages, or 55 thousand, have functioning FPAs. In these functioning FPAs, we also estimate that about 2.08 percent of China's households (or about 4.95 million) participate in FPAs. Such numbers, while large in absolute terms, still only represent a small fraction of China's rural households. Moreover, the estimates of functional FPAs are considerably below estimates routinely used by the MOA.

It should be noted that we did not eliminate FPAs from the functioning list if village leaders were the leader or director of the association. In fact, during our field work, we observed that in almost 67% of FPAs the leaders was a village cadre. In our view, leaders in many villages will naturally gravitate to the role of leader and it is really the extent to which leaders dominate decision making (which is a criteria), not their position, that distinguishes a functioning FPA from a non-functioning one.

While the discussion of formal and functional might suggest that there should be consider overlap, since an association that followed the rules in setting itself up might be expected to also function better, our data show that while there is considerable intersection, there are a number of systematic aberrations (Table 3). Only about half of the sample FPAs (54 percent) is both formal and functional (column 2, row 2). The other half shows that being formal does not imply functionality and vice versa (rows 1 and 2). Specifically, most of the FPAs (81 out of 87) that are not functional (that is, they operate like a commercial enterprise or a government-led development project) are formal (that is, they followed the rules for registration and chartering quite closely). Likewise, most informal FPAs are functional (42 out of 48). While the current data set is not designed to definitively answer the question why this might be the case, it is possible that although government officials and opportunistic entrepreneurs may be willing to invest the time and resources to set up an organization that will meet the formal requirements for an association, such an effort does not always end up in promoting well functioning FPAs. In fact, informal FPAs do quite well in terms of functionality.

The Emergence of FPAs in China: When, Where and What

In this section we use our data to try to paint a picture of role that FPAs are playing in China and where they are appearing. To do so, we first examine when FPAs emerged in China. Next we will examine where they are most prevalent and where they are conspicuously absent. In particular, we will examine the incidence of FPAs by province, by distance from China's metropolitan cities and by income categories. Finally, we briefly survey what activities they are engaged in.

When. When examining the emergence of FPAs, there are three fairly distinct time periods: the early reform era; the mid-1990s; and the recent years (Table 4). The early reform period was one of almost no systematic activity in terms of FPAs. In our sample of more 2000 villages, only 14 villages saw any FPA activity before 1994 (rows 1 to 6). During the first half of the reform era, only 5 percent of all of the post-reform FPAs emerged (column 2). Moreover, the activity appears to be relatively idiosyncratic. For example, the earliest FPA (in 1980) in our sample was an association created by farmers growing nursery plants in Li Xian, the poorest county in Gansu Province (the poorest province in our sample). In 1986, the next FPA, a garlic growing association, emerged in Dafeng County, a middle income county in Jiangsu Province (the richest province in our sample). The rest of the 10 FPAs that emerged between 1990 and 1993 were scattered throughout Jilin, Hebei and Sichuan Provinces. In short, before the mid-1990s there was almost no FPAs in China and when they did arise, they appear literally all over the map.

In the mid 1990s, however, just at the time that fruit and vegetable production began to expand rapidly in China, there was a noticeable rise in FPA activity (Table 2, rows 7 to 10). Between 1994 and 1997, on average, about 8 to 9 new FPAs emerged each year. While the total rise of FPAs only accounts for 11 percent of the total increase in the reform era, it is perhaps notable that it was occurring at all given the focus of China's government at this time on grain fundamentalism.

The fastest expanding period of FPAs has occurred during the past 5 years. Villages started fully 84 percent of all FPAs since 1998. On average, nearly 40 FPAs per year were started in our sample villages during the recent 6 year period, a time in which

the government certainly was giving farmers mixed signals: promoting structural adjustment on one hand, while beginning a period of a subsidizing staple grains on the other. In other words, during the past five year there has been a noticeable acceleration in activity; indeed if the accelerating trend were to continue, there is no doubt that FPAs would begin to become a more formidable and widespread institution.

When asked why there were so few new FPAs in 2003, selected respondents that we contacted since the survey reminded us that most local and regional initiatives had been put on hold in 2003 because of the SARS epidemic. In informal discussions with many of the village leaders that were responding, we were told that local leaders had an impression that there is increasing demand for such organizations. If so, then, it is possible that we are only seeing the earliest indications that there is rising interests in FPAs.

Where. According to our data we find that all of the sample provinces have FPAs, though some have more than others. When weighting by provincial populations (instead of regional populations as we do in the rest of the paper), we find that Sichuan province has the most FPAs (Table 5, columns 2 to 4). No matter if we are examining total number of reported FPAs (32 percent), formal FPAs (35 percent) or functional FPAs (35 percent), Sichuan ranks first in terms of number of associations. It should be cautioned, however, that the main reason that Sichuan has the most FPAs is due to the size of its population. Sichuan also has the largest population share of any of the sample provinces (column 1). When considering this, then, Sichuan actually is about average when it comes to FPA participation. The share of FPAs is almost the same as its population share.

The provincial level data also can show us which provinces are relatively intensive in their FPA activity and which ones are less intensive (Table 5). Shaanxi and Hebei provinces both have report, formal and functional FPA participation rates above their population weights. For example, the rural population in Shaanxi accounts for only 11 percent of the population of the six sample provinces, but accounts for 18 to 21 percent of the FPA villages. In contrast, Jiangsu has fewer villages with FPAs than its population share. Such variations mean that the ranking of provinces in terms of their intensity of participation (Sichuan, Hebei, Shaanxi, Jiangsu, Gansu and Jilin) differs from the ranking based on populations weights (Sichuan, Hebei, Jiangsu, Shaanxi, Gansu and Jilin).

The results change somewhat, however, when we use the provincial data as proxies for regional data by extrapolating the estimates to provinces with similar characteristics elsewhere in China (for details and assumptions, see footnote 1). In Table 5 (columns 5 to 8), we show the regional population weights of the six regions (column 5) and the population weighted estimates for the total number of FPAs and the numbers of formal and functional FPAs. The main difference in the results occurs in the ranking of the first and second provinces. In contrast to the results when weighted by provincial populations, in all of the series (total, formal and functional—columns 6, 7 and 8) our sample survey suggests that most of China's FPAs are in the central region of the country (provinces that we assume are similar to Hebei, such as Henan, Hubei, etc.). Moreover, in all cases, the share of FPAs (38 to 55 percent) is larger than its population share (33 percent). Hence, according to the data based on these rankings, the Hebei region ranks first, higher than the ranking of Hebei province (ranking was 2nd) when only the

provincial weights were used. Sichuan drops to the second ranking for all measures, and its FPA participation rates are far below the Sichuan region population weight. The rest of the regional-weighted participation rankings (#3—Jiangsu; #4—Shaanxi; #5—Gansu; #6—Jilin) are similar to the provincial-weighted ones.

Although our data are fairly well distributed across provinces (with certain exceptions as noted above), when examining our FPA participation data by county, we find that there appears to be a significant amount of clustering that occurs at the county level (Table 6). For example, there are three counties (8 percent of the sample counties) that have no FPAs at all (column 1) and 21 counties (58 percent) that have only 79 FPAs (27 percent—column 2). In contrast, in 12 sample counties, we find 211 FPAs (column 3). In other words, one third of the counties hosts nearly three quarters (73 percent) of the FPAs. While we have not pinpointed the reason for such clustering—it is possible that it is due to either local policy effort or because some regions have higher demands for the services of FPAs—a finding is still of interest and would be important to those wanting to study or work with FPAs.

When examining the location of FPAs along a rich region/poor area spectrum, we find that there are consistent non-linear patterns that occur with examining total reported FPAs, formal FPAs and functional FPAs (Table 7). For example, in the case of functioning FPAs, villages in the poorest quartile have formed 21 percent of the associations (column 3). The FPA participation rate, however, falls to 15 percent for the second quartile (the lower, middle income category). As villages move into the third and highest income quartiles villages again become more likely to participate. Indeed, villages in the richest one-quarter of our sample have formed 40 percent of the

functioning FPAs. While the results suggest that households in better off villages have a higher propensity to being functioning FPAs, those in poor ones also do. Interestingly, although as we saw above there is considerable difference between the cohort of villages that have formed functioning FPAs and those that have formal FPAs, the pattern across income space is fairly similar.

An even more distinct, although still somewhat non-linear, pattern appears when examining the location of FPAs in relation to China's main economic centers (Table 8).[5] When examining the villages in the most remote quartile (i.e., the 25 percent of the villages that are in counties at least 460 kilometers away from an economic center), we find little FPA activity of any kind (row 2). For example, only 5 percent of functioning FPAs are in the most remote quartile. In contrast, 59 percent of functioning FPAs are in the quartile of villages closest to China's main economic centers. If functioning FPAs are providing technological and marketing services for farmers that are seeking to interact with institutions that are emerging with the rise of China's agricultural marketing system, our data shows that either leaders or farm households (or both) are more willing to start FPAs in regions that are closer to China's large centers of economic demand. According to Fulton (2004) such patterns of FPAs with respect to income and proximity to a metropolitan region are unique; cooperative activity in most countries is typically highly correlated (positively) with income and proximity.

[5] In our analysis we assume that China's economic centers are the metropolitan cities that lie in the center of G. William Skinner's core-periphery macro regions (Skinner, 1994) and assign a number, measured in kilometers, to each county based on the distance of the county from the nearest major economic center. For example, in Sichuan we measure the distance of each county from Chengdu. In Gansu, since there is no economic center in the province, we measure the distance between each county and Xian, the capital of the neighboring province, Shaanxi.

What. When villages in China finally do begin to form associations, the targeted activities includes a wide range of activities in the rural China (Table 9). According to our data, 70 FPAs (or 24 percent of FPAs) are involved in cropping activities, which includes all field crops, cash crops and vegetable and specialty crop producing organizations. While grain and cash cropping FPAs are the most prevalent across China in terms of sown area, the proportion of villages with FPAs that are primarily involved with grain and cash crops are relatively rare. Only 31 percent of cropping FPAs (9 percent for grain—6 FPAs—and 20 percent for cash crops—14 FPAs) are devoted to grains or cash crops. In contrast, vegetables and specialty crops have relatively more FPAs, given their relative shares of sown area. More than one-quarter of cropping FPAs focus on vegetable production (18 FPAs). More than 40 percent concentrate on specialty crops (27 FPAs), such as medicinal herbs, mushrooms and watermelons.

Because of their large share in the total population of FPAs, orchards are examined separately. In total, although the orchards only make up about 5 percent of China's sown area, they account for 18 percent of all FPAs (Table 9). In part, the greater intensity of FPAs for orchards may be explained by the greater needs for farmer assistance in both upgrading orchards technologically and in assisting them in their marketing efforts.

The largest concentration of FPAs is engaged in livestock operations. Just less than half (44 percent or 128 FPAs) are involved with livestock (Table 9). While the range of activities within livestock is great, the most frequently reported FPAs deal with hogs (19 percent of livestock FPAs or 24 FPAs) and aquaculture (18 percent or 23 FPAs). There also are a significant proportion of livestock operations that deal with beef and

dairy cattle (13 percent), mutton lamb and wool (13 percent), poultry (11 percent) and silk cocoon production (11 percent).

Some of the sample FPAs also specialized in the provision of services. Unfortunately, our survey did not ask all villages with FPAs in them to report the major tasks of their village's organization (e.g., marketing or technology). From field work, our impression is that most successful FPAs are either trying to provide their members technological assistance or marketing information and services (perhaps, with the role of technology being a bit more important). Although we can not provide more systematic details on this topic, our data do show that 14 percent of FPAs (or 40 FPAs) specifically focused their efforts on service provision without reference to a particular commodity (Table 9). Of these, most (just less than 75 percent of service-oriented FPAs or 29 FPAs) reported to be providers of technology. Less than 10 percent of FPAs said they primarily provided marketing services and less than 10 percent said they were involved in seed production and/or distribution.

Exploring Possible Determinants: Specialization, Government Policy and Learning

In this section we continue to examine our data, focusing on some of the factors that may be behind the rise of FPAs. In particular, we first examine whether of not villages with greater degrees of specialization (in cropping, by irrigated area and self-employed businesses) are more apt to have FPAs. Second, we examine the data to find if there is any evidence that officials in China's government hierarchy are most responsible for the rise of FPAs. Third, we see if there is any evidence that human capital is affecting

the emergence of FPAs. Finally, we present the results of simple regression analysis to examine what factors affect the emergence of nominal, function and formal FPAs.

Specialization and the need for new technologies and new ways to market the harvest more effectively are often the impetus for the emergence of FPAs in many countries. Unfortunately, our data on the cropping patterns within villages only allow us to breakdown crops into grain and cash crops, a gradation that may not allow use in depth insight into specialization. Even using our rough approximation, however, we do find a positive, albeit somewhat weak, relationship between specialization and the emergence of FPAs (Table 10). The proportion of the FPAs rises for all definitions of FPAs when comparing the lowest specialization quartile (those that are least specialized) to the high specialization quartile (the most specialized). One problem with our measure that may be obscuring the relationship is that while most FPAs are focused on horticulture and orchards, in many of the villages, the farmers actually specialized in grains (and rarely—in only 6 villages, as seen in Table 9—moved to start an FPA).

Areas that have high levels of irrigation, however, appear to more inclined to begin FPAs (Table 11). Those villages with less than 0.6% of irrigated area (that is, virtually unirrigated areas) have the lowest degree of FPA activity. In contrast villages with more and more irrigated area have progressively more FPA activity.

The relationship between the presence and absence of FPAs in villages with and without a substantial number of small businesses is even less sharp than the FPA-specialization relationship (Table 12). There is little differentiation among the quartiles in the proportion of FPAs in villages with little and villages with a lot of small business activity. If small businesses were to emerge more strongly in an environment that was

characterized by better markets, we might expect households in such an environment to try to innovate institutionally and start organizations such as FPAs. On the other hand, when villagers are busy with activities outside of agriculture they may have little time to invest in farm-oriented organizations. Since we see almost no FPAs that are set up to service small businesses (a puzzle in and of itself), it could be that there is some effect that retards FPA emergence, such as the rise in opportunity costs, which is offsetting and/or obscuring any market effect.

While FPAs are not clearly associated with rising specialization or small business market emergence, they clearly do rise rapidly as the government becomes involved (Table 13). For all types of FPAs, in villages in which the upper level government has taken actions to promote FPAs, associations have emerged more frequently. In villages with FPAs, only 14 to 17 percent of them are in villages in which no action was taken by upper level officials (row 2). In contrast, in villages with FPAs, 84 percent of them (30+54—rows 3 plus 4) are in villages in which upper level officials either sent an official document to or held a meeting (or both) with village leaders urging them to start FPAs. Such a result has two possible, somewhat contradictory, implications. On the one hand, it may be a sign that FPAs in the China are in fact almost fully being pushed and started by and perhaps dominated by government officials. If so, as we have seen, it could be that some FPAs are not really functioning as pro-farmer associations and may have little positive impact on the rural population. In contrast, the importance of the government in starting FPAs may, in fact, indicate that the government has an important role to play in the launching of FPAs. Because of the difficulties that are often inherent in initiating collective action, it could be that a third party is needed to get FPAs started.

Without government intervention, our data shows that few associations emerge. Of course, if an outside force is needed to start an FPA but can also be a disruptive force, the role of those charged with jump-starting China's FPA movement will require a delicate balancing of catalyzing without interfering.

Finally, areas that have high levels of human capital also appear to somewhat more likely to begin FPAs (Table 14). Those villages with less than 2.1% of the population that is a high school graduate have the lowest degree of FPA activity (row 2). In contrast villages with more high school graduates (more than 2.1—rows 3 to 5) have progressively more FPA activity.

Multivariate Analysis. In order to better understand the determinants of FPAs we use multivariate analysis. To do so, we use probit and ordered probit analysis to explain which villages have established FPAs and which have not. In the three probit regressions we explain if a village has a nominal, formal or functioning FPA (yes or no). In the first of the next four regressions (for which we use an ordered probit estimator) we seek to explain if villages have one or two of formal and functioning FPAs (as a count). In the next three we examine how many criteria that contribute to the creation of formal, functioning and formal plus functioning FPAs exist in each village. Our independent variables include 12 factors, including per capita land holdings, the share of irrigated area, the distance to the nearest large metropolitan area, per capita income, the specialization index (linear and squared), the proportion of high school graduates, the proportion of laborers in the village that out migrate, the proportion of laborers in the village the have a job in the local wage earning sector, the proportion of households that

have a small business, the first year that the county established an FPA and the effort in promotion put out by the government. In total, we had 2289 villages with complete data.

Consistent with a number of our descriptive statistics we find several robust and strong relationships (correlations). For example, the share of irrigation was a strong positive factor in all of the regressions. In contrast, the further away from the city was the village, the lower the likelihood was the probability. Income was positive in all of the regressions, though only significant in two. Hence, according to our analysis, we find that those villages that were irrigated, relatively closer to the city and somewhat richer were more likely to have FPAs.

The structure of the village's economic activities also appears to matter. Villages with a lot of out migration systematically have less FPA activity. Those with more wage-earning non farm activity also have less FPAs. Interestingly, small business ownership did not contribute or detract from FPA emergences, perhaps reflecting the tension of the focusing on non farm sector but the need to cooperate. Clearly most FPAs are for those that are still engaged in farming.

Finally, as in the descriptive statistics, the role of the government in starting up FPAs is evident. When the government sent documents and held meetings, FPA activity increased. This finding reflects the need for a catalyst to begin FPAs in general. Interestingly, per capita land, specialization, the human capital indices and the years that the county has had FPAs have no significant correlations in the regression analysis.

Conclusions and Implications

There are a number of findings and implications of our work. In this section, we list them in bullet points to emphasize some of the important ones:

-- FPAs do exist in China; however, they are still in a fairly early stage of emergence. About 7 percent of villages in China have functioning FPAs. Only around 2 to 3 percent of China's households participate in any type of FPA. Although the level of participation is low, in recent years the pace of emergence has risen rapidly and appears to be accelerating.

-- We also have shown that not all FPAs are the same. When analyzing FPAs, we have shown that there is a great difference between those that are formal and informal and those that are functioning and those that are not. Interestingly, we also find that although there is some overlap between formal and functioning FPAs, most non-functioning ones are actually formal ones; and most informal FPAs function well according to our definition. This may have implications for the formal registration and charting requirements of FPAs as leaders seek to expand the role of FPAs in China. It could be that fewer formal rules may not harm the functioning of the FPA movement.

-- We also find that although FPAs summarily are in richer villages, there are substantial numbers poorer areas. There is a non-linear relationship between income and FPA participation.

-- One of the most distinctive correlates of FPAs is the distance from a major economic center. As villages move further away from major economic centers,

FPA activity falls rapidly. This means that if households in more remote areas are going to start FPAs, they will require substantially more help than in the past.

-- We find little spontaneous (or strong) relationship between specialization and marketization (for small businesses) and FPA emergence. It could be that our measures are just not very sensitive. However, it could be that the environment is such that household can not easily or spontaneously begin FPAs.

-- On the other hand, the government clearly has a big influence on the emergence of FPAs—of all types. The pervasiveness of government influence may mean that they have been a disruptive force (since many do not function) or it may mean that FPAs need the government to initiate them. Such a finding may mean the those in charge of the rural economy may consider to adopt a system like that used in other countries in which government employees are hired with the explicit job to be an advocate for the starting and operating of FPAs. Such an official would be rewarded to the rapid expansion of FPAs as long as they developed in a way that were pro-farmer and positively affect rural welfare.

Although the impetus to meet and act as a group must be from the farmers themselves, the government can create an environment in which FPA can thrive. *First*, leaders need to develop laws and regulations that promote and protect FPA. The legal status of groups needs to be clear. FPA need to have the ability to enter into contracts and take loans. Also beneficial would be regulations that enable farmers to organize themselves into locally-run credit cooperatives. FPA need the authority to be able to act for the members of their group as well as to be subject to well-designed regulations that protect the membership from the leadership, including the way in which the leadership is

selected and monitored. FPA leaders tell us the lack of formal, annual membership fees is hurting their efforts to expand, since every effort to act as an FPA often must be accompanied by an assessment of fees on members.

Second, the experience of FPA in other countries has shown that even when a favorable legal and regulatory framework exists, an independent catalyst (that is, someone or group outside the government) is often needed to get FPA started, expand and perform better. While China has a number of FPA-promoting agencies, these institutions are controlled by the Government. Alternative models should be sought to create catalysts that are first and foremost responsive to the needs of farmers' and FPAs. The main role of such an advocacy organization is not to control FPA, but to facilitate their creation and provide information that allows its members to promote the interest of the association.

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Table 1. National Point Estimates of Villages and Farm Households that Participates in Farmer's Professional Associations (FPAs) in China, 2003.

		Total FPAs [a]	Formal FPAs [a]	Functional FPAs [a]
National Point Estimates of Number of Villages with FPAs [b]	Percent	10.21	7.49	7.50
	Number of Villages (thousands)[c]	75	55	55
National Point Estimates of Number of Farm Households that Participate in FPAs [b]	Percent	2.91	1.76	2.08
	Number of Households (millions)[d]	6.93	4.19	4.95

[a] Total FPAs include all reported FPAs without any qualifications. Formal FPA's is a term that designates FPAs in villages that meet three of the four criteria, including being registered, being chartered, having formal membership requirements and/or charging annual fees. Functional FPA's is a term that designates FPAs in villages that meet three criteria, including *not* being registered as a commercial entity in Marketing Administration Bureau, *not* being mainly set up to run a commercial business and *not* being dominated by a government official in the making of major decisions.

[b] Regional weights are calculated for six regions in China that are estimated on the basis of estimates from the six sample provinces. Jiangsu represents the eastern coastal areas (Jiangsu, Shandong; Shanhai, Zhejiang, Fujian and Guangdong); Sichuan represents the southwestern provinces (Sichuan, Guizhou and Yunnan) plus Guangxi; Shaanxi represents the provinces on the Loess Plateau (Shaanxi and Shanxi) and neighboring Inner Mongolia; Gansu represents the rest of the provinces in the northwest (Gansu, Ningxia; Qinghai and Xinjiang); Hebei represents the north and central provinces (Hebei; Henan; Anhui; Hubei; Jiangxi; and Hunan); and Jilin represents the northeastern provinces (Jilin, Liaoning and Heilongjiang). While we recognize that we have deviated from the standard definition of China's agoecological zones, the realities of survey work justified our compromises. The regional population weight is the population of the region (the sum of the population of all of the provinces in the region) divided by the sum of the populations of all of the region

[c] Number of villages estimated by multiplying the estimated proportion of villages with FPAs (row 1) times the number of villages in rural China (737,000—China National Statistical Yearbook, 2001).

[d] Number of households estimated by multiplying the estimated proportion of households that participate in FPAs (row 3) times the number of households in rural China (238.1 million—China National Statistical Bureau, 2001).

Source: Authors' survey

Table 2. Analyzing the Formality and Functionality of Farmer's Professional Associations (FPAs) in Rural China, 2003.

	FPAs that answered yes to the following questions: (percent)	FPAs that answered "no" to the following questions: (percent)
Formality criteria [a]		
Registration	74	26
Formal Membership	72	28
Having Formal Charters	82	18
Having Annual Fees	14	86
Formality Index	Number of "yes" answers:	Frequency of "yes" answers (percent)
(FPA is formal if at least two of the four functionality criteria are met)	0	2
	1	15
	2	**33**
	3	**41**
	4	**10**
	FPAs that answered yes to the following questions: (percent)	FPAs that answered "no" to the following questions: (percent)
Functionality criteria [b]		
Not registered as commercial entities at the marketing administration bureau	94	6
Government leaders don't have dominant authority in decision-making	90	10
No commercial	81	19
One-person-one-vote [c]	77	23
Functionality Index	Number of "yes" answers:	Frequency of "yes" answers (percent)
(FPA is functional if all three functionality criteria are met)	0	0
	1	4
	2	27
	3	**69**

[a] Formality is a term that designates FPAs in villages that meet three of the four criteria, including being registered, being chartered, having formal membership requirements and charging annual fees.
[b] Functionality is a term that designates FPAs in villages that meet three criteria, including *not* being registered as a commercial entity in Marketing Administration Bureau, *not* being mainly set up to run a commercial business and *not* being dominated by a government official in the making of major decisions.
[c] We do not include "one-person / one-vote as part of the functionality index. We do, however, report it, since in some circles this is an important sign of being a functioning FPA.

Data Source: Authors' survey.

Table 3. Relationship between Formality and Functionality in the Organization of Farmer's Professional Associations (FPAs) in Rural China, 2003.

			Functionality [b]	
			No (according to criteria, FPA is *not* a functional FPA)	Yes (according to criteria, FPA is a functional FPA)
Formality [a]	No (according to criteria, FPA is *not* a formal FPA)	0	6 (2%)	42 (15%)
	Yes (according to criteria, FPA is a formal FPA)	1	81 (29%)	152 (54%)

[a] Formality is a term that we coin here that designate FPAs in villages that meet three of the four criteria, including being registered, being chartered, having formal membership requirements and charging annual fees.

[b] Functionality is a term that we coin here that designate FPAs in villages that meet three criteria, including *not* being registered as a commercial entity in Marketing Administration Bureau, *not* being mainly set up to run a commercial business and *not* being dominated by a government official in the making of major decisions.

Data source: Authors' survey.

Table 4. The Year of Establishment of Farmer's Professional Associations in Rural China, 1980 to 2003.

Year FPA was Established	Number of FPAs during year	Cumulative Percentage
1980	1	0.3
1986	1	1
1990	5	2
1991	1	3
1992	4	4
1993	2	5
1994	15	10
1995	4	11
1996	6	13
1997	9	17
1998	38	30
1999	42	44
2000	28	54
2001	55	73
2002	52	91
2003	27	100
Total Number of FPAs	290	

Data Source: Authors' Survey.

Table 5. Estimated Proportion of Farmer's Professional Associations (FPAs) in Sample Provinces and Regions in Rural China, 2003.

Province	Proportion of FPAs by Province				Proportion FPAs by Region [a]			
	Population weight[c]	Total FPAs [c]	Formal FPAs [c]	Functioning FPAs [c]	Population weight[c]	Total FPAs [c]	Formal FPAs [c]	Functioning FPAs [c]
	(Percent)				(Percent)			
Jiangsu	20	12	13	10	28	17	19	12
Gansu	7	5	6	6	4	3	4	4
Sichuan	36	32	35	35	21	19	22	16
Shaanxi	11	21	19	18	7	14	14	8
Jilin	5	4	4	4	6	3	4	6
Hebei	20	26	22	26	33	44	38	55
Total	100%	100%	100%	100%	100%	100%	100%	100%

[a] The sample regions are estimated from the six sample provinces. Jiangsu represents the eastern coastal areas (Jiangsu, Shandong; Shanhai, Zhejiang, Fujian and Guangdong); Sichuan represents the southwestern provinces (Sichuan, Guizhou and Yunnan) plus Guangxi; Shaanxi represents the provinces on the Loess Plateau (Shaanxi and Shanxi) and neighboring Inner Mongolia; Gansu represents the rest of the provinces in the northwest (Gansu, Ningxia; Qinghai and Xinjiang); Hebei represents the north and central provinces (Hebei; Henan; Anhui; Hubei; Jiangxi; and Hunan); and Jilin represents the northeastern provinces (Jilin, Liaoning and Heilongjiang). While we recognize that we have deviated from the standard definition of China's agoecological zones, the realities of survey work justified our compromises.

[b] Total FPAs are all of those reported by respondents without being subject to any qualifications. Formal and Functional FPAs are defined in Tables 2 and 3 and in text.

[c] The provincial population weight is the population size of the province divided by the sum of the populations of the provinces. The region population weight is the population of the region (the sum of the population of all of the provinces in the region) divided by the sum of the populations of all of the region.

Data Source: Authors' Survey.

Table 6. The Appearance of Clusters of Farmer's Professional Associations within Sample Counties by Province in Rural China, 2003.

Province	Number of FPAs in Counties:		
	No FPAs	1 to 10 FPAs	Greater than 10 FPAs
		(Number of Counties)	
Jiangsu	1	2	3
Gansu	2	3	1
Sichuan	0	5	1
Shaanxi	0	3	3
Jilin	0	5	1
Hebei	0	3	3
Total Number of Counties	3	21	12
% of Sampled Counties	8%	59%	33%
Total Number of FPAs	0	79	211
% of Total FPAs that are found in Clusters of 1to 10 or Greater than 10	0%	27%	73%

Data Source: Authors' Survey.

Table 7. The Proportion of Villages with Farmer's Professional Associations (FPAs) by Per Capita Income Quartiles (Yuan per capita) in Rural China, 2003.

Per Capita Income Quartiles of Villages (615 villages per quartile)	Total FPAs [a]	Formal FPAs [a]	Functional FPAs [a]
Number of Observations	290	231	209
	(proportion of FPAs in different income quartiles)		
Less than 900 Yuan	26	22	21
901 to 1580 Yuan	15	14	15
1581 to 2430 Yuan	21	23	24
Greater then 2430 Yuan	39	41	40
Total	100%	100%	100%

[a] Total FPAs are all of those reported by respondents without being subject to any qualifications. Formal and Functional FPAs are defined in Tables 2 and 3 and in text. All numbers weighted with regional weights where the regional population weight is the population of the region (the sum of the population of all of the provinces in the region) divided by the sum of the populations of all of the region.

Data Source: Authors' Survey.

Table 8. The Proportion of Villages with Farmer's Professional Associations (FPAs) by Geographic Location (Measured as Distance between Home County and Nearest Major Economic Center in Kilometers) in Rural China, 2003.[a]

Distance Quartiles	Total FPAs [a]	Formal FPAs [a]	Functional FPAs [a]
Number of Observations	290	231	210
	(proportion of FPAs in different distance quartiles)		
Greater than 460 km	7	9	5
291 to 460 km	20	24	20
201 to 290 km	18	11	15
Less than 200 km	55	56	59
Total	100%	100%	100%

[a] The distance variable measures the distance in kilometers between the sample county and the nearest major economic center. The major economic centers for counties in each province: for Jiangsu—Shanghai; for Jilin—Shenyang; for Hebei—Beijing; for Sichuan—Chengdu; for Shaanxi—Xian; for Gansu—Xian.

[b] Total FPAs are all of those reported by respondents without being subject to any qualifications. Formal and Functional FPAs are defined in Tables 2 and 3 and in text. All numbers weighted with regional weights where the regional population weight is the population of the region (the sum of the population of all of the provinces in the region) divided by the sum of the populations of all of the region.

Data Source: Authors' Survey.

Table 9. The Main Economic Activities Pursued by Farmer's Professional Associations in Rural China, 2003.

		Total FPAs		
		Major Group Subtotal[a]	Minor Group Subtotal[a]	Specific Crops[a]
Cropping	**Subtotal**	**70 (24%)**		
	Grain and General Cropping		6 (9%)	
	Cash Crops		14 (20%)	
	Cotton			4 (29%)
	Tobacco			8 (57%)
	Peanuts, etc.			2 (14%)
	Vegetables		18 (26%)	
	Specialty Crops		27 (39%)	
	Medical Herbs			8 (30%)
	Water Melon			6 (22%)
	Mushroom			5 (19%)
	Other Specialty Crops			8 (30%)
	Others		5 (7%)	
Orchards	**Subtotal**	**52 (18%)**		
	Orchards		37 (71%)	
	Specialty Fruits		15 (29%)	
Livestock	**Subtotal**	**128 (44%)**		
	Hogs		24 (19%)	
	Beef and Dairy Cattle		16 (13%)	
	Mutton, Lamb & Wool		16 (13%)	
	Poultry		14 (11%)	
	Aquaculture		23 (18%)	
	Silk Cocoon Products		14 (11%)	
	General and Others		21 (16%)	
Technologies & Services	**Subtotal**	**40 (14%)**		
	General Technologies		29 (73%)	
	Marketing		4 (10%)	
	Others		7 (18%)	

Data Source: Authors' Survey.

[a] First number is number of observations in sample; figure in parentheses is subgroup total in percent.

Table 10. The Proportion of Villages with Farmer's Professional Associations (FPAs) by Degree of Specialization in Rural China, 2003.[a]

Specialization Index Quartiles	Total FPAs [b]	Formal FPAs [b]	Functional FPAs [b]
Number of Observations	290	231	210
	(proportion of FPAs in different Specialization Index quartiles)		
Less than 0.01	18	18	21
0.01 to 0.06	28	26	23
0.06 to 0.18	27	24	29
Greater then 0.18	27	31	27
Total	100%	100%	100%

[a] The Specialization Index is calculated as follows: Index = (share of sown area for cash crop)^2 + (share of orchard area)^2 which is a measure that achieves a maximum at 1 (most specialized) and minimum of near zero (least specialized).

[b] Total FPAs are all of those reported by respondents without being subject to any qualifications. Formal and Functional FPAs are defined in Tables 2 and 3 and in text. All numbers weighted with regional weights where the regional population weight is the population of the region (the sum of the population of all of the provinces in the region) divided by the sum of the populations of all of the region.

Data Source: Authors' Survey.

Table 11. The Proportion of Villages with Farmer's Professional Associations (FPAs) by Irrigation Rate of Arable Land in Rural China, 2003.[a]

Irrigation Rate Quartiles	Total FPAs [b]	Formal FPAs [b]	Functional FPAs [b]
Number of Observations	290	231	210
	(proportion of FPAs in different Irrigation quartiles)		
Less than 0.6%	13	15	11
0.6 to 43.3	16	20	18
43.3 to 91.1	24	30	27
Greater then 91.1	47	36	45
Total	100%	100%	100%

[a] Irrigation rate=irrigated area/arable land area of the village.

[b] Total FPAs are all of those reported by respondents without being subject to any qualifications. Formal and Functional FPAs are defined in Tables 2 and 3 and in text. All numbers weighted with regional weights where the regional population weight is the population of the region (the sum of the population of all of the provinces in the region) divided by the sum of the populations of all of the region.

Data Source: Authors' Survey.

Table 12. The Proportion of Villages with Farmer's Professional Associations (FPAs) that are Associated with Different Levels of Business Activities from Household Businesses in Rural China, 2003.

Share of Households with Small Businesses	Total FPAs [a]	Formal FPAs [a]	Functional FPAs [a]
Number of Observations	290	231	210
	(proportion of FPAs in different small business quartiles)		
Less than 1.53%	22	26	24
1.54 to 3.22	20	20	26
3.23 to 6.45	31	25	22
Greater then 6.45	27	29	28
Total	100%	100%	100%

[a] Total FPAs are all of those reported by respondents without being subject to any qualifications. Formal and Functional FPAs are defined in Tables 2 and 3 and in text. All numbers weighted with regional weights where the regional population weight is the population of the region (the sum of the population of all of the provinces in the region) divided by the sum of the populations of all of the region.

Data Source: Authors' Survey.

Table 13. The Proportion of Villages with Farmer's Professional Associations (FPAs) that are Associated with Different Levels of Government Promotion of FPA Activities in Rural China, 2003. [a]

Degree of Involvement by Government Officials in Promotion of FPAs	Total FPAs [b]	Formal FPAs [b]	Functional FPAs [b]
Number of Observations	290	230	211
	(proportion of FPAs in different government involvement quartiles)		
None	16	17	14
Documentations or Meetings	30	25	28
Documentations and Meetings	54	58	58
Total	100%	100%	100%

[a] Government involvement in promoting FPAs includes two types: the issuance of government documents and the convening of meetings.

[b] Total FPAs are all of those reported by respondents without being subject to any qualifications. Formal and Functional FPAs are defined in Tables 2 and 3 and in text. All numbers weighted with regional weights where the regional population weight is the population of the region (the sum of the population of all of the provinces in the region) divided by the sum of the populations of all of the region.

Data Source: Authors' Survey.

Table 14. The Proportion of Villages with Farmer's Professional Associations (FPAs) by Human Capital in Rural China, 2003.[a]

Human Capital Index Quartiles	Total FPAs [b]	Formal FPAs [b]	Functional FPAs [b]
Number of Observations	290	231	210
	(proportion of FPAs in share of high school graduates quartiles)		
Less than 2.1%	21	17	18
2.1 to 4.3	26	28	29
4.3 to 8.6	25	26	26
Greater then 8.6	28	29	27
Total	100%	100%	100%

[a] Human capital is defined by the share of high school graduates over total village population.

[b] Total FPAs are all of those reported by respondents without being subject to any qualifications. Formal and Functional FPAs are defined in Tables 2 and 3 and in text. All numbers weighted with regional weights where the regional population weight is the population of the region (the sum of the population of all of the provinces in the region) divided by the sum of the populations of all of the region.

Data Source: Authors' Survey.

Table 15. Regression Results for the Determinants of FPAs in China.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Nominal	Formality	Functioning	Formality & Functioning	Formality	Functioning	Formality & Functioning
	Probit	Probit	Probit	Ordered Probit	Ordered Probit	Ordered Probit	Ordered Probit
Per Capita Land	0.012	0.006	0.010	0.027	0.012	0.017	0.013
	(0.024)	(0.026)	(0.022)	(0.023)	(0.023)	(0.024)	(0.021)
Share of Irrigated Area	0.686**	0.261	0.573***	0.724***	0.740***	0.563***	0.669***
	(0.267)	(0.186)	(0.209)	(0.258)	(0.217)	(0.209)	(0.202)
Distance to the City	-0.201**	-0.030	-0.096	-0.192*	-0.156*	-0.133	-0.127
	(0.095)	(0.098)	(0.081)	(0.098)	(0.081)	(0.091)	(0.079)
Per Capita Income	-0.021	0.241**	0.135	0.166	0.067	0.179*	0.096
	(0.138)	(0.111)	(0.124)	(0.127)	(0.109)	(0.107)	(0.111)
Specialization Index	0.210	-0.339	0.080	0.014	-0.160	-0.049	-0.234
	(0.731)	(0.685)	(0.675)	(0.750)	(0.684)	(0.685)	(0.688)
Specialization Index2	-0.342	0.367	-0.024	-0.136	0.019	-0.073	0.303
	(0.968)	(0.880)	(0.992)	(1.002)	(0.983)	(0.935)	(1.049)
Prop. of High School Graduates	0.411	1.061*	0.845	0.810	0.781	0.820	0.838
	(0.695)	(0.640)	(0.612)	(0.704)	(0.611)	(0.645)	(0.599)
Prop. of Out-migrated Laborers	-1.169***	-1.286***	-1.058***	-0.810**	-1.030***	-1.051***	-1.040***
	(0.422)	(0.358)	(0.322)	(0.374)	(0.358)	(0.344)	(0.327)
Prop. of Households In Non-farming	-1.216**	-1.674***	-1.626***	-1.937**	-1.742***	-1.945***	-1.697***
	(0.578)	(0.643)	(0.496)	(0.770)	(0.559)	(0.684)	(0.514)

Share of Households with Small Businesses	0.385 (0.556)	0.051 (0.543)	0.380 (0.505)	-0.029 (0.590)	0.305 (0.526)	0.139 (0.546)	0.272 (0.520)
Years of the County W/ FPAs (Learning)	0.024 (0.015)	0.055*** (0.011)	0.046*** (0.012)	0.036** (0.015)	0.044*** (0.013)	0.043*** (0.012)	0.048*** (0.012)
Gov't Promotion of FPAs	0.264*** (0.051)	0.206*** (0.054)	0.200*** (0.048)	0.225*** (0.054)	0.186*** (0.048)	0.225*** (0.051)	0.198*** (0.048)
Observations	2289	2289	2289	2289	2289	2289	2289

Note: The dependent variables in specification (1)-(3) are defined previously. The dependent variable in specification (4) is the summation of those in (2) and (3), those in (5) and (6) are defined by the number of yes answers in Table 2 rather than the dummy variables in (2) and (3), and the one in (7) is the summation of those in (5) and (6). Standard errors are in parentheses, and * significant at the 10 percent level, ** significant at the 5 percent level and *** significant at the 1 percent level.

Appendix TABLE 1
Sampling and Basic Statistics

	Entire Sample	Jiangsu	Gansu	Sichuan	Shaanxi	Jilin	Hebei
Observations	2459	457	329	365	369	367	574
Number of HHs	392.35	808.01	255.75	359.74	204.47	320.22	326.57
Average Village Population (persons)	1435.13	2636.19	1229.12	1265.02	856.73	1144.68	1259.07
Per Capita Arable Land (mu)	1.92	1.43	2.45	0.91	1.42	3.82	1.73
Irrigated Rate (%)	46.71	78.06	18.20	45.98	20.68	16.95	74.14
% of Exclusive Non-Farming HHs	8.42	9.72	3.48	12.83	7.71	9.80	7.06
% of HHs with Small Businesses	5.71	6.75	5.85	4.80	5.43	4.20	6.53
% of Local Wage-Laborers	7.23	3317.49	976.27	1795.72	1309.70	1654.43	1624.03
% of Commuting Wage-Laborers	8.99	9.65	3.17	4.13	7.23	4.87	11.09
% of Out-Migrated Laborers	19.38	14.95	3.43	6.76	8.00	7.66	10.32
Share of High School Graduates (%)	6.46	8.17	5.89	4.33	6.69	5.44	7.27
Per Capita Income (yuan)	1835.10	29.37	18.17	33.52	16.03	12.81	9.68
Specialization Index	0.130	0.157	0.079	0.121	0.165	0.114	0.132
Years First FPA Established	7.791	7.842	12.543	7.138	6.277	5.081	8.656

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Small Traders and Small Farmers: The Evolution of China's Horticulture Economy

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Abstract

The supermarket revolution has arrived in China and is spreading as fast as or faster than anywhere in the world. As the demand for vegetables, fruit, nuts and other high valued products have risen, urban retailers are finding new venues from which they can sell to the increasing prosperous city residents. However, the experience of many developing countries suggests that there could be serious distributional impacts of the rising of supermarkets. There is concern among policy makers and academics that poor, small farmers might be excluded from market. The main goal of our paper is to understand what types of farmers have been able to participate in the horticultural revolution, how they interact with markets and how supply chains affect their production decisions. Using a unique set of spatially sampled communities in the Greater Beijing area, in contrast to fears of some researchers, we find small and poor farmers have actively participate in the emergence of China's horticulture economy. Moreover, there has been almost no penetration of modern wholesalers or retailers into rural communities. In the paper we document seven characteristics of China's food economy that we believe account for this set of findings.

Keywords: Horticulture; Modern Supply Chains; Farmer Impacts; Poverty; China

JEL Classification Codes: O33; O53; Q13

Small Traders and Small Farmers: The Evolution of China's Horticulture Economy

The supermarket revolution has arrived in China and is spreading as fast as or faster than anywhere in the world. As the demands for vegetables, fruit, nuts and other high valued products have risen, urban retailers are finding new venues from which they can sell to the increasing prosperous city residents. From its start in the early 1990s, today supermarkets have over $55 billion in sales (Hu et al., 2004). China's supermarkets already sell much higher levels of fresh fruits and vegetables to domestic consumers than exporters sell into overseas markets. This development has been driven by factors shared by other developing countries—urbanization, income growth and liberalization of foreign direct investment in retailing—as well as a number of China-specific policies (e.g., government investment in the sector and policies promoting conversion of wetmarkets to supermarkets—Bi et al., 2004; Hu et al., 2004). Although there has been no systematic study of the penetration of procurement into rural areas, researchers have written about signs that supermarket procurement systems have begun to shift away from the traditional wholesale system toward the use of large, centralized distribution centers, specialized/dedicated wholesalers operating preferred supplier systems and private standards for quality and food safety. Clearly, the spread of supermarkets, in particular, and the rise of the demand for horticultural products, more generally, present opportunities for China's agricultural producers to diversify into activities with higher income prospects.

The experience internationally, however, suggests that there could be serious distributional impacts of the rise of supermarkets. For example, there are case studies in

Guatemala and Costa Rica that suggest that it is the rich, large farmers that benefit from the rise of demand for fruit and vegetables and the emergence of supermarkets (Berdegué et al., 2005; Alvarado, 2002). Because of the high transaction costs involved with purchasing from millions of small farmers and difficulties in monitoring quality and food safety, it is often assumed that supermarkets and their agents (for example, specialized wholesalers; preferred suppliers) will turn to large and better-off farmers. As a consequence, the rise of demand for horticultural and other high-valued commodities in the consumption basket of consumer and the concomitant rise in supermarkets have created concern among the international community about the possible adverse consequences on small, poor farmers (Reardon and Timmer, 2005).

In many respects, the process that will allow China's procurement systems to mature and spread over larger regions faces similar, if not more severe, challenges than those faced by food retailers in other countries. The average farm size in China is small, less than 0.6 hectare per household (CNSB, 2005). Farmers are not well organized, since historically cooperatives and associations have not been encouraged (Shen et al., 2005). Households who are engaged in mostly farming (that is, full time-farmers) are among the absolute poorest in China and live in relatively poor parts of the nation (Rozelle, 1996; World Bank, 2005). Hence, the typical farm family faces significant challenges in meeting the demanding product and transaction attributes that are required by most supermarket retailers. Indeed, the rise of supermarkets, like elsewhere in the world, has also generated a concern among policy makers about their impact on the small, poor farming sector (Reardon and Swinnen. 2004). In fact, in China this concern has already dampened the initial enthusiasm of some of those that believed the rise in the

demand for high valued horticulture and other commodities would provide opportunities for farmers to move into the production of goods that could provide them with a higher level of income (Yu, 2003; Yuan, 2004).

Surprisingly, given the importance of this topic, there has been little, if any, systematic empirical analysis of the effect of the rise of demand for high-valued farm commodities and the rise of the supermarket sector that is promoting these high-valued goods on the welfare of farmers in China. The work that has been done (e.g., Hu.et al 2004; Yu 2003; Yuan, 2004), while interesting and providing important insights, is unable to answer a few key questions in a systematic way: Where are the new high-valued crops being cultivated and who is cultivating them? Are the farmers that are supplying most of the demand rich and large? Are farmers that are poor and small able to benefit? What is the nature of the supply chains that facilitate the procurement of crops from the farmers? Are these supply chains imposing new quality and food safety standards on farmers?

The main goal of this paper is limited to one major theme: getting the facts right regarding the emergence of supply chains and the participation of farmers in China's rapidly evolving food economy. To meet this goal, we have three main objectives. First, we sketch a picture of who is supplying horticultural products in China. Second, we describe the patterns of marketing chains in China's rural areas, examining who is procuring vegetables, fruits and nuts from farmers, where the transactions are taking place and to whom the first buyer is selling. Finally, we seek to understand if there is any descriptive evidence about how marketing supply chains are affecting the way farmers are producing horticulture crops.

Even given such a circumscribed set of objectives, we still must further recognize the limitations of our work. First, while our sample is spatially sampled and is able to produce a representative view of China's horticultural economy in rural areas, we are still only looking at one region, the greater Beijing metropolitan region. We also only look at the first two links in the marketing chain. Hence, our findings are not able to trace the marketing paths of vegetables, fruits and nuts all the way to the consumer. Hence, while we know from our study that supermarkets are largely absent from rural areas, we can not say anything about how supermarkets procure their horticultural goods. Finally, because exports are such a small part of total horticulture production (only around 2%), and because we are not studying horticultural production in Shandong Province or other centers of the export industry, we are almost exclusively focusing on the domestic side of the industry. Hence, we are unable to answer many questions about the dynamics of the export segment of the market, which in many cases may be expected to behave quite differently.

To meet our objectives, the rest of the paper is organized as follows. The first section describes our data. The next two sections examine the production and procurements sides of the horticultural economy. The following section briefly examines descriptively the way that marketing channels are affecting the way that horticultural crops are being produced. The final two sections use multivariate analysis to try to explain who is benefiting from the rising demand for horticultural goods and concludes.

Data

The data set, collected by ourselves, is comprised of observations on 201 villages in the greater Beijing metropolitan region. In the summer of 2005 enumerators visited each of the villages and interviewed village leaders about the horticultural economy from the village's point of view between 2000 and 2004.[1] Among other things, during a several hour-long, sit-down questionnaire sessions with enumerators, village leaders recounted information about production trends of their community's major horticultural commodities. The leaders also provided information on the two most common ways that horticultural goods are procured from farmers—including a.) the type of buyer that purchased the crop from the farmer (henceforth, the *first-time buyer*); b.) the location of the first transaction; and c.) the agent/trading firm to whom the goods were sold by the first time buyer (henceforth, the *second buyer*). In total we identify 8 main types of first-time buyers and 7 main types of second buyers. Finally, we asked leaders to tell us the nature of the contractual arrangement—either explicit or implicit—between the farmer and first-time buyers. Enumerators also asked village leaders about the characteristics of their communities (for example, income per capita; cultivated land per capita; location; etc.).

The main way that our study is differentiated from previous research on these issues is in the way that we chose our sample. In simplest terms, we began with detailed administrative maps of Beijing Municipality and Hebei Province. We then took a

[1] During the pretest we were concerned that village leaders would not be able to have very accurate information about the horticulture production and marketing activities of their villagers. We were careful in convincing ourselves that they did and proved it to ourselves by conducting a pilot survey of village leaders *and* randomly selected farmers in the same village. We found their answers were mostly consistent. In a follow up study (henceforth called the *intensive survey*) on 50 of the 201 villages (henceforth called the *extensive survey*), we visited 10 randomly selected households. In the case of almost all of our variables, the aggregated average of the answers of the household were close to that of the level of the variable produced from information provided by the village leader.

compass, sticking the needle end into the point representing Tiananmen (the geographical center of Beijing) and tracing out five concentric rings. Each ring was progressively larger in circumference than the former (including circles with radii of 40, 60, 80, 100 and 140 kilometers). Next, we divided the concentric circles into 10 wedges by drawing what appear to be 10 spokes from the center of the hub (Tiananmen) to the edge of the outer circle. Each spoke had a length of 140 kilometers and each wedge was defined by the two spokes that created an angle of 36 degrees and cut each concentric circle into 10 arc that were each 36 degrees. In total there were 50 arcs (5 circles times 10 wedges). The next step was to draw 50 random numbers between 0 and 36. The random number defined a point on each arc. Once the point was drawn, we were then able to calculate precisely its coordinates (longitude and latitude) and used GIS mapping software and a database of the coordinates of all of China's towns and townships (henceforth, townships) to choose the township that was linearly closest to the point on the arc. In total 50 townships were sampled. The township sampling strategy is illustrated in Figure 1.

The next step was to choose the sample villages. With the list of 50 townships, we phoned each township's administrative office and asked an official to fax to us a comprehensive list of all villages in the township. From this list, we randomized the village names and randomly chose 4 villages. As a result, our sample consists 201 villages randomly selected from the greater Beijing area (an area covering more than 80 thousand square kilometers—$\pi * r^2$, where r is 160 kilometers).[2]

[2] The number 160 is used since the township nearest to the point on the arc could have been inside or outside of the arc of the circle. The village that is furthest away from Tiananmen is 159 kilometers.

We also used secondary information to provide information that we use to weight our sample communities. Our weighting strategy took advantage of access to a GIS data base managed by the Chinese Academy of Sciences that contains detailed information on 24 land use categories of every township in the sample region (including the sample ones and the non-sample ones). We were mainly interested in computing the total cultivated area (in hectares) in each of the 50 sampling wedges. In the analysis we use these cultivated area numbers to construct weights that are used to produce point estimates for the greater Beijing area.[3]

Who are Producing China's Vegetables, Fruits and Nuts?

The rise of demand for horticultural crops (henceforth the term used to describe "vegetables, fruits and nuts grown in orchards") that have been observed in the demand statistics is beginning to change production patterns of farmers from grain into other crops in the greater Beijing area after 2000 (Table 1, columns 1 and 2). The total sown area of grain between 2000 and 2004 fell from 68 percent to 58 percent. In contrast, cash crops (which include mainly crops, such as cotton and peanuts, crops that are *not* the focus of our study) rose by 4 percentage points. During the same period, the area sown to horticultural crops also rose by 7 percentage points (from 22 percent in 2000 to 29 percent in 2004). Vegetables rose by 2 percentage points; fruit—by far the crop category

[3] As is expected, since the physical area of the outer-most wedges are much larger than the physical areas of the inner-most wedges, the amount of cultivated area rises as one moves from concentric circle 1 (40 kilometer radius) to concentric circle 5 (140 mile concentric circle). In fact, the average relative weight for each wedge of each concentric circle, after normalizing the weight for concentric circle 1 to 1.00 is as follows: concentric circle 2=1.35; concentric circle 3=1.63; concentric circle 4=2.96; concentric circle 5=4.83.

accounting for the largest share of horticultural crops—rose by 3 percentage points; and nuts rose by 2 percentage points.

While the production trends for the entire greater Beijing area match fairly closely the rise in horticulture demand in China's urban areas, in this paper we are most interested the types of farmers that are participating in the supplying the horticulture crops. In fact, when information on the typical farmer that is engaged in farming inside each of the concentric circles is compared (that is information on those farmers close to Beijing are compared to those far from Beijing), it can be seen that farmers in all areas are adjusting their production structure (Table 1, columns 3 to 12). In particular, while average farmers in all areas reduced the share of their area sown to grain by 10 percent (from 68 to 58 percent, row 1), as might be expected (Fafchamps and Shilpi. 2003) farmers in the first two circles (40 km and 60 km circles) reduced the share of area sown to grain (12 to 16 percent) more than farmers in the other 3 circles (6 to 10 percent) that are far away from Beijing. In other words, although the production of horticultural crops rises everywhere, the largest rise in terms of the share that a village's land that is allocated to horticulture crops is in the 40 and 60 kilometer circles. Interestingly, while the share of horticultural crops in 40 kilometer circles rise mainly came from fruit (19 to 26 percent), the rise in 60km circle came from vegetables and nuts (vegetables, 4 to 9 percent; nuts, 11 to 17 percent).

Participation by the Poor

While the relative smaller rise of horticultural area share in remote area is what one may expect according to the theories of von Thunen (1826), the most significant finding, based on our data, is that poor farmers are increasing their share of the

production of horticulture crops (Table 2). To show this, we divide villages into four quartiles, according to each village's reported income per capita. Between 2000 and 2004 we find that farmers in the very poor and poor categories (those farmers living in villages with incomes below the median income level) have increased their share of total sown area of horticultural crops, in general (top row). In fact, by 2004 farmers in very poor and poor villages produced more than half (55 percent) of horticultural crops in Greater Beijing. Even more significantly, farmers in the very poor villages increased their share of vegetables, fruits and nuts between 2000 and 2004 (rows 2 to 4, columns 1 and 2).

A similar picture emerges when examining different types of horticultural crops (Table 2, row 2, columns 5 and 6). For example, in the case of fruit, production is dominated by the farmers in the very poor and poor farmer village. In contrast, farmers in average income villages produce most of the vegetables. Of course, one of the most interesting findings of Table 2 is that the richest farmers are not the driving force (or beneficiary) of vegetables, fruits or nuts.

Hence, according to our data, we have strong evidence the rise of horticultural production in the greater Beijing area is not following the trends that have been observed in other developing countries (e.g., Farina and Machado 1999). Clearly, our data show that farmers in very poor and poor villages are not being left out. In fact, especially in the case of the very poor, they are the driving force behind the rise in the supply of fruit and nuts. Moreover, there is no evidence—even for vegetable crops—that richer farmers are dominating production. Indeed, farmers that live in the richer villages (above average and rich) have lost their share in all categories of horticultural crops (eg, 65 to 59 percent

for vegetable, 48 to 38 percent for fruits and 62 to 51 percent for nut). In 2004 the richest 25 percent of farmers only cultivated 19 percent of the region's horticultural area.

Where are the Supermarkets?

The surprises on the supply side, if anything, are matched by surprises on the procurement side (Table 3). Although there has been a lot of discussion about the potential implications of the rise modern supply chains and the effect of their procurement agents on welfare in rural areas, according to our data, supermarkets are completely absent. Indeed, not one of the 201 village leaders that we interviewed reported the presence supermarkets for the procurement of any horticultural goods (Table 3, Panel A, column 1). Likewise, village leaders reported that only 2 percent of procurement from farmers was from specialized suppliers and only 2 percent was from processing firms (columns 2 and 3). Hence, in the greater Beijing area in 2004, only 4 percent of all horticultural goods were procured by those operating in firms that could be described as part of the modern supply chain.

Even when we look at data on the second buyer in the supply chain, the modern supply chain plays a fairly minor role (Table 3, Panel C, columns 1 to 3). When asked to whom the first buyer sells, supermarkets only are involved in 3 percent of the volume. Specialized supply firms also account for only 3 percent. Processing firms are the second buyer for 10 percent of the volume of horticultural crops. Hence, in total, even by the second link of the marketing chain, modern supply chains are playing a relatively minor role, accounting for only 16 percent of the volume. Therefore, in summary, it is safe to say that in the greater Beijing sample villages, despite the rise of demand for high-valued

horticultural products, and despite the rapid emergence of supermarkets in urban areas, modern supply chains in 2004 were almost non-existent at the producer end of the marketing chain.

Small Traders and Their Domination of Traditional Supply Chains

Instead, the main story of horticulture marketing in China in 2004 is the domination of traditional supply channels, mostly by small traders. According to our data, fully 79 of the first-time buyers of horticultural goods were small traders (Table 3, Panel A, row 1, column 4). These small traders, which during harvest season can be seen veritably everywhere in areas that are producing horticultural crops, enter the village itself and buy directly from farmers. Almost all transactions are spot market transactions, exchanging the commodity for cash. In addition, in another 8 percent of the cases farmers take their crop, as they have done for hundreds of years, to local period markets to sell to local consumers and traders (column 5—Rozelle and Huang, 2001).

Almost certain in part due to the domination of traditional small traders, it can be seen from our data that the supply chain penetrates far into the village (Table 3, Panel B). While some of the traders bought from farmers in local periodic markets (about 6 percent), most of them came to the farmer. In fact, when aggregating procurement by traders in the farmer's own fields (65 percent), at some spot in the village's center (9 percent) or at the side of the road near the village (3 percent), more than 75 percent of all procurement took place inside or immediately next to the boundary of the village (row 1 in Panel B). Only 15 percent of first time sales take place in formal wholesale markets (11 percent) or urban wet markets (4 percent).

Finally, small traders not only make up the first link in the marketing chain. In fact, 49 percent of second buyers also were small traders (Table 3, Panel C, column 4). In other words, in nearly half of the cases, small traders bought from farmers and sold their goods to a second small trader. In addition, 13 percent of small traders took their goods to a nearby retail market and sold their goods to consumers (column 5).

While a comprehensive study of traders is still needed, given their primary role in the rural segment of the marketing chain in the horticultural economy, from interviews and from another data set collected by the authors in 2000, we can sketch a simple profile of small traders.[4] By far, from discussions with village leaders and farmers, most small traders in the greater Beijing area are from three poor provinces, Hebei, Henan and Anhui. On average, small traders worked in small groups (henceforth, trading firms) of 3 to 4 people. On average they received only 7 years of education and their average age was over 30 years old (older and less well-educated than the average migrant to China's largest cities). In almost all cases, those employees/partners working in the same small trading firm were either relatives or fellow villagers, people that could be relied upon to work hard and trusted to work for the good of firm. Moreover, despite the long hours of work (on average, for 8 months of the year), the average income of traders was only about 3200 yuan per person. If this was their only source of income and if we assume each small trader has to support, on average, a single dependent, this would put them right at the high international poverty line (about $2 per day in purchasing power parity

[4] We thank Jian Zhang, a Ph.D. student in the department of agricultural and resource economics, University of California, Davis for these statistics. The data are from a 2000 household data set collected by the Center for Chinese Agricultural Policy and the University of California, Davis. Among other sections of the survey, one part focused in family-run businesses and carefully enumerated the income and expenses, assets and liabilities, and working hours of more than 350 small micro-enterprises, including more than 50 small trading firms.

terms). Hence, these small traders can be thought of as poor themselves and willing to engage in labor intensive economic activities, including going far distances to procure horticultural crops from farmers.

Marketing Supply Chains and Impact on the Quality of the Supply

In this section we examine the data that we collected about technology used by farmers in our sample. Our main purpose is to examine the effect that marketing supply chains have on the use of technology. Although in this paper we examine questions that will let us see how those at the village level perceived marketing supply chains effects, a more definitive answer, based in rigorous multivariate analysis awaits further research.

On one hand farmers, there may be reason to believe that the rise of the horticultural economy has spawned linkages between markets and production choices in the village. In the sample farmers frequently changed technologies—either the crop they were producing or the type of variety they were planting. For example, of the 201 villages in our sample, the main vegetable, fruit or nut crop that was planted in the village in 2000 was replaced by another crop by 2004 in 14 percent of the villages. When discussing their main vegetable, fruit or nut crop, farmers reported that they switched varieties on average about once every 3 to 5 years. Clearly, farmers in the horticultural economy in the greater Beijing area are actively searching for new technologies.

These descriptive statistics, however, do not really answer our question about the impact of modern supply chains. There are many other reasons why farmers may switch technologies beyond the marketing supply chain. In other words, counts of technology turnover can be deceiving. In fact, during the 1980s, a time when there clearly were not

modern supply chains in the grain sector (Sicular, 1988), farmers turned over their grain varieties up to once every three years (Jin et al., 2004). Moreover, during the 1990s when the market clearly played a larger role in grain marketing, farmers slowed their turnover of varieties to once every 5 years. Hence, the observed turnover in varieties/crop types may be due to other factors.

In fact, when we asked village leaders directly about whether or not their farmers were being required by the procurement agent (including small traders) to change the way that they were producing their horticultural crop, the answer was nearly "zero." In only 3 of 201 villages (or 0.9 percent of villages when weighting in used) was it reported that trading firms influenced the timing, quantity or brand of the fertilizer that farmers used on their crop. In only 6 of 2001 villages (or only 1.5 percent) was it reported by trading firms influenced the timing, quantity or brand of the pesticide that farmers used on their crops. Hence, in our sample, at least from the view point of the producer in 2004, there is little *direct* link between the demands of the trader and the farming practices of the producer.

Who is Enjoying the Fruits of the Horticulture Boom?

Since descriptive statistics may not be able to accurately gauge the net impact of any single factor on horticultural production or marketing, in this section we estimate the determinants of horticultural production. Although our original intention was to analyze the determinants of participation in modern marketing channels and the effect of modern marketing channels on the way farmers produce and market their horticultural crops, because there are so few villages that had any direct interaction with modern supply

chains it was not possible to conduct the analysis on modern supply chain participation or its impacts. In fact, since traditional, small trader channels are so pervasive, and farmers are mainly interacting with buyers in their villages, the real question of importance is what are the determinants of participation in the horticulture sector. Even more specifically, the main objective of this section is to understand if poor people are benefiting from the boom of the horticultural economy (that is, holding all other factors constant, are those that are poor able to participate in the production of horticultural crops).

To examine what factors, including income, facilitate the participation of farmers in the horticulture economy (as well as what factors keep farmers from doing so), we specify a simple multivariate model:

(1) Horticultural area = f (income; income * year; geographical factors; socio-economic factors)

where *horticultural area* is the dependent variable, which is measured as the total amount of village land (in mu) that is allocate to horticultural production.[5] The independent variable of interest, income, is measured as a set of quartile income dummy *variables* (where the very poor have average per capita incomes in the villages less than 985 Yuan in 2000; the *poor* have per capita incomes between 986 and 1900; the *above average* income villages have per capita incomes between 1901 and 2718; and the rich villages have average per capita incomes above 2719). In order to measure the increasing or decreasing importance of income, the income variables are also interacted with a year-*2004* dummy variable which is equal to 1 if the year is 2004 and 0 if the year is 2000. The model also includes a number of control variables to hold constant the effects of

[5] 15 mu equals 1 hectare.

geography (a set of concentric ring dummies; and a variable that measures the distance of the village from the nearest all-weather road—distance_to_road; dummy variable which indicates the village is in mountainous area—mountains equals *1,* otherwise 0) and socio-economic variables (total land area of the village—in mu; share of cultivated area in the village that is irrigated; share of laborers in the village that work as migrant_share; and the share of households in the village that are engaged in running their own self-employed business share).

In the multivariate analysis, we estimate the model in equation (1) by using two approaches. First, we use a standard Ordinary Least Squares (OLS) estimator. Second, because 45 of the villages produce no horticultural crops, we also account for the limited dependent nature of the explanatory variable by using a Tobit estimator.

Results

The model performs well in several dimensions (Table 4). First, although the R-square of the OLS version of the model is 0.1, this is a level that is normal for such cross section regression analyses. Second, and more importantly, many of the coefficients on the control variables are as expected. For example, the sign on the *migrant* variable is negative in both the OLS and Tobit equations, which suggests that those farmers that have high opportunity costs for their time, spend relatively more time working off the farm. We also find that the sign on the coefficient of the self-employed business_share variable is negative (and significant in the Tobit version of the equation).

There also are several other interesting more general findings. For example, our results demonstrate that villages that are in mountainous areas are relatively more likely to enter the horticulture economy. This may be a sign that the economy is reacting to

market signals since farmers in mountainous areas may have a comparative advantage (though not necessarily an absolute advantage) producing fruit and nuts in their villages.

Above all, however, our results show that over time the poor are benefiting increasingly more from the rise of China's horticulture economy. Specifically, we find that when looking the *income quartile dummies* in the year 2000, in those in the very poor category, ceteris paribus, were not participating as much as villages in the other income quartiles. Since the very poor villages were acting as the base set of villages, the positive sign on the coefficients in both the OLS equation (column 1) and the Tobit equation (column 2) means that farmers in very poor villages allocated less of their land to horticultural crops in the year 2000 (the base year). The signs are significant on all of the income quartile dummies in the Tobit equation.

While farmers in very poor village were participating less in 2000, between 2000 and 2004 our data show that it was many these farmers that were able to significantly expand their area. When looking at the interaction terms, we find that the only coefficient that is positive and significant is that for the very poor villages (Table 4, row 4, columns 1 and 2), Hence, since 2000, a time when the horticultural economy has boomed, we see that, holding all other things equal paribus, it is the farmers in the poorest villages that have expanded their area relatively the most.

Discussion and Conclusions

In this paper we set out to assess the effect that modern supply chains and the rise of the horticultural economy in China has had on the farming sector in China. Although we only have data on a single area of China—greater Beijing, our sample is spatially

sampled and so we are able to produce regionally representative figures on the rise of opportunities for planting horticultural crops and the penetrations of modern marketing supply chains into rural areas. These questions have worried policy officials not only in China but are of concern to leaders around the world.

Interestingly, although we showed the rise of horticultural crops was paralleled by a surge in the emergence of supermarkets in urban areas, there has been almost no penetration of modern wholesalers or retailers into rural communities. Less than 6 percent of first-time buyers and less than 16 percent of second buyers could be identified as being from modern supply chains—either supermarkets, professional suppliers or processing firms. Instead, China's horticultural economy is dominated by small traders who are themselves poor and small, operating in firms of 4 people or so and are themselves earning low wages. Moreover, unlike the evidence found in other countries, it appears as if in China, far from being hurt by the rise of supermarkets and the horticulture boom that has come with it, poor, small farmers in our sample appear to have gained. The richest farmers, in contrast, were playing a smaller role in 2004 than in 2000. Clearly it appears as if this is a special case of "Producing Horticultural Crops with Chinese Characteristics."

So what makes China special? While a full analysis and more definitive conclusions require more research, it is our opinion that there are 7 characteristics about China's horticultural economy that produces these surprising results. First, China's land holdings (and those in our sample—see Appendix 1, row 2) are relatively equal (characteristic 1). In essence, there are no large farmers in China; indeed in our sample, the average farm size of the largest 20 percent of the farmer is only 0.36 ha per capita.

Second, there also are almost no farmer cooperatives that can allow farmers to act in concert with one another (characteristic 2). In our sample, only 11.4 percent of the villages reported that they had a horticultural or general farm cooperative. Only 1.05 percent of farmers said that they belonged to a cooperative (row 3, column 1). These numbers, as it turns out, are remarkably similar to figures for all of China reported by Shen et al. (2004) using data from a national representative sample of more than 2000 villages. Because of characteristic 1 and 2, it is easy to see why it could be so difficult for supermarkets and other modern supply firms to deal with farmers, given their atomistic size and the absence of organization. Clearly the transaction costs of contracting or direct procurement would be high.

The third characteristic that may be relevant to explaining the role of small, poor farmers in the rise of China's horticultural economy is that although land is relatively equally allocated across all communities in China, here are still differences (characteristic 3). And in the case of horticultural producers, farm households in more poorer, more remote areas have relatively more land (0.17 ha per capita) than those in areas nearer to the richer, urban center (0.09 ha per capita—row 2, columns 2 and 6).

In addition, there are also differences in the access that these households have to labor for working on the farm (characteristic 4). Although horticultural farmers have the same family size as those not engaged in horticultural farming, the main differences are due to differential access to off farm jobs (rows 4 to 7). Farm households that are nearest to Beijing have a higher percentage of their labor force in off farm employment (42 for those nearest; 31 for those furthest) and they work a larger number of days per year (111 for those nearest; 82 for those furthest). The same is true when dividing the sample

between better off households and poorer households. Poorer households have more land and labor available for use in producing horticultural crops (Appendix 2, rows 2 to 5). Hence, when considering characteristics 3 and 4 together, it is easy to see why poor farmers have increased their share of area in many of the horticultural crops—they are relatively land and labor rich, the two factors that are keys factors in the production of horticulture crops.

Two additional characteristics help reinforce the propensity for poorer farmers to be increasing their participation in the horticultural economy, while the supermarkets are almost completely absent from the production areas. Since China's horticultural economy is almost completely unregulated (characteristic 5) and since China's road and communication networks have improved remarkably over the past 10 years (characteristic 6—Appendix 1, row 11 to 13), small traders working with a limited amount of capital and using extremely large amounts of low cost labor (while utilizing the relatively efficient road and communication infrastructure) appear to be out-competing all other types of would-be procurement agents. According to our interviews with the small traders and producers, the competition among small traders is fierce and profit margins on traders are almost always razor thin. There is little above normal profits available to attract new, more innovative entrants. Interestingly, in this type of small trader dominated system, there is little or no effort being made to impose or monitor quality or safety standards directly on producers.

Finally, one of the main characteristics of China's economy that produces the status quo is that China is still a relatively poor nation and its consumer, so far, may not be placing a very high premium on food safety or obtaining a standard product

(characteristic 7). Although there is a rising middle class, most urban consumers still live in households making around 1000 US dollars per capita annual disposable income (CNSB, 2005). Many of them are becoming increasingly stressed with rising payments in other expenditure categories—housing, automobile ownership, education and health care (among other expenditure categories). Combined with the absence of an active pro-consumer lobby (which may be limiting the information consumers have on the quality of their food), it is almost certain that the premium willing to be paid by the average urban consumer is still relatively small. When this low premium is combined with the high transaction costs that would have to be born should the supermarket want to maintain tight control over its horticultural supply, along with the thriving, deep, extremely competitive wholesale markets, it may be (although further research is required to definitively say so) that, at least now and in the immediate future, China will still be relying mostly on traditional wholesale channels.

If this is true, food safety in China's food system may suffer. However, it is good news for small poor farmers. Although, it should be recalled how fast China is changing in so many areas; if any one (or perhaps any several) of these characteristics changed, we should expect to see China's horticultural economy—from both the supply and procurement side change. The change, like so many other things in China, could be very fast.

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Table 1. Cropping Patterns and the Role of Horticultural Crops in Greater Beijing, 2000 and 2004

Crops	Greater Beijing (total)		40 km Concentric Circle Sample Region		60 km Concentric Circle Sample Region		80 km Concentric Circle Sample Region		100 km Concentric Circle Sample Region		140Km Concentric Circle Sample Region	
	2000 (%)	2004 (%)	2000 (%)	2004 (%)	2000 (%)	2004 (%)	2000 (%)	2004 (%)	2000 (%)	2004 (%)	2000 (%)	2004 (%)
Grain	68	58	64	52	63	47	68	62	72	64	72	62
Cash crop	10	14	9	12	9	13	9	11	9	14	12	17
Horticultural Crops [1]	22	29	27	36	28	39	23	27	18	22	16	21
Vegetables	4	6	4	4	4	9	6	7	2	3	4	6
Fruit	13	16	19	26	13	13	12	16	13	16	10	11
Nuts	5	7	4	6	11	17	5	5	3	3	2	5

[1] Sown area for horticultural crops includes area sown to vegetable, fruit and nut orchards.

Table 2. Contribution of Sampling Areas by Income Category (Quartiles) to Horticultural Production in Greater Beijing, 2000 and 2004

Crops	Very Poor First Quartile (1-25)		Poor Second Quartile (26-50)		Above average Third Quartile (51-75)		Rich Last Quartile (76-100)	
	2000 (%)	2004 (%)	2000 (%)	2004 (%)	2000 (%)	2004 (%)	2000 (%)	2004 (%)
Horticultural Crops	15	23	31	32	33	25	20	19
Vegetables	9	12	25	29	53	47	12	12
Fruit	16	25	37	37	34	24	14	14
Nuts	21	30	17	19	8	9	54	42

Data source: Authors' survey.

Table 3. Supply and Marketing Channels of Horticultural Markets in Greater Beijing Area, 2004

Panel A: First-time buyers (percent)

	Modern Supply Chains			Traditional Supply Chains		Other Supply Chains		
	Supermarkets	Specialized suppliers	Processing firms	Small traders	Farmers sell in local periodic markets	Cooperatives	Consumers direct purchase from farmers	Others[1]
Horticultural Crops	0	2	2	79	8	0	7	2
Vegetables	0	3	5	82	5	0	1	3
Fruit	0	1	1	75	11	0	9	3
Nuts	0	6	0	88	3	0	3	0

Panel B: Location of First Transaction (percent)

	Farmer's fields	Village center	Roadside	Periodic markets	Wholesale markets	Urban wetmarkets	Others[2]
Horticultural Crops	65	9	3	6	11	4	2
Vegetables	64	0	3	6	18	9	0
Fruit	60	12	3	9	12	3	2
Nuts	86	11	0	0	0	0	4

Panel C: Second-time Buyers (percent)

	Modern Supply Chains			Traditional Supply Chains		Other Supply Chains	
	Supermarkets	Specialized suppliers	Processing firms	Small traders	Traders sell to consumers in periodic markets	Cooperatives	Others
Horticultural Crops	3	3	10	49	13	0	22
Vegetables	6	0	6	57	11	0	20
Fruit	1	2	9	46	16	0	26
Nuts	3	10	19	50	6	0	12

[1] "Others" (first time buyers) includes purchases by agents of hotels or restaurants, gifts to other farmers or procurement by organized groups (such as enterprises for distribution to their workers).

[2] "Others" (second time buyers) includes sales to other villages and sales to market sites that supply processing and other food firms.

Table 4: Ordinary Least Squares (OLS) and Tobit Analysis of the Determinants of horticulture Area in Greater Beijing, 2000 to 2004

Explanatory Variables	Dependent variable: Horticultural Area	
	OLS	Tobit
Quartile income dummies		
Poor	309.08**	430.33**
	(2.29)	(2.09)
Above average	233.68	382.11*
	(1.14)	(1.82)
Rich	149.59	517.31**
	(0.84)	(2.32)
Interaction of income dummies and Year-2004 dummy		
Very poor	156.58*	342.79*
	(1.66)	(1.68)
Poor	-8.20	80.82
	(0.05)	(0.42)
Above average	-110.62	15.70
	(0.64)	(0.08)
Rich	105.34	157.29
	(0.50)	(0.83)
Concentric ring dummies and Geographical factors		
60KM ring	361.85**	315.54**
	(2.05)	(2.09)
80KM ring	20.03	-33.83
	(0.21)	(0.21)
100KM ring	104.41	-10.72
	(0.93)	(0.06)
140KM ring	-63.93	-361.81**
	(0.56)	(2.04)
Mountain	129.95	395.56***
	(1.32)	(2.61)
Distance to Road	-1.79	-1.15
	(1.03)	(0.31)
Socio-economic factors		
Land area	-0.0004	0.088*
	(0.01)	(1.86)
Irrigated land area	40.93	38.69
	(0.28)	(0.23)
Migrant_share	-524.49***	-735.01***
	(4.51)	(3.19)
Self-employed business_share	-0.44	-2.26*
	(0.64)	(1.92)
Observations	400	400
Adjusted R^2 (Pseudo R^2 for Tobit)	0.1	0.01

Note: the numbers in bracket are absolute values. *** refers to 1% statistically significant level, ** refers to 5% statistically significant level, * refers to 10% statistically significant level.

Appendix 1. Summary statistics for sample households and villages, 2004

	Variable	Unit	Total Concentric circle sample region	40km Concentric circle sample region	60km Concentric circle sample region	80km Concentric circle sample region	100km Concentric circle sample region	140km Concentric circle sample region
Household	No. of sample households	hhs	494	143	60	111	90	90
	Cultivated land per capita[1]	ha	0.14	0.09	0.07	0.16	0.13	0.17
	Share of households that belong to a cooperative	%	1.05	2.68	0	3.58	0.59	0
	Share of laborers that have off-farm job [2]	%	35	42	53	24	43	31
	Average days of per laborer of those that have off-farm job	day	96	111	125	67	122	82
	Share of off-farm income in net income [3]	%	40	44	61	25	50	34
	Household size	person	3.98	4.06	4.19	3.70	4.46	3.77
	Size of household labor force	person	2.82	2.75	2.89	2.72	3.09	2.72
	Income per capita	yuan	2913	3881	2974	2299	3085	2752
Village	No. of sample villages	number	201	40	40	41	40	40
	Average distance from village to the nearest county road	km	4.95	2.46	3.51	6.09	6.30	4.65
	Share of villages that are within 5 kilometers of a paved road	%	79	86	76	77	80	78
	Share of households that have cell phone	%	48	66	53	42	50	43

[1] Cultivated land includes all farmer-managed land, including contracted land and land rented in, but excluding land rented out.

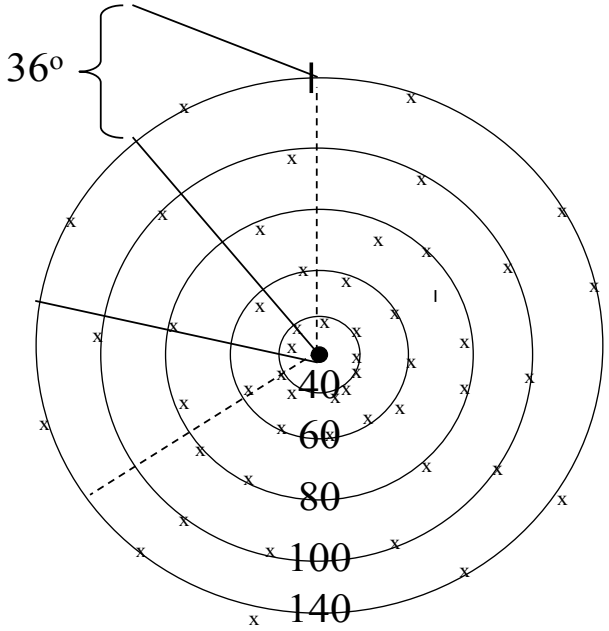
[2] Labor includes all able bodied persons 16 to 65 years old and excludes persons within this age bracket that are at school.

[3] "Net income" includes cropping net income, off-farm net income and other sources of net income.

Appendix 2. Summary statistics by asset wealth categories, 2004[a]

Variables	Unit	Total sample	Poor (Percentile range: 1-25)	Average (Percentile range: 26-75)	Rich (Percentile range: 76-100)
Number of sample households	Number	494	124	247	123
Cultivated land per capita	Ha	0.14	0.14	0.16	0.08
Share of able-bodies laborer that have off-farm job	%	35	24	35	50
Days worked off farm by those with off farm jobs	day	96	90	87	128
Share of off-farm income in net income	%	40	34	37	53
Household size	person	3.98	3.54	4.16	3.98
Size of household labor force	person	2.82	2.72	2.86	2.83
Net income per capita	yuan	2950	1870	2795	4971
Asset wealth per capita	yuan	10485	1064	6143	35525

Data source: Authors' survey.
Note: see Appendix 1 for definition of selected variables.
A Wealth categories were developed from household level data on total household assets including housing, own business, farm tools and consumer durable assets.



Total Town Sample Size:

5 circles x

10 towns per circle =

50 towns

(or $N_t = 50$)

Note: Four sample villages were randomly chosen from complete list of all villages in each township (N_v=200). Numbers on circle represent kilometers from Tiananmen Square.

Figure 1. Schematic Illustration of Spatial Sampling Procedure

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Agricultural Trade Liberalization and Poverty in China

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Agricultural Trade Liberalization and Poverty in China

I. Introduction

China's economy has experienced remarkable growth since the economic reform was initiated in the late 1970s, which has led to significant decline in the nation's poverty. The annual growth rate of gross domestic product (GDP) was nearly 9 percent in 1979-2003 (NSBC, 2003a). In the past two and half decades, based on China's official poverty line, more than 230 million Chinese rural residents have escaped poverty, the absolute level of poverty has fallen from 260 million in 1978 to less than 30 million in 2002 (NSBC, 2003b). The incidence of rural poverty has fallen equally fast, plunging from 32.9 percent in 1978 to less than 3 percent in 2002.

While economy growth and reduction of rural poverty in the past are impressive, there are still great challenges ahead. Agricultural growth rate has declined since the late 1980s. High input levels in many areas of China and diminishing marginal returns mean that increasing inputs will not provide large increases in output. Water shortages and increasing competition from industry and domestic use do not provide much hope for large gains in area and yield from irrigation expansion. In the future, many have predicted that almost all gains will have to come from second- and third-generation Green Revolution technologies that could significantly improve agricultural productivity (Huang et al., 2002).

The economy growth also accompanied with the large income disparities. The income gap among regions, between urban and rural, and among households within the same location has been continually increasing since the middle 1980s (Rozelle, 1996). The rural to urban income ratio exceeds 3.4 in 2002 (NSBC, 2003a). Income disparities have risen within rural areas. The rising income disparity in rural area is indicated by rising Gini coefficients, which increased from 0.24 in 1980 to 0.35 in 2000 and 0.32 in 2001 (NSBC, 2003b).

Trade liberalization further challenges China's agricultural and rural economy. Agriculture has been at the center of discussion of China's entry into the WTO, due in part to the vulnerability of parts of the rural economy and in part to the importance of agriculture in the political economy of a number of developed nations with whom China negotiated its accession to the World Trade Organization (WTO). However, debates on the future of China's agriculture continue. Some argue that the impact of WTO accession on China's agriculture will be substantial, adversely affecting hundreds of millions of farmers (Carter and Estrin 2001; Li et al., 1999). Others believe that, although some impacts will be negative and even severe in specific areas, the overall effect of accession on agriculture will be modest (Anderson et al., 2004; Martin, 2002). In part, the confusion about the ultimate impact of WTO accession on agriculture can be traced to a general lack of understanding of the policy changes that accession will engender (Huang et al., 2004). However, in perhaps an even greater way, the lack of clarity of the debate can be traced to a lack of understanding of the fundamental facts about the nature of the distortions to China's economy on the eve of its WTO entry.

Although China's joining the World Trade Organization (WTO) may have significant implications to the world trade and China's economy, little empirical work has sought to answer basic questions about the expected effects of China's entry in the WTO on the poor. In our previous work (Huang et al., 2003), we showed that, on balance, the nation's accession to WTO helps rural residents and improves incomes. Despite our earlier impact studies were conducted for 11 rural income groups of farmers by 3 regions (Western, Central and Eastern China), the analyses are still too aggregate as the farmers and agricultural production differ significantly among provinces within the same region.

The overall goals of this chapter are to have a better understanding of China's agriculture and examine the impacts of trade liberalization on China's agriculture and poverty. The impacts on agriculture are analysed by commodities. Because different provinces and different farmers in the same province produce diverse commodities, we analyse the impacts on households and their implications for the poverty through the simulation of household production and consumption changes in response to the market prices changes.

The chapter is organized as the follows. In the next section, we briefly describe an overview of China's trade liberalization. China's WTO accessions are followed in the third section. The fourth section describes the methodologies and data used in this study. The results on the impacts of WTO on China's agriculture and poverty are presented in sections 5 and 6. The final section concludes the study.

III. Foreign Trade Liberalization Prior to China's WTO Accession

Foreign Exchange Policy

China's open door policy contributed to the rapid growth of its external economy. The expansion of external economy has become one of major driving forces of China's economy growth. The growth of trade also results in greater reliance on both domestic and international trade to meet consumer demand.

Historically, the overvaluation of domestic currency for trade protection purposes had reduced agricultural incentives. Real exchange rates remained constant and even appreciated during the 30 years prior to reforms. As tradable commodities, agricultural sector has been heavily intervened (Huang and Chen, 1999).

After reform, however, the exchange rate depreciated rapidly, with the exception of several years of the domestic price inflation during the mid-1980s. From 1978 to 1992, the real exchange rate depreciated 400 percent. Falling exchange rates increased export competitiveness and have contributed to China's phenomenal export growth record (i.e. non-grain food products) and the spectacular national economic performance of the 1980s.

The situation, however, has changed since the early 1990s. From 1992 to 1997, the real exchange rate appreciated by about 30 percent. Moreover, the pressure to appreciate RMB (or Chinese yuan) from the major trade partners, particular USA, is growing. Chinese government, however, has been insisted to maintain its current exchange rate policies as the national leaders consider that a stabilized foreign

exchange rate is a key to the national economic stabilization. Meantime, China has been accelerating the reform of foreign exchange management through further liberalization of foreign exchange demand and supply and is considering to gradually eliminate export tax rebates in order to avoid the sharp rising of its foreign exchange reserve.

Liberalizing International Trade

The changes in the exchange rate system occurred at the same time that China also began to liberalize its international trading system. In the initial years, most of the fall in protection came from a reduction in the commodities that were controlled by single desk state traders (Huang and Chen, 1999). In the case of many products, competition among non-state foreign trade corporations began to stimulate imports and exports (Martin, 2002). Although several major agricultural commodities were not included in the move to decentralize trade, the moves spurred the export on many agricultural goods. In addition, policy shifts in the 1980s and 1990s also changed the trading behavior of state traders. Leaders allowed the state traders to increase imports in the 1980s and 1990s.

Maize and cotton are two major commodities in which the liberalization had been minimal. For example, China had used export subsidies in the years prior to its WTO accession to increase exports of maize and cotton. By providing exporters with payments to encourage the export of maize, leaders had increased the protection of domestic producers by raising the price of domestic commodities. During interviews in the field during 2001, we found that maize and cotton exporters respectively received subsidies that averaged 34 percent and 10 percent of their export prices. However, China eliminated export subsidies for cotton in 2002 and maize in the early 2004.

Moves to relax rights of access to import and export markets were matched by actions to reduce the taxes that were being assessed at the border. After the fall of restrictions on imports and exports of many of China's agricultural commodities, a new effort began in the early 1990s to reduce the level of formal protection. From 1992 to 1998, the simple average agricultural import tariff fell from 42.2 percent in 1992 to 23.6 percent in 1998 to 21 percent in 2001 (MOFTEC, 2002).

Impacts on Trade

In the same way that trade liberalization has affected growth in the domestic economy (Lardy, 2001), changes in the external economy have affect the nature of China's trade patterns (Huang and Chen, 1999). Whereas the share of primary (mainly agricultural) products in total exports was over 50 percent in 1980, it fell to only 10 percent in 2002 (NSBC, 2003a). Over the same period, the share of food exports in total exports fell from 17 to 5 percent and the share of food imports fell from 15 to 2 percent.

Disaggregated, crop-specific trade trends show equally sharp shifts and suggest that exports and imports increasingly are moving in a direction that trend toward products in which China has a comparative advantage and therefore have also facilitate the structural changes of its agriculture (Anderson et al., 2004). The net exports of land-

intensive bulk commodities, such as grains, oilseeds and sugar crops, have fallen; exports of higher-valued, more labor-intensive products, such as horticultural and animal (including aquaculture) products, have risen. The proportion of grain exports, which was only around 20 percent of total agricultural exports in the 1990s, is less than half of what it was in the early 1980s. By the late 1990s horticultural products and animal and aquatic products accounted for about 80 percent of agricultural exports (Huang and Chen, 1999). These trends are even more evident when reorganizing the trade data grouping them on the basis of factor intensity (Figure 1).

Nominal Protection Rates

NPRs for each commodity are estimated in 2001 when China joined WTO. For those commodities that either they simultaneously import and export significantly or the difference of import and export is not large in the past decades, we estimated NPRs based on both CIF and FOB prices. These include rice, maize, cotton and beef. Because there are differences among major types of any individual agricultural commodity, we weighted to get average NPRs by either their sown area (for crops) or production (for meats) shares, sets of more traditional, by-commodity, aggregate NPRs can be created. Wheat, for example, has an NPR of 15 percent when the individual NPRs are weighted by their area shares. On average, the price of all varieties of domestically produced wheat that are sold in the domestic markets of China's major port cities are 15 percent above the average CIF price of all types of imported wheat varieties. The results are summarized in Table 1.

Our findings show not only that significantly positive rates of protection exist for a number of China's major field crops, but also that they vary according to the position in which China finds itself (as a net importer or as a net exporter). Maize prices, according to exporters, were more than 30 percent, on average, above world prices. In other words, traders would have lost more than 30 percent of the value of their shipment, if the government did not subsidize the transaction. It is interesting to note that the level of protection of maize almost exactly corresponds to total export subsidies and tax rebated that were being paid to exporters of maize during the fall of 2001 (Table 1). Protection rates when considering maize as an import differed among regions, however. For example, traders in the northeast told our survey team that if they were not exporting and foreign maize was to come into China, the importer could make, on average, 22 percent.

Table 1 also shows that despite the large volume of increase of soybean imports in recent years, there is still a difference between the CIF and domestic price in the port. The average difference between the domestic price and the international price was 17 percent. In one sense, the fact that there is a remaining price gap is remarkable given that China imported 20 MMTs of soybeans in 2003, the official tariff is only 3 percent, and the commodity can be traded by any foreign trade company (that is, trading firms do not need to secure a license or quota allocation). On the other hand, the remaining price gap reminds us that there may be other reasons for distortions beyond tariffs and state trading. In fact, the gap between the domestic and international price fully demonstrates the effect of China's policy of assessing a value-added tax on imported soybeans at the border (13 percent of CIF).

Beside maize, some other commodities such as cotton, edible seeds and sugar were also fairly highly protected in 2001 (Table 1). The distortions for these commodities in the fall of 2001 came from the official tariff rate, value added tax (VAT), and NTB (for sugar and edible oil seeds).

Our results also find that there are a number of commodities, beside rice, that had negative NPRs in 2001. Vegetable, fruits, pork, and poultry are facing significantly non-trade tariff barriers from the rest of world where they are importing these commodities from China.

III. China's WTO Accession

In its most basic terms, the WTO commitments in the agricultural sector can be classified into 3 major categories: market access, domestic support and export subsidies. The commitments on market accession will lower tariffs of all agricultural products, increase access to China's markets by foreign producers of some commodities through tariff rate quotas (TRQs) and remove quantitative restrictions on others. In return, China is supposed to gain better access to foreign markets for its agricultural products, as well as a number of other indirect benefits. Domestic support and export subsidies are the other two critical issues that arose during the course of negotiations. Together with a number of other market-access commitments make China's WTO accession unique among all other developing countries that have been admitted to the WTO's new environment.

Some of the direct import market access commitments that China has made to WTO members actually do not appear to be substantial. Overall agricultural import tariffs (in terms of its simple average) declined from about 21 percent in 2001 to 17 percent by 2004. A continuance of earlier trends, the simple average agricultural import tariff fell from 42.2 percent in 1992 to 23.6 percent in 1998. Although important, when taken in the context of the discussion in the previous section about China's external economy reforms of the last two decades, one would have to conclude that the commitments are merely an extension of China's past changes. WTO in this way can be thought of as just another step on China's road to opening up its economy.

Except for national strategic products, such as grain, cotton, edible oil and sugar, other agricultural products (horticulture, livestock, fishery, wine, tobacco, soybean and Barley) have become part of a tariff-only regime (Table 2). For most commodities in this group, effective protection fell by varying amounts by January 2002; for most the tariffs will fall even further by 2004. To the extent that tariffs are binding for some of these commodities, the reductions in tariff rates should stimulate new imports.

It is important to note, however, that although published tariff rates will fall on all of these commodities, imports will not necessarily grow summarily. Indeed, China has comparative advantage in many commodities under the single tariff regime. For example, lower tariffs on horticultural and meats might impact only a small portion of domestic market (e.g., those parts of the market that buy and sell only very high quality products—meats for five-star hotels that cater to foreigners). Although tariffs fall for all products, since China produces and exports many commodities at below world market prices, the reductions will not affect producers or traders.

Such movements, however, will almost certainly be (and can legally be) limited for a class of commodities called "national strategic products." China's WTO agreement allows officials to manage trade of rice, wheat, maize, edible oils, sugar, cotton and wool with tariff rate quotas (TRQs). These commodities are covered under a special set of institutions. As shown in Table 3, except for sugar (20 percent) and edible oils (9 percent), the in-quota tariff is only 1 percent for rice, wheat, maize, and wool. However, the amount brought in at these tariff levels is strictly restricted. The in-quota volumes, however, are to grow over a three year period (2002 to 2004) at annual rates ranging from 4 percent to 19 percent. China does not have to bring in this quantity, but provisions are in place that there is supposed to be competition in the import market so if there is demand inside China for the national strategic products at international prices, traders will be able to bring in the commodity up to the TRQ level.

At the same time, there are still ways theoretically to import these commodities after the TRQ is filled. Most poignantly, tariffs on out-of-quota sales will drop substantially in the first year of accession and fall further between 2002 and 2005. But, during the transition period, most people believe such rates are so high (e.g., 65 percent for grains and sugar in 2004 and edible oils in 2005) that in the coming years they will not bind (Table 3).[1]

After the first four to five years of accession, a number of other changes will take place. For example, after 2006, China agreed to phase out its TRQ for edible oils. But China is likely to maintain the TRQ for maize after 2005 though the amount of TRQ will be certainly raised. State trading monopolies also will be phased out for wools after 2004 and gradually disappear for most of other agricultural products (Table 3). Although China National Cereals Oil and Foodstuffs Import & Export Co. will continue to play an important role in rice, wheat and maize, there will be an increasing degree of competition from private firms in the importing and exporting of the grains in the future.

In its commitments to WTO accession, China also agreed to a number of other items, some of which are special to the case of China. First, China must phase out all export subsidies (most subsidies were used in maize export in 2001) and not to introduce any these subsidies on agricultural products in the future. Moreover, despite clearly being a developing country, China's de minimis exemption for product-specific support is equivalent to only 8.5 percent of the total value of production of a basic agricultural product (compared with 10 percent for other developing countries). Some measures, such as investment subsidies for all farmers and input subsidies for the poor and other resource-scarce farmers, that are generally available for policy makers to use in developing countries, are not allowed in China (i.e., China must include any such support as part of its aggregate measurement of support which should be less than 8.5 percent of agricultural output values).

Because of its Socialist background and the difficulty that the world has had in assessing the scope of the government's intervention into business dealings of all types, China was enforced to accept a series of measure governing the way that they

[1] Although 65% above tariff rates seem high, it is important to note that in fact when compared to other countries, this is low. Most Asian countries that have a TRQ system, high tariff bindings are 2 or more times higher than this.

will deal with the rest of the world in cases of anti-dumping and countervailing duties. Most simply, special anti-dumping provisions will remain for 15 years. According to these provisions, in cases of anti-dumping China will subject to a different set of rules that countries can use to prove their dumping allegations. In addition, the methods that countries can use against China to enforce anti-dumping claims when they have won will differ from most of the world. In essence, this set of measures makes it easier for countries to bring, prove and enforce dumping cases against China. It should be noted, however, that although the rules differ from those governing trade among other countries, China will get the same rights in their dealings with other countries, an element that could help them in some cases with their dealings with dumping matters when they concern their partners' exporting behavior.

IV. Methodology and Data

In order to evaluate the impact of China's WTO accession in 2001-2005 and further trade liberalization until 2010 on China's agriculture, poverty and chemical uses in China, a quantitative method has been developed based on CCAP's Agricultural Policy Simulation and Projection Model (CAPSiM). CAPSiM was developed out of need to have a framework for analyzing policies affecting agricultural production, consumption, price and trade at the national level. CAPSiM is a partial equilibrium model. Most of the elasticities used in the CAPSiM were estimated econometrically by ourselves using state-of-the-art econometrics and with assumptions that make our estimated parameters consistent with theory. Both demand and supply elasticities change over time as income elasticities depend on the income level and cross-price elasticities of demand (or supply) depend on the food budget shares (or crop area shares). Details of the model description can be found in Huang and Li (2003).

Because the analysis based on the original CAPSiM framework can only be done at national level and was designed to be used to simulate the future effects of policy shifts, we have to modify the original model in order to allow us to disaggregate the national impacts into household production, consumption and poverty at the provincial level and to assess the impact that trade liberalization will have on households in different income groups in the same provinces.

Two scenarios are formulated. The baseline scenario assumes that China's economy continues to operate during the next 10 years as if there were no trade reform. The alternative scenario assumes that China's NPR moves over the next 10 years levels that are consistent with its WTO accession agreement.

China's regional productions differ largely due to its vast variation of climate and natural resources. Rice is the most important crop in Southern part of China, accounted for more than half of crop areas in Jiangxi and Hunan, while wheat is the more important crop in North China plain (e.g., Henan, Shangdong and Hebei) and Northeast China (e.g., Qinhai, Gangsu, and Ningxia), and soybean dominated in Heilongjiang. Eastern China produces more vegetable and fruits than the central and western China.

In order to make the analysis manageable, however, we classify all commodities into 12 crop or crop-groups and 7 livestock-product and fish groups. Even with these groupings, however, in many of our analyses, there are still too many commodities.

As a result, the presentation of our commodity analyses, we show only those results for commodity group such as exportable and importable. Exportable commodities are those that have negative NPRs and importable commodities are those have positive NPRs (see Table 1). For beef and poultry that are both exported and imported, we regard them as exportable category.

V. Impacts of WTO on China's Agriculture

According to our analysis, WTO will have impacts on the prices for nearly all crop and livestock commodities. Compared with baseline (without WTO accession), the prices of most crop commodities decline in the coming decade (Table 4). For vegetable, fruits, meats and fish, however, the prices increase.

While the decline pattern over time for most of crops (exceptions are japonica rice, vegetable and fruits) are similar, the extent of price decline due to trade liberalization vary significantly among commodities (Table 4). For example, for the commodities with small NPRs in 2001, such as indica rice, wheat, coarse grains, soybean and cotton, although trade liberalization will affect domestic prices, the extent of impacts are much less than those that had higher NPRs in 2001 (e.g., maize, oil crops and sugar crops). Compared with the baseline, WTO will lower domestic prices of the wheat, soybean and cotton by about 2-4% in 2005-2010. While the impacts could be as high as 7-20% for maize, oil and sugar crops in the same time period.

On the other hand, trade liberalization will increase domestic prices of those commodities that China has comparative advantage in the international market. The expected rise in exports of these commodities increases their domestic prices. For example, we estimate that the prices of vegetables will be about 4-6% higher in WTO scenario than the baseline in 2005 and 2010. Over the same period, the prices of pork and poultry prices will rise even more (by 4-14%, Table 4). A similar increase pattern will occur in fish prices. Among all animal products, milk is an exception. Its domestic price will decline with trade liberalization.

Overall, agricultural producer and food prices are projected to rise slightly over projection period. Using a Stone price index (where prices of individual commodities are aggregated using weights constructed with value shares), the aggregated agricultural (crop + meat + fish) output prices, crop output prices and food consumption prices are generated. While the aggregated crop output price level will falls by 2.26 in 2005 and 2.18% in 2010 under WTO scenario (compared with baseline scenario), overall agricultural prices will rise by 0.48% in 2005 and 1.8% in 2010 thought the changes are essentially minimal. That the overall agricultural prices does not fall with more trade liberalization when the crop output prices do is simply because the prices of most of meats and fish rise with trade liberalization (Table 4). For the aggregated food prices, we estimate a higher rate of increase under WTO scenario because some of crops with falling prices (e.g., cotton and most of maize) are not consumed as food. Compared with the baseline scenario, overall food prices with WTO will rise by 2.36% in 2005 and 4.37% in 2010.

The shift in prices due to trade liberalization means that the incentives of agricultural producers will change, but unlike sector-wide policies, trade liberalization policies are unique in that they frequently change the relative prices of domestic agricultural

commodities because the impacts of trade policy differ among commodities. In general, trade liberalization stimulates domestic production of sectors that are producing commodities in which the nation has a comparative advantage while dampening those in which producers do not have an advantage. As a result, trade policies can lead to different impacts, sometimes negative and sometimes positive. Moreover, because most of the commodities are competing for domestic resources, such as land, labor and capital, cross-commodity substitutions could result in a policy targeting one commodity having an effect on another.

Table 5 present the results of our simulations on the impacts of China's WTO accession and further trade liberalization on agricultural production in 2005 and 2010. The analyses show that trade liberalization will affect domestic production moderately. The signs of impacts due to trade liberalization are as expected. Overall, the impact on production is negative for wheat, maize, cotton, oil crops and sugar crops. In contrast, the impact is positive for those commodities that China has comparative advantage such as rice, vegetable, fruits, meat and fish (Table 5). Increase prices of these commodities due to trade liberalization will stimulate their domestic production.

It is worth to note that not all commodities with rise in price will lead to increase in domestic production. The production impacts are associated with both own price and cross price substitution impacts. Soybean, a less comparative crop that had been liberalized before China's WTO accession in 2001, is an interesting case for understanding the impact of trade liberalization. Liberalization of soybean had led substantial increase of imports and decline in domestic price and production prior to China's WTO accession. Import reached more than 15 million tons to a similar level of domestic production at the time China joined WTO. While further trade liberalization after China's WTO accession will decline soybean price marginally (Table 5), the decline in soybean price is such a small so that the impacts of own price are less than the impacts due to changes in the prices of substitute commodities such as vegetable, fruits, rice and some coarse grains, and changes in input prices (e.g., fertilizer and pesticide) in the post WTO era.

As there are both positive and negative impacts of WTO on China's agriculture, we estimate overall impacts for the whole agricultural sector for average farmer, which are reported in Table 6. When examining the overall effects of trade on agricultural production, several facts become clear. In contrast to some of the commodity-specific effects that were presented above, the overall effects of China's WTO accession and further trade liberalization are positive. According to our analysis, agricultural output value for average farm will rise 191 yuan (about 26 yuan or US$ 5.6 per person), accounted for 2.8% of total agricultural output in 2005 (Table 6). The net benefits in terms of output values will increase to 460 yuan in 2010, which is about 5.6% of household's agricultural output values. Among the benefit, about 20-30% is due to the rise in prices and the other 70-80% is due to the growth in the real output through the changes in production patterns – moved from less comparative advantage agricultural products to more comparative advantage ones.

The importance of accounting for production responses to changing prices can be seen by noting the rise in overall production occurs when import rises and export expands. Facing the price shifts, producers in China according to our simulation respond by

moving into the production of commodities which experience price rise and out of commodities that experience price falls. At the end of the period we forecast that enough structural change has occurred that overall agricultural output ends up rising. By 2005, while output value of importable products will decline by 7.2% under WTO scenario (compared with the baseline scenario), exportable products will rise by 9.3% (the 2nd column, Table 6).

Between 2005 and 2010, the fifth and tenth year after the implementation of WTO, the rate of rise of household's agricultural output accelerates (Table 6, columns 3 and 4). Because liberalization continues for both those products that are protected (especially for maize, sugar and edible crops) and those that are exportable (e.g., livestock, fish, vegetables and rice), agricultural output will continues to increase under more liberalized trade environment in 2005-2010. However, because we have not accounted for the increased production output values that occur due to the higher inputs, increase in agricultural output values should not considered as increase in agricultural income. When comparing our results to those of other trade models that have simulated the impact of the accession to WTO on China's agriculture, our results (which are couched in terms of output rather than income) are fairly consistent (around 2-3% agricultural income changes in 2005-2010; if one takes a fraction of output—say 50%--as increased profits).

Our simulations show that per capita food consumption of importable commodities rise as their prices fall with trade liberalization, while per capita food consumption of the exportable commodities will decline. The large impacts are found in edible oils, sugar, vegetable, fruits, livestock products and fish. The overall effects of trade liberalization on food expenditures for average rural household are summarized in Table 6. Compared with production impacts, the overall effects of China's WTO accession on food consumption are more modest (4-6th rows, Table 6). By 2005, total household food expenditure will be 1.1% higher in WTO scenario than that under baseline. The impact will rise to 2.3% in 2010.

Because overall food prices change with trade liberalization, to examine the impacts of WTO on food consumption, we need to compare the food expenditure share changes with the overall food price changes in the projection period. Because the aggregate food prices will rise by 2.36% in 2005 and 4.37% in 2010 under WTO scenario (compared with the baseline scenario), these imply that increases in food expenditure due to trade liberalization are all from the rise in food prices. Real food consumption at constant prices indeed will decline by about 1% in 2005 and 2% in 2010 due to trade liberalization.

Baseline projection shows that the self-sufficiency of all land intensive crops except for rice will fall in the coming decade, and WTO will further lower the self-sufficient levels of these commodities (Table 6). Under WTO scenario, cereal imports will rise from 3 million tons in 2001 to 41 million tons in 2010. Most of the imports are feed grain. Although export (mainly rice) will also increase, the net import will reach 32 million in 2010, accounted for about 7% of domestic consumption. In the other word, the self-sufficient level of cereal will fall from 101% in 2001 to only 93% 2010, which would be 96% if China would be not a member of WTO in 2001-2010 (Table 7).

Other land intensive crops such as oil and sugar crops, their self-sufficient levels will fall even more than those of cereal crops. The imports of edible oils will account for 31% (100-69%, Table 7) of domestic consumption under WTO scenario in 2010, about 20% (89-69%) higher than that under baseline scenario. By 2010, China will also have to import nearly 30% of sugar from the world market.

On the other hand, China can benefit substantially from trade liberalization for rice and labor intensive products such as vegetable, fruits, meats and fish. Self-sufficiency of rice will be improved by 4% with its WTO membership (107-103%, Table 7). China can export 5-6% of its horticultural products to international markets, compared to the baseline of nearly zero net export. Export expansion of meat and fish products will be even larger than the horticulture.

In sum, while grain self-sufficient levels will fall with trade liberalization, food grain (excluding feed grain) and overall food self-sufficiency will rise. Trade liberalization will facilitate China's agricultural diversification and transformation of China's agriculture from less comparative advantage sectors to more comparative advantage ones.

VI. Impacts of WTO on China's Rural Households and Poverty

Characteristics of Rural Households

Because all rural households have access to land, the size of farm in China is small by international standards. For the national as a whole, the average size of farm is 7.9 mu, or 0.53 hectare (15 mu = 1 ha). With such small size of farms, households in China have to intensively use their land resources. They use their land both to produce their own staple food and for cash crops for sales into the market.

Sustainable rises in rural labor productivity and household income, however, will require more than income from the average farm in China. As a result, farm households need to find off farm employments in the off-farm sector. In fact, this is what has been happening in rural China since the early 1980s (deBrauw et al., 2002). By 2003, on the average farmer allocated 35.6 percent of his/her time on off-farm activities and earned 56 percent of the family's income from non-agricultural sector. Most of the off farm earnings were in the form of wage earning.

There is significant regional variation of economic activities, sources of income and the patterns of spending. Income levels in the eastern region are twice as high as those in the west. The average farmer in most of the west earned more from agriculture. Income variation among regions also means that the patterns of spending by farmers also differ. The poverty incidence rate is higher in west and center than in the east.

Our analyses also indicate that agricultural income of the poor depend more on the less comparative advantage commodities than those of the richer. To show this, we divide the household agricultural production into 2 groups: importable and exportable commodities. Importable commodities are those their prices will decline with trade liberalization, while the exportable commodities are those their prices will raise (or their NPRs were negative in 2001, see previous section for detail). The results of this

analysis are presented in Figure 2a-b, which show that as farmers move from the lower income categories to the higher ones, the shares of their importable commodity output in total production decline or exportable increases.

It is interesting to note that production patterns that we have observed by income category for the nation (Figure 2) do not appear in each region, a close analysis of production of different farmers by province reveals some key differences. For example, in Shanxi and Jilin, nearly all farmers (exception is the richest) produce more commodities that China has less of comparative advantage in, while the farmers in all categories regardless the poor or richer in Zhejiang province produce most of their products which prices will rise with trade liberalization. These suggest that future trade liberalization will affect poor farmers in the poor areas since it will invariably lead to lower prices of the products they are highly reliance on. On the other hand, both poor and non-poor farmers may gain equally in many coastal and southern provinces with China's WTO accession.

Impacts on Rural Households by Income Group and by Region

According to the analysis, if China implements its promises for the WTO agreement, the changes in domestic prices will affect both production and consumption of all rural households (Table 8). As discussed above, our simulation analysis predicts that, after five years for the average farm, agricultural output value will rise 2.8% (4th row, Table 8). During the same period, food expenditures will rise by 1.1% (13th row), albeit at a rate less than production output value increase. Aggregate food expenditures also rise as the results of overall food price increase and reduction of total food consumptions. For importable commodities, falling the prices increase their consumption. Reduction of expenditure on importable foods means that the consumers gain from both increase in consumption and decline in price. For exportable commodities, the consumers lose from the rising prices and decline in consumption.

Not all farm households, however, benefit equally from China's accession to the WTO. Our results show that in 2005 and 2010, the poor gain much less than the average and richer farmers. Agricultural output values for the poor will increase by 77 yuan per household in 2005, while they will be 191 yuan for average farmer and 583 yuan for the top 10% richest farmers (1st column, Table 8). Even in the percentage changes, the rise in agricultural output values for the poor is also less than those for the richer. On the other hand, food expenditure increases for all farmers, but in percentage terms the rates of rise are nearly identical in 2005 and fall from rich to poor in 2010 (albeit a very small difference).

Despite the average farmers in each group at national level will gain from the trade liberalization, the farmers in western and northern China are negatively affected. Indeed the gains we estimated for China as a whole are mainly due to the positive effects occurred in southern and coastal provinces. Agricultural output value per household will decline as much as 100-340 yuan (or 1-4.5% of output) in Northwest and Northeast China, while it will increase 100-500 yuan (1-8%) in southern China (Table 9). This should not come to surprise as the production structures differ significantly across regions. The provinces with positive effect form trade liberalizations are those that produce more exportable commodities than the importable commodities (Table 9).

Likewise, at national level, while we show that average group of farmers, including the poor will gain from trade liberalization, however, this result does not hold for every province (Table 10). From Table 8 we see that at the national aggregate levels, the overall impact is small. The main reason is that there are offsetting effects among provinces. But from Table 10, the impacts differ significantly across provinces even for the farmers in the same income categories.

Because trade impacts are more commodity-specific, and because farmers in different income groups in different provinces grow different sets of commodities, they have more sharp regional and income class-specific impacts (Table 10). This also means that they affect equity. In the case of China, while nearly all farmers in many provinces in east and south will benefit from trade policy, liberalization will hurt producers in west and north primarily because the region is the largest producer of maize, wheat, cotton, edible oil, sugar, and soybean, the sets of commodities that are most hurt by liberalization.

Interestingly, not all the poor will gain or loss their production with trade liberalization. Our analyses show that the poor in the rich areas (again in south and east) gain from trade liberalization, while the poor in the poor area (in west and north) are hurt (Table 10). Therefore, trade liberalization may contribute to poverty alleviation in same part of China, but it may also worsen income distribution in other part of the nation. The other important finding is that the poor will gain (or lost) less than the rich for each sector because despite having farms that are of a similar size, their land produces less than that of the richer producers. It could be that the lower production is due to inferior land and climate resources. It could also be that poorer producers have access to fewer inputs. If so, the clear policy implications are that the government needs to provide ways for farmers to access better technology, water control and credit.

The impacts of WTO on food consumption by income group in the selected provinces are showed in Table 11. Several observations can be made from these results. First, the effect on rural residents as producers typically is larger than the effect on them as consumers. Production side shifts (both positive and negative) are larger than shifts in expenditures because while the rural resident as producer enjoys (suffers) all of the gain (loss) from the price rise (fall), the rural resident as consumer only is affected by a fraction since much of the output is sold to consumers in the city.

Second, the difference of consumption impacts among income groups within the same province (Table 11) is much less than those of production impacts (Table 10). This is explained by the fact that variation of consumption pattern among income groups is much less than the variation of production structure.

Finally, our analysis also shows that the trade effects on commodity type are more important than the region of the country in terms of expenditure impacts (Table 11). In other words, when examining our data by province, we find that there are only slight differences among provinces. Evidently, because markets are fairly well integrated, all consumers in China consume a basket of goods that is more similar than their production baskets. The farm households in north and west of the country obviously cultivated a product mix that will been hurt more by trade liberalization.

VII. Concluding Remarks and Policy Implications

China's trade liberalization has been processed smoothly since the late 1980s. Through nearly 20 years external reform, China's foreign trade regime has gradually changed from a highly centralized, planned and import substitution regime to a more decentralized, market-oriented and export promotion regime.

In analysing the impacts of WTO on China's agriculture, we conclude that the positive impacts are more than negative. Although other effects on the rural economy from other subsectors may be equally large or even large, this study's focus on the agricultural sector showed that there will be an impact and the net impacts are positive for average farmers in China. Our findings on the NPRs show that indeed for some agricultural commodities WTO will lead to a fall in prices and a rise in imports. Edible oils, sugar, maize and cotton may be most affected. There are also commodities in which China has considerable comparative advantage – e.g., japonica rice, meats, and horticulture products-- and, hence, WTO could provide benefits to those engaged in these activities. The prospect of increased imports of feed grains (e.g., maize and soybeans) at lower prices means that livestock producers could become even more competitive.

Our study also shows that as some prices rise and others fall, WTO is encouraging farmers to adjust their agricultural production structure toward more comparative advantage products. In response to the overall food price rise, consumers decrease their consumption. However, with the increased incomes that accompany the shift of farmers to more profitable agricultural products, most of the farming sector likely will be better off (although we do not measure the indirect rise in consumption due to the income effects of higher agricultural profits).

We demonstrate that although the absolute effects of trade liberalization will not be very large, policy makers should be concerned about the poverty and equity effects. We show this through several findings. First, according to the analysis, although on average farmers at national level will benefit from WTO, it does not hold for all provinces. Average farmers in many less developed provinces in west and north parts of China will not gain from trade liberalization. The main reason is that the farmers in east and south produce more products that China has the comparative advantage in. The net impacts on agricultural production of average farmers in several west and north provinces indeed are negative.

Second, while the nation as a whole the average poor benefit, not all the poor in each region will gains from trade liberalization. We find that the poor in many provinces in west and north will loss in agricultural production. Third, in nearly all provinces, if there are gains, the richer will gain more than the poor. The main reason for the advantage of rich farmers in the same province is that the rich farmers have land that produce higher yields for the same commodity and more output (e.g., more horticulture, meats and fish).

As a consequence of equity issues, policy makers need to take one of two actions. First, they need to try to encourage farmers in poorer, inland areas to shift their production decisions (where appropriate) to more competitive crops. Second,

officials may also need to take other, non-trade actions to increase the livelihood of farmers in these areas. In many areas, farmers do not have an advantage in any farming activity. In such areas rural education, better communications and other policies that might facilitate their shift into the non-farm sector may be the most beneficial policy.

The impact on agriculture, however, is only part of the story. Although we do not analyze the non-farm impacts, trade liberalization is expected to also affect the access of households to non-farm employment and the wage they earn for being in the off farm market. In general, China will gain a lot from trade liberalization. Rising exports of manufacturing goods will hire a lot of rural labor. In country like China, raising the demand for off farm labor is probably the most important thing that can happen in the economy. The nation needs to keep promoting policies that facilitate investment and allows rural households to move to these jobs without constraints.

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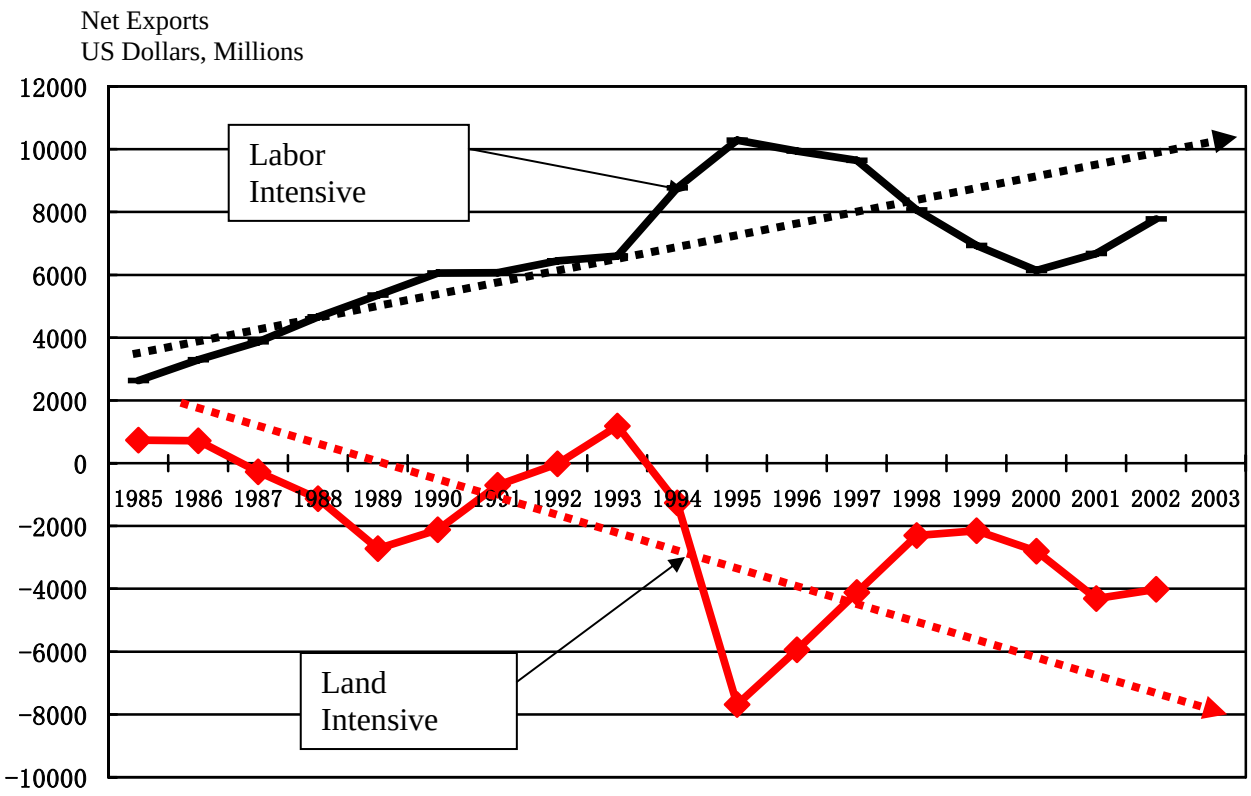

Source: Data are from various publications of China's National Statistical Bureau and China's Custom Authority. Land intensity products include grain, oils, sugar and cotton and wools; Labor intensity products include livestock, fish, horticulture and beverages.

Figure 1. Agricultural trade balance by factor Intensity (mil US$), 1985-2003

Figure 2a. Agricultural production structure by income group in 2003:
Importable output %

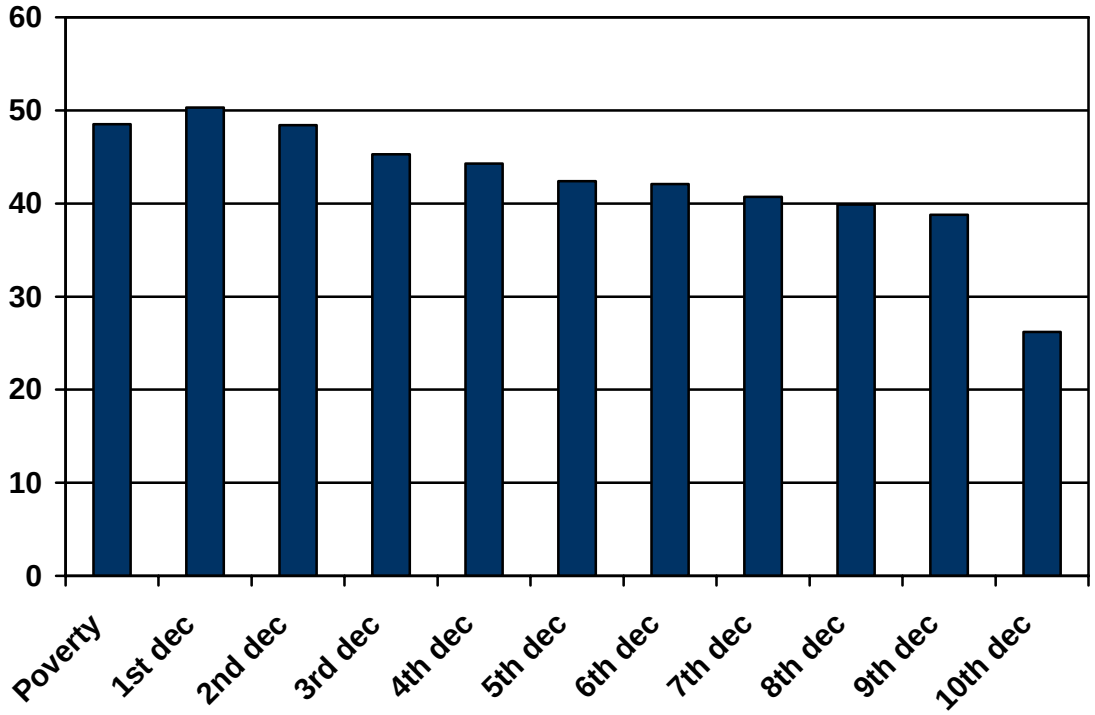

Figure 2b. Agricultural production structure by income group in 2003:
Exportable% - importable %

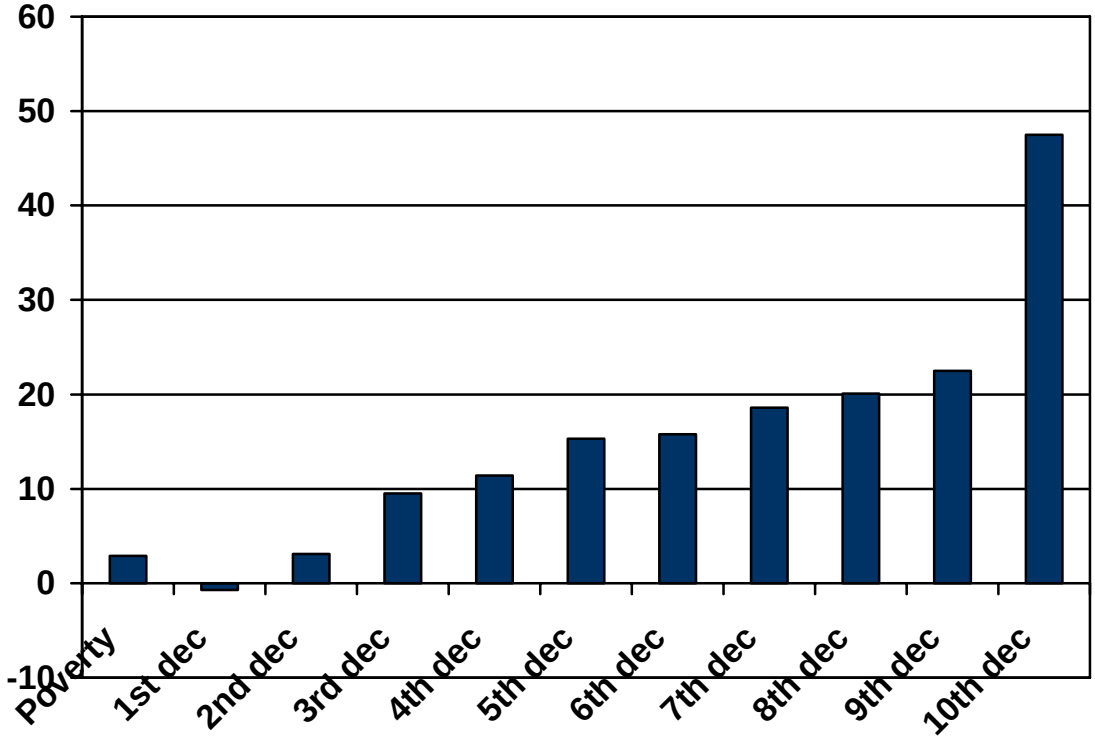

Table 1. NPRs and sources of policy distortion in China, 2001.

	Import tariff equivalent				Export subsidy equivalent			
	Tariff rate	*VAT*	NTB China	NPR	Tax rebate	Subsidy	NTB abroad	NPR
Rice	1	13	3	17	1	0	-9	-8
Wheat	1	13	1	15				
Maize	1	13	8	22		32	0	32
Other grains	1	13	1	15				
Soybean	3	13	1	17				
Cotton	3	13	2	18	5	10	0	20
Oilseed	13	13	21	47				
Sugar crops	25	15	10	50				
Vegetable					1	0	-11	-10
Fruits					1	0	-11	-10
Pork (meat)					5	0	-25	-20
Beef	45	15	0	60	5	0	-13	-8
Mutton					5	0	-10	-5
Poultry (meat)	20	15	0	35	13	0	-30	-17
Egg					1	0	-5	-4
Milk	50	17	0	67				
Fish					5	0	-20	-15

Table 2. Import tariff rates on major agricultural products subject to tariff-only protection in China.

	Actual tariff rates in 2001	Effective as of 1 January	
		2002	2004
Barley	114 (3)[a]	3	3
Soybean	3[b]	3	3
Citrus	40	20	12
Other fruits	30-40	13-20	10-13
Vegetables	30-50	13-29	10-15
Beef	45	23.2	12
Pork	20	18.4	12
Poultry meat	20	18.4	10
Dairy products	50	20-37	10-12
Wine	65	45	14
Tobacco	34	28	10

a: Barley was subjected to licence and import quota, the tariff rate was 3% for import within the quota and no above-quota barley with 114% tariff was imported in 2001.
b: Tariff rate was as high as 114% before 2000 and lowered to 3% in after the early of 2000.
Source: China's WTO *Protocol of Accession*, November 2001.

Table 3. Tariff Rate Quota of agricultural products.

	TRQ (million tons)		Tariff (%)		Quota for non-state own enterprises (%)
	2002	2005	In-quota	Above-quota	2000-2005
Wheat	7.3	9.6	1	65	10
Maize	4.5	7.2	1	65	25-40
Rice	2.6	5.3	1	65	50
Cotton	0.743	0.894	-	-	67
Soybean oil	1.7	3.2	9	121	50-90

Table 4. Impacts of WTO and trade liberalization on agricultural output prices, percentage compared with the baseline, 2005-2010.

Commodity	2005	2010
Rice	1.5	2.3
-- Japonica	6.8	10.2
-- Indica	-0.4	-0.6
Wheat	-1.7	-1.7
Maize	-6.6	-6.6
Sweet potato	-0.9	-0.9
Potato	-0.9	-0.9
Other cereals	-0.9	-0.9
Soybean	-0.9	-2.6
Cotton	-3.4	-3.4
Oil crops	-16.7	-20.2
Sugar crops	-9.3	-16.7
Vegetable	3.7	6.2
Fruits	3.7	6.2
Pork	8.3	13.9
Beef	2.9	4.8
Mutton	1.8	2.9
Poultry	6.8	11.4
Egg	1.4	2.3
Milk	-9.9	-13.7
Fish	5.9	9.8

Table 5. Impacts of WTO and trade liberalization on agricultural production, percentage change compared with the baseline, 2005-2010.

Commodity	2005	2010
Rice	1.5	2.3
Wheat	-0.2	0.1
Maize	-3.5	-3.1
Soybean	1.0	0.2
Cotton	-0.3	0.1
Oil crops	-7.5	-9.0
Sugar crops	-2.5	-5.6
Vegetable	2.9	4.9
Fruits	3.3	5.4
Pork	7.6	11.0
Beef	3.5	4.8
Poultry	6.9	9.7
Milk	-5.6	-8.4
Fish	4.3	6.6

Table 6. Impacts of WTO and trade liberalization on agricultural output value and food consumption expenditure for average farm household in China, compared with the baseline, in 2005 and 2010.

	2005		2010	
	Changes in value (yuan/hh)	Percentage change (%)	Changes in value (yuan/hh)	Percentage change (%)
Agricultural output	191	2.8	460	5.8
Importable sector	-198	-7.2	-264	-8.5
Exportable sector	389	9.3	723	15.1
Food consumption	44	1.1	102	2.3
Importable sector	-16	-2.0	-17	-1.9
Exportable sector	61	1.9	119	3.3

Note: Importable sector includes wheat, maize, all coarse grains, soybean, edible oil, cotton, sugar, and milk. Exportable sector include rice, vegetable, fruits, all meats and fish.

Table 7. Self-sufficiency under baseline and WTO scenarios in 2005 and 2010.

Commodity	2001	2010	
		Baseline	WTO
Cereal Crops	101	96	93
Rice	101	103	107
Wheat	100	97	96
Maize	105	90	80
Soybean	53	49	47
Oil crops	83	89	69
Sugar crops	89	80	71
Vegetable	101	100	105
Fruits	100	99	106

Table 8. Impacts of WTO and trade liberalization on per household food expenditure by income in China, compared with the baseline, in 2005 and 2010.

	2005		2010	
	Changes in value (yuan)	Percentage change (%)	Changes in value (yuan)	Percentage change (%)
Agricultural output value				
Under int'l poverty	77	1.7	221	4.4
Importable sector	-138	-6.3	-177	-7.2
Exportable sector	215	9.6	399	15.5
Average farmers	191	2.8	460	5.8
Importable sector	-198	-7.2	-264	-8.5
Exportable sector	389	9.3	723	15.1
Top 10% richest farmers	583	5.3	1205	9.3
Importable sector	-212	-7.5	-304	-9.3
Exportable sector	795	9.7	1509	15.6
Food consumption				
Under int'l poverty	25	0.9	76	2.4
Importable sector	-20	-2.3	-21	-2.2
Exportable sector	45	2.4	97	4.4
Average farmers	44	1.1	102	2.3
Importable sector	-16	-2.0	-17	-1.9
Exportable sector	61	1.9	119	3.3
Top 10% richest farmers	62	1.0	134	2.0
Importable sector	-13	-1.5	-12	-1.3
Exportable sector	75	1.4	146	2.6

Table 9. Agricultural production structure, importable and exportable shares (%), by province in China in 2001.

	Importable	Exportable	Net exportable	Rice	Horticulture	Importable
Tibet	88	12	-75	0	1	99
Xinjiang	72	28	-44	2	9	90
Gansu	67	33	-35	0	3	97
InnerMongolia	66	34	-31	2	3	96
Heilongjiang	65	35	-30	12	3	86
Hebei	63	37	-27	1	4	95
Jilin	60	40	-20	14	4	82
Shanxi	57	43	-13	0	6	94
Henan	56	44	-13	4	5	91
Qinghai	56	44	-12	0	2	98
Ningxia	53	47	-7	7	8	86
Shandong	53	47	-6	0	18	81
Shaanxi	48	52	3	2	7	91
Anhui	41	59	18	29	8	63
Liaoning	40	60	19	14	8	78
Tianjin	39	61	23	0	1	99
Beijing	31	69	37	1	13	87
Hubei	31	69	37	38	7	55
Yunnan	30	70	40	25	9	66
Jiangsu	28	72	45	33	11	56
Guizhou	27	73	45	23	12	65
Chongqing	24	76	51	30	21	49
Sichuan	24	76	51	25	14	61
Guangxi	23	77	54	51	9	40
Jiangxi	10	90	79	77	8	15
Hunan	10	90	79	70	9	21
Hainan	10	90	80	62	14	24
Shanghai	9	91	81	56	17	27
Guangdong	8	92	85	64	21	15
Zhejiang	4	96	91	34	58	8
Fujian	3	97	93	70	14	16
National	40	60	19	18	8	74

Table 10. Impacts of WTO and trade liberalization on per household agricultural output value by income in the selected provinces, compared with the baseline, in 2005 and 2010..

	2005		2010	
	Changes in value (yuan)	Percentage change (%)	Changes in value (yuan)	Percentage change (%)
Zhejiang				
Under int'l poverty	157	6.8	309	11.4
Average farmers	397	7.6	752	12.5
Top 10% richest farmers	951	8.2	1786	13.5
Guangdong				
Under int'l poverty	163	4.4	323	7.7
Average farmers	684	7.6	1348	12.8
Top 10% richest farmers	2936	11.0	5799	17.9
Jilin				
Under int'l poverty	-77	-1.3	61	0.9
Average farmers	-128	-1.2	105	0.9
Top 10% richest farmers	370	1.8	1165	5.0
Jiangxi				
Under int'l poverty	187	4.7	368	8.3
Average farmers	278	4.5	549	8.0
Top 10% richest farmers	476	4.9	913	8.2
Henan				
Under int'l poverty	-7	-0.2	77	1.7
Average farmers	80	1.2	296	3.8
Top 10% richest farmers	818	5.8	1685	10.5
Sichuan				
Under int'l poverty	164	3.8	355	7.2
Average farmers	389	5.9	789	10.6
Top 10% richest farmers	683	7.5	1339	12.7
Ningxia				
Under int'l poverty	42	1.0	166	3.4
Average farmers	-3	0.0	88	0.9
Top 10% richest farmers	-119	-0.7	-238	-1.1
Shaanxi				
Under int'l poverty	27	0.7	123	2.9
Average farmers	101	2.0	280	4.8
Top 10% richest farmers	297	3.5	664	6.7
Guizhou				
Under int'l poverty	138	3.4	317	6.9
Average farmers	270	5.0	565	9.2
Top 10% richest farmers	471	6.8	941	12.0

Table 11. Impacts of WTO and trade liberalization on per household food expenditure by income in the selected provinces, compared with the baseline, in 2005 and 2010..

	2005		2010	
	Changes in value (yuan)	Percentage change (%)	Changes in value (yuan)	Percentage change (%)
Zhejiang				
Under int'l poverty	65	1.4	133	2.5
Average farmers	88	1.4	170	2.3
Top 10% richest farmers	105	1.1	200	1.8
Guangdong				
Under int'l poverty	67	1.2	141	2.3
Average farmers	123	1.5	243	2.7
Top 10% richest farmers	151	1.4	283	2.4
Jilin				
Under int'l poverty	46	1.5	97	2.8
Average farmers	41	1.3	88	2.6
Top 10% richest farmers	34	0.9	79	2.2
Jiangxi				
Under int'l poverty	32	1.0	70	1.9
Average farmers	47	0.9	98	1.9
Top 10% richest farmers	50	1.0	99	1.8
Henan				
Under int'l poverty	-1	0.0	18	0.7
Average farmers	13	0.4	43	1.3
Top 10% richest farmers	70	1.3	149	2.6
Sichuan				
Under int'l poverty	50	1.4	106	2.7
Average farmers	65	1.6	129	2.9
Top 10% richest farmers	68	1.4	130	2.6
Ningxia				
Under int'l poverty	7	0.2	49	1.4
Average farmers	24	0.7	91	2.4
Top 10% richest farmers	38	1.0	149	3.7
Shaanxi				
Under int'l poverty	-5	-0.3	11	0.4
Average farmers	-1	-0.1	17	0.6
Top 10% richest farmers	2	0.1	22	0.7
Guizhou				
Under int'l poverty	42	1.3	95	2.7
Average farmers	56	1.6	115	3.1
Top 10% richest farmers	64	1.6	126	2.9

Market Development, Commercialization and Small Farmers in China

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I. Introduction

After China launched the economic reform in the late 1970s, its economy has experienced rapid growth and deep structural changes. The average annual growth rate of real GDP was 9.4 percent between 1979 and 2004 (NSBC). Although agricultural growth did not match that of the overall economy, it recorded a rate that was 3 times higher than the rate of population growth during the entire reform period. Because of the faster growth of the industrial and service sectors, the share of agriculture in total GDP has fallen from more than 30% in 1979 to less than 14% in 2004 (NSBC). Significant structural changes also have occurred within agriculture; grain and other subsistent commodities have been replaced in part by high-value commodities such as horticulture, livestock and fishery. The shifts in the economy can also be seen in the structure of employment. Agriculture employed 81 percent of the labor force in 1970. After 2000, employment in agriculture has fallen to less than 50 percent. With such a sharp shift in the structure of employment, China also is gradually beginning its transition from a rural-based society to an urban-based one.

The rapid economic growth has been accompanied by substantial improvement in food security and a reduction of poverty. Per capita food availability reached 3040 kcal per day in 2000, a level that is 14 percent higher than the average of developing countries and 8 percent higher than the world average (FAO, 2002). With 20 percent of the world's population and less than 10 percent of the world's cultivated land, China has shifted from a food net importer to net exporter since the middle 1980s and net cereal exporter since the late 1990s (Huang et al., 2003). Moreover, China has a foreign exchange reserve ranked second among the world which can assure a high degree of food purchasing power if the nation would encounter any degree of short-term grain insecurity. Based on China's official poverty line, more than 230 million Chinese rural residents have escaped poverty, the absolute level of poverty has fallen from 250 million (31 percent) in 1978 to 29 million (less than 3 percent) in 2003. Even based on international standard of poverty line, which is set at one dollar per day (in PPP terms), the headcount and the incidence of poor has fallen equally fast, from 62 percent in 1980 to 8 percent in 2003 (OECD, 2005; Huang et al, 2004).

The developments of markets and the shift to urbanization coupled with increased incomes have significantly changed consumption patterns since the early 1980s, particular in 1990s, which facilitated sharp economic structure changes. The average

consumer in urban China spent 55 percent of his/her total expenditures on food in 1980 and 54 percent in 1990. During the 1980s, it is clear that the rise in food expenditures was moving in parallel with the income growth (NSBC). However, further increase since 1990 in urban income has considerably reduced food budget from 54 percent in 1990 to 37 percent in 2003. Over the same period, the food budget share declined from 62 percent in 1980 to 59 percent in 1990 and 46 percent in 2003 in rural China.

Off the farm, more than 40 percent of rural residents have employment and about 100 million of them have moved to urban areas for employment (deBrauw et al., 2002). In fact, more than 80 percent of households have at least one member working off the farm. Growth in agriculture, rise in non-farm employment and the expansion of rural industry in conjunction with the transformation of domestic and international markets have changed the face of rural China and are playing key roles in the nation's modernization (CCICED).

While successful growth and structural changes in the past should instill optimism, there are still great challenges ahead. Income growth, demand changes, urbanization, trade liberalization as well as rapid changes in food retail markets (e.g., the growth of super markets) have challenged the current production system. There has been increasing concern about food safety, quality control, technology adoption and agricultural marketing for an agriculture sector with millions of small farms. It is obvious that the Household Responsibility System (HRS) reform that allocated each community's collectively owned land equitably to individual farmers significantly contributed to China's agricultural growth, poverty reduction and food security in the early 1980s. Truly HRS has been the foundation on which the gains in agricultural production and improvements in marketing are based (Nyberg and Rozelle, 1999). Currently, there are a total of 240 million farms with an average of 0.54 hectare of cultivate land in 2003. In China's new environment the main measure of success will be the extent to which all farmers, particular the poor and those with small holdings, can continue to be an integral part of the nation's push towards a market-oriented economy and ultimately the modernization of the country. The concerns of small farmers and the trends towards smaller farm sizes have raised many questions on how Chinese farmers could effectively adapt themselves and become a productive part of the nation's rapid market development. There also are concerns about the fate of the small farmer in the wake of China's commitment to trade liberalization as well as the increasing demand for new and higher quality products in an increasing sophisticated market-oriented food economy. In a market economy in which assets and information are often becoming concentrated in the hands of private individuals and enterprises, farmer organizations or associations can be key agencies in leveling the playing field. Today, however, such institutions are still weak in China.

The objectives of this study are to understand how China has reformed its agricultural institutions and developed its market during its economic transition and the challenges that the farmers may face in the process of market development and commercialization. In the next section, we identify and discuss the major institutional changes (HRS) that have shaped China's agriculture and as well as document the emergence of China's

agricultural markets. To examine the nature of the new agricultural product markets we look at spatial patterns of market prices contours over time and examine the extent to which market prices are integrated. In the third section, we examine how the transformation and emergence of markets has affected the ability of farmers to specialize their productions. In the fourth section, we look at the next stage of evolution of markets, especially those forces that the are being driven by the nation's urbanization movement. In particular, we examine the rise of wholesale and supermarkets. The rise of these new forms of food retailing enterprises has the potential of radically changing China's future food sector. In other countries, these institutions have been shown to affect the production and income of small farmers. Because they are so new and recent, there is no research up-to-date in China that examines this impact. Thus it will be a part of our future research agenda. The final section concludes with policy implications, discuss the possible ways that farmers may respond to the new trend toward demand for special, high-valued, food-safe products. Specifically, we examine the possibility that farmers may be able to create a new institution, called Farmer Professional Associations—that can help them to take advantage more capably of the new opportunities. In general, we want to understand what barriers are aiding small farmers in China's new environment and what are hindering them.

II. The Institutional Changes and Agricultural Market Developments

Institutional Reform

China's reformers, more than anything, have followed a strategy based on providing incentives through property rights reforms, even though in China the shift to private ownership is today far from complete. The reforms started with the Household Responsibility System (HRS). The HRS reforms dismantled the communes and contracted agricultural land to households, mostly on the basis of family size and number of people in the household's labor force. Although the control and income rights after HRS belonged to individuals, the ownership of land remained collective.

The HRS reforms were completed in 1984. At its conclusion, on average, average farm size was about 0.7 hectare. The size of farms vary among regions, ranging from more than 1 hectare in the Northeast and nearly 1 hectare in North China to about 0.5 hectare in Southwest and 0.2 to 0.3 hectare in South China. Because the multiple cropping index (the number of crop seasons planted per year on a single plot of land) increases from 1 in the Northeast to 2 to 3 crops in South China, variations of sown area among China's regions are less than those of farm size.

China's land rights are complicated and changing (Brandt et al., 2002). The first term of the land use right contract was stipulated to for 15 years. The effects of such a land policy on the equitable distribution of land to farmers and its effect on food security and poverty alleviation have been obvious and well documented. The land policy also has contributed greatly to efficiency. Specifically, the income and control rights contributed significantly

to the agricultural production and productivity growth in the early 1980s (McMillan et al., 1989; Fan, 1991; Lin, 1992; Huang and Rozelle, 1996).

Although local leaders were supposed to have given farmers land for 15 years in the early 1980s and 30 years starting in the last 1990s, collective ownership of land has resulted in frequent reallocation of village land. Many scholars and policy makers have been concerned that such moves by local leaders could result in insecure tenure and negative effects on investment (Brandt et al., 2002). Others have shown, however, that in fact there has been little affect on either short- or long-run land productivity. There is still concern by officials that collective ownership and weak alienation and transfer rights could have other effects, such as impacts on migration and rural credit (Johnson, 1995). As a result, China has recently passed a new land law, the Rural Land Contract Law (effective after March 1, 2003), which seeks to greatly increase tenure security.

Above all, the government is now searching for a mechanism that permits those that stay in farming to be able to gain access additional cultivated land and increase their incomes and competitiveness. Even without much legal protection, researchers are finding increasingly more land is rented in and out (Zhang et al., 2001). In order to accelerate this process, the new Land Contract Law further clarifies the rights for transfer and exchange of contracted land. The new legislation also allows family members to inherit the land during the contracted period. The goal of this new set of policies is to encourage farmers to use their land more efficiently and increase their farm size.

Commodity Price and Marketing Policies

In addition to property rights reform and transforming incentives, the other major task of reformers is to create more efficient institutions of exchange. Markets—whether classic competitive ones or some workable substitute—increase efficiency by facilitating transactions among agents to allow specialization and trade and by providing information through a pricing mechanism to producers and consumers about the relative scarcity of resources. But markets, in order to function efficiently, require supporting institutions to ensure competition, define and enforce property rights and contracts, ensure access to credit and finance and provide information (John McMillan, 1997; World Bank 2002). These institutions were either absent in the Communist countries or, if they existed, were inappropriate for a market system.

Although markets did not exist in the pre-reform era, price and market reforms were key components of China's transition strategy to shift from a socialist to a market-oriented economy. The price and market reforms initiated in the late 1970s were aimed at raising farm level procurement prices and gradually liberalizing the market. These reforms included gradual increases in the agricultural procurement prices toward market prices, reductions in procurement quota levels, the introduction of above quota bonuses for cotton, tobacco, and other cash crops, negotiated procurement of surplus production of rice, wheat, maize, soybean, edible oils, livestock, and most other commodities at price levels higher than those for quota procurement, and flexibility in marketing of surplus production of all categories of agricultural products by private traders. It is interesting

that in the initial years there was little effort to move the economy to one in which most all resources and factors were allocated according market price signals. Significant market reform has been implemented only after the late 1980s.

By the late 1990s, the domestic markets of all agricultural commodities except for grain had been liberalized. For example, in the early 1980s, China liberalized the state procurement of vegetables, fruits and all minor crops that were produced and consumed locally. The retail markets for these commodities were also liberalized by the middle 1980s. After the nation adapted to this new market system, the state procurements and retail controls were eliminated for meat and aquatic products in the late 1980s. Since the early 1990s, the liberalization of the state procurements had been implemented in succession from edible oil crops and sugar to cotton.

While the reforms of most agricultural commodity markets have been implemented smoothly since 1980s, market reform for grain, the national strategy commodity, is complicated. After a record growth in grain production in 1984, grain price and market reforms was announced in 1985 aimed at radically limiting the scope of government price and market interventions and further enlarging the role of market allocation (Rozelle et al., 2000). Incentives were introduced through the reduction of the volume of the quota and increase in procurement prices. Because of the sharp drop in the growth rate of grain output and rise in food prices in the late 1980s, the pace of grain marketing reform stalled. Mandatory procurement of grain continued. As grain production and prices stabilized in the early 1990s, another attempt was made to abolish the grain ration system. Urban officials discontinued sales at ration prices to consumers in early 1993. For a year and a half, the liberalization move succeeded. Then, while it appeared that both the state grain distribution and procurement systems had been successfully liberalized, food prices rose sharply. As a result, the state compulsory grain quota system was again re-imposed in most parts of China in 1995, but at a lower procurement level.

Since the middle 1990s, several new policies—some pro-market, others anti-market—were implemented. Immediately after the price rises in the middle 1990s, China started the provincial governor's "Rice Bag" responsibility system. Major measures under the system included investing in production bases inside the province and attempting to keep grain from being shipped outside of the province. The efforts to restrict the flow of grain by local provinces, however, were not successful. Market flows continued as the share of total government procurement in domestic production reduced from 26% in 1994 to 22% in 1996, being driven by the profits that traders could earn by shipping grain from low to high priced areas (Huang et al., 2004).

With three record levels of grain production in the late 1990s, rising grain stocks and declining food prices, leaders worried of falling farmers' income, instead of proceeding with market reform, leaders actually opted to try to exercise greater control over grain prices by price protection policy. Market intervention policy shifted from taxing grain producers through lower government quota procurement price (lower than market price) to prevent grain price falling through implementation of grain protection price (higher than market price). Individuals and private companies were prohibited from procuring

grain from farmers. Leader expected that they could monopolize grain markets through the commercial arms of grain bureau, and that the grain bureau would be able to sell the procured grain at an even higher in the market and meet the nation's goal of raising farmer income. The win-win (from the government's point of view) policies, however, did not work, primarily because the government could not suppress market activities of traders and the commercialized grain system employees. While the above market prices were offered to farmers in some years, cash strapped grain bureaus could not procure all of the grain that farmers wanted to sell. Grain production increased, but since grain bureaus were trying to sell grain to urban and commercial users at above market prices, they had few takers. Unable to stop the activities of millions of private grain traders, urban users continued to buy from their original channels at market set prices. Not surprisingly, stocks started to accumulate, the real price in the market fell even further, and the commercialized grain bureaus that had been forced to buy grain at high prices, had huge stocks of grain that was worth less than they had bought it for and their debts rose greater than ever.

In the early 2000s, marketing reforms were once more launched. Restrictions on marketing were removed. New efforts to commercialize the grain bureau were begun. The support prices that had been given to some farmers in some areas were eliminated. In short, a new effort was made to push the policy environment to be even more market-oriented. In fact, as seen from this recounting of nearly 25 years of reform, grain marketing reform has been an on again / off again policy effort. When grain prices are low and grain relatively abundant, markets are liberalized. Policymakers make efforts to curb market actions, however, in times of rising grain prices. What is unclear, however, is how effective the policy were in dampening market activity or facilitating the operation of well-functioning markets. It is to this question that we turn to in the next sub-section.

Market Integration in China

Because all agricultural commodities except for grain were fully liberalized either in 1980s or 1990s, our discussions in this sub-section are exclusively on grain market integration. If grain markets in China are highly integrated, it is likely possible to generalize the degree of integration and competitiveness to other agricultural commodities. Although a complete analysis is beyond the scope of this paper, we do summarize some of the key results from our recent studies on China's grain markets (Park et al., 2003; Huang et al., 2003 and 2004; Rozelle et al., 2004). To understand the efficiency of grain market in China, we first examine the trends of grain prices in different markets across China. Then we conduct formal market integration test for rice and maize.

In nearly in all markets where monthly, fortnight and weekly price data are available, grain prices have been closely moving together since the mid-1990s. For example, Figure 1 shows that how closely maize prices in Dalian (in Northeast China's maize production region) and Guangdong and Fujian (in South China's consumption areas, thousands kilometers away from Dalian) track each other (Figure 1, Panels A and B). While prices have moved together since the mid-1990s between Dalian and Guangdong

and between Dalian and Fujian, the tracking among markets appears to be even closer in recent years. Almost every turning point (a shift from low to high or high to low) in Guangdong and Fujian can be found in the Dalian market. The close movement of prices occurs even though the primary way grain moves between the two sets of markets is by ocean going vessel. With the advent of private shipping and commercial trading, there are now many shipping lines and trading companies that move grain between the Northeast and South China's main consumption areas. Although not reported here, using the same data sources we find prices similarly move together for pairs of markets both in the same region and across more distant locations for rice.

To conduct formal tests of market integration, we use Engles-Granger cointegration analysis to examine how prices move together over time. We do the analysis in several time periods based on the available data. For maize and rice, our analysis is based on every 10 days prices from 1996 to 2000 of nearly 50 sample sites (local rural periodic markets) from 15 of China's provinces provided by the Ministry of Agriculture. Because this is the same source of data used in Park et al. (2002), we can compare our results (1996-2000) with those in the late 19890s and early 1990s by Park et al, which are shown in Table 1. We also use the other source of data collected by the Jilin Province Grain and Oil Information Center which allows us to look at price behavior after 2000. For maize, on a weekly basis between August 10, 1998 and February 24, 2003, and monthly price series at the provincial level from 1999 to 2003 are used in the analyses. We test co-integration of Dalian, the main port from which exports to foreign and other domestic markets (by ship) leave, with other major maize major markets in China (Table 2). For a description of our cointegration methodology see Huang et al. (2004).

The results of the cointegration analysis illustrate that China's grain markets have continuously developed in the late 1990s, especially when the results are compared to the market integration research in the late 1980s and early 1990s (Table 1). In middle part of the reform era (1988 to 1995), a time when markets were starting to emerge, between 20 to 25 percent of markets showed signs the prices were moving together during the study periods and sub-periods (Park et al., 2002). According to the Park et al. findings, although there were many market pairs in which prices did not move together, between the late 1980s and mid-1990s, there was evidence of rising integration.

Using the results from the early 1990s as a base line, our current analysis shows that during the late 1990s, China's grain markets continued along their previous path of maturation. In the late 1990s, examining the co-movement of prices among pairs of markets in our sample, we see a significant increase in the fraction of market pairings that are integrated. In fact, some markets in China are remarkably integrated. In the case of maize, for example, in 89 percent of the cases, prices in one market move at the same time as in another (Table 1, column 2). This is up from only 28 percent of the time in the early 1990s. The integration of these markets is notable because in many cases, the pairs of market are separated by more than a 1000 kilometers. For example, we find maize prices in many years to be integrated between markets in Shaanxi and Guangdong provinces and between those in Sichuan province and southern Jiangsu. The share of

market pairs (for japonica rice and indica rice) that exhibit price integration also increases similarly(rows 2 to 3).

Despite the significant progress in terms of integration, our results do also show that there were pairs of markets during different years in the 1990s that were not integrated. After 2000, however, this begins to change. Using our statistical analysis, we find that after 2000 all pairs of our sample markets in the Northeast are integrated in a statistically significant way (Table 2). Compared to the results in the late 1990s (reported in Table 1) our analysis shows that during the post-2000 period maize markets in China have continued to become more integrated. Literally all pairs of markets (100%) in the Northeast sample are integrated. Testing of Dalian with 4 maize consumption provinces in 1999-2003 shows that Dalian is integrated with others (at a 5 level of significance for Fujian and Guangdong and a 10 percent level of significance for Hubei and Jiangsu).

III. Market Emergence and Specialization

Few authors have attempted to quantify the gains from market liberalization. Part of the problem may be the short period of analyses, the inability of standard methodologies and measures or indicators of market liberalization to separate efficiency gains of market reform from overall gains in the reforming economy. According to our reading of the literature, in only three papers have there been an attempt to isolate empirically the effect of reforms that facilitate the emergence of markets. In deBrauw et al. (2004) it is shown that there is a positive effect of increasing marketization on productivity. Lin (1992) and Huang and Rozelle (1996) finds a similar results. In all three of these papers, the authors conjecture (without an empirical basis) that the gains are due in part to increasing specialization.

In order to try to understand whether or not specialization has occurred since the mid-1990s when markets began to emerge and integrate, in 2004 we conducted a national representative survey of 400 communities. In the survey of community leaders we asked the following question: Are farmers in your village specializing in any particular crop or livestock commodity? The question was asked about 1995 and 2004. If the respondent answered affirmatively, we asked for the commodity in which they were specializing. If the farmers in the community were specializing in a cropping activity, we asked for the area sown to the specialty commodity.

The results of our survey show that indeed specialization has been occurring in China's agricultural sector. Between 1995 and 2004, the percentage of villages that are specializing in an agricultural commodity has increased sharply and has done so in every province (Table 3, columns 1 and 2). On average, throughout our sample from across China, 30 percent of China's villages are specializing, up from 21 percent in 1995. Although the percent of villages that specialize has risen in all of our sample provinces, some (e.g., Liaoning, Inner Mongolia and Shanxi) have risen faster than others (Hebei, Henan and Shaanxi). The percent of area sown to the specialty crops has also risen,

rising across our sample average from 13 percent of total sown area in 1995 to 24 percent in 2004 (columns 3 and 4).

When examining the composition of the output of villages that are specializing, it is clear that the rise in the demand for horticulture and other specialty products is what is driving the specialization (Figure 2). In our sample, fully 60 percent of those villages that are specializing are producing either fruits (28%) or vegetables (13%) or other cash crops (28%—e.g., sugar cane, tobacco and cotton). There also are villages that are specializing in livestock commodities, oil seed crops, forest products and other commodities. The diversity of specific crops can be seen in Appendix Table 1.

Interestingly (and perhaps surprisingly), the propensity to specialize is not correlated with either income levels or the geographical location of the village, implying that poorer farmers may be equally or even more responsible for the rise of specialization (Table 4). For example, in villages that have incomes in the top 25th percentile, only 28.35 percent of villages are specialized; in contrast, 22.86 percent of those in the poorest 25th percentile are specialized (rows 1 and 2). Villages further away from county seats are less likely to be specialized than those that are further away (rows 3 and 4). While initially this may be somewhat surprising, when it is remembered that, all farmers are nearly equal small size, many specialty crops are labor intensive (Huang and Chen, 1999) and that access to off farm jobs is more favorable to those that are in better off and less remote areas (deBrauw et al., 2002), the rise of China's markets can be seen to have provided new possibilities for those rural residents that are poorer, have lower opportunity costs and live in more remote areas.

IV. Traditional and New Institutional Environment in Marketized Economy

The purpose of the section is to document the nature of some of the important institutions that may shape (or have the potential to shape) the environment within which farmers live and work in the coming years. Because markets are so competitive, if the institutions that are emerging during this time affect financial returns and economic opportunities in the rural sector, they could have a dramatic effect on producer well-being. In particular, we examine two institutions: the traditional marketing channels and the supermarket sector.

Traditional and Wholesale Market Development

Compared with the gradual reform of agricultural procurement, China's retail sector of its agri-food system has experienced a much more rapid change after 1990. Before the early 1990s, the structure of China's food retail markets was fairly simple. Most of its fresh fruits and vegetables and a large fraction of its meat were sold through private traders operating in wet market venues that were set up and regulated by urban marketing authorities. Groceries and other dry food goods and other miscellaneous goods were mostly sold through state-owned food stores. In some metropolitan areas by the 1980s a fraction of the state-owned food stores were contracted out to individuals that were gradually beginning to operate their outlets as private businesses. In other metropolitan

areas, a small *denovo* sector was gradually emerging. However, food retailing was still heavily influenced by state policies and regulations and the distribution system was highly fragmented. There were no large-scale, self-service format stores like those that were so common in most developed countries.

Although the state- and collective-owned retail system was dominant in the early 1980s, they were nearly transformed to private sector by 1990. Traditional markets (e.g., various rural and urban *Jimaoshichang* such as wetmarkets and open markets) re-emerged and offered a viable market substitute to the state-owned agricultural food distribution system (Skinner, 1985; Rozelle, et al, 2003). But after reaching its peak in mid-1990s, the number of wet-markets, however, has stagnated. After the mid-1990s in some areas the number of wet-markets has declined (Bi et al., 2004). At the same time, other marketing forms, for example, wholesale markets and the newly emerging supermarket sector (discussed in the next section) are starting to replace the traditional wet-markets (Hu et al., 2004).

The increasing role of wholesale market development in China's agricultural production and marketing has experienced only after the late 1980s. Wholesale markets of agricultural products were either developed from traditional wetmarkets or established by government, collectives and even private sector (Qiu et. al, 2001, and Zhang, 1999). To strengthen market management, governments at different levels began to establish local, regional and national wholesale markets. Among the various market development programs, the "vegetable basket program," initiated in the late 1980s, has played a critical role in the expansion of wholesale markets (Ministry of Agriculture, 1995).[1] The number of agricultural wholesale markets increased from 1224 in 1987 to 3517 in 1995 and reached a record level of 4532 in 2000 (Bi et al., 2004). By the late 1990s, nearly all wholesale markets had established permanent physical marketing structures, such as refrigeration facilities, distribution centers, trading halls and storage warehouses (Qiu et al., 2001 and author's survey). The total value traded in agricultural wholesale markets rose from less than US$1 billion in 1986 to more than US$40 billion in 2001 (Yu, 2003 and Zhou, 2001).

Given the larger trade flows, participants are much more diversified in wholesale markets than in the traditional wet-markets. For example, there are professional traders (long-distance and local ones), producers, state- and privately-owned trading enterprises, agricultural processors, supply agents and franchisers. Most trading firms are small. In many (most?) local wholesale markets there are few strictly enforced rules keeping traders out. While the expansion of wholesale markets since 1990s is expected to have had a significant impact on agri-food marketing and farm specialization, there is no empirical study that examines these impacts in China. In other words, despite the massive amounts of food that are moving around China today, there is almost nothing known about the supply chain that have emerged in recent years.

[1] A program to ensure stable supply of vegetable, fruits, meats and fish to urban areas.

Modern Market Development

Beyond the recent shifts in wholesale markets, an even more fundamental change in China's agri-food market system appears to be the recent emergence of supermarkets. We use the term "supermarkets" for simplicity to mean the full set of modern retail formats (supermarkets, hypermarkets, club and discount stores, cash and carry all as large formats, and chains of convenience stores).[2] In the rest of the section, we examine this sector and try to identify the ways the emergence of the sector may be affecting producers.

Patterns in Growth in the Supermarket Sector in China

Although during the 1980s there were virtually no supermarkets in China, things were soon to change. After the first supermarket started in coastal Guangdong province in 1990, store numbers of the supermarkets increased to 2500 in 1994 and 53,100 in 2002 (Table 5). Over the period between 1994 and 2002, the shares of sales value of supermarket in the nation's whole retail markets raised from 0.2% to 11 % (or US$ 55 billion in 2002, Table 5). Although retailing foods in supermarkets encountered certain difficulties in their very early development stage (in getting approval from government regulators and in designing ways to serve their customers, Hu et al (2004) estimated that there is approximately 15 billion dollars of food were sold annually through supermarkets in recent years in China, accounting for nearly 6 percent of the nation's food retail (or about 13 percent of urban food retail). In some developed areas, supermarkets have even penetrated into townships (Bi et al., 2004).

The nature of supermarkets also have changed over time and there are a large variety of stores in China in recent years. By 2002, approximately 36,700 of the stores making these sales are large format (supermarkets, hypermarkets, discount stores, club stores). There are also 16,400 chain convenience stores. CCFA (2003) notes that in 2002, the average hypermarket had 28 million dollars in sales and 9400 square meters (with 22k the largest), an average supermarket, 4.4 million dollars and 1960 square meters of floor space, and a convenience store, 216,000 dollars with 109 square meters. Hence, convenience store chain sales only represent roughly 3.5 billion dollars of sales, about 5% of the supermarket sector's sales; this is very much in the range one finds in for example Latin America, with numerous stores but low share of total sales. In addition, there is evidence of consolidation and multi-nationalization of the supermarket sector in China, much as has been happening around in the developing regions in the 1990s/2000s (Reardon, Timmer, Barrrett, Berdegue, 2003).

Finally, supermarkets are spreading throughout China. The movement also is going in multiple dimensions. For example, supermarkets have spread well beyond their initial niche in the middle/upper-income neighborhoods of the largest cities of the central-

[2] Note that the China Chainstore and Franchise Association (CCFA) defines a hypermarket as selling food and nonfood products, and having more than 5,000 sq. meters of floor space; a supermarket has from 300 to 4999 square meters, and a convenience store, less than 200 square meters. These definitions are similar to those internationally.

eastern and southeastern coastal regions – into other regions, small cities and towns, and beginning to penetrate the food markets of the urban poor. Chains are also differentiating their formats as they spread. The general evolution of formats in the 1990s was from small to larger supermarkets and then the introduction of hypermarkets (first by foreign chains and then by domestic chains), which are usually introduced to reach the mass market in early 2000s. In recent years, retailers have used new formats to penetrate low-income niches with a low cost, no frills format. Other chains have introduced membership clubs for bulk buying.

Supermarkets: From processed to fresh

Supermarkets are also making inroads into fresh foods. In the early years, most all sales were of processed foods and those foods that did not perish. Large storage facilities and bulk merchandising give supermarkets an advantage over small shops in selling processed, packaged and bulk foods, such as edible oil, grains, noodles, and condiments. These factors allowed supermarkets to quickly penetrate the processed dry foods markets in the 1990s in urban China. For example, ACNielsen (2002) notes that in a subset of processed foods, "crispy snack food," the supermarket share went from 50% in 2000 to 65% in 2001 in urban China.

A second category into which supermarkets have moved very quickly in the past half decade is processed semi-fresh foods such as dairy products, tofu and processed meats. Recent evidence shows that supermarkets in the main cities have captured the majority of the milk products market, a market that has grown much faster over the past half decade (Hu, Fuller, and Reardon, 2004).

However, the slowest market penetration by supermarkets, by product category, is of fresh foods such as FFV, meats and fish. For instance, it is roughly estimated that supermarkets only have a 10 percent, or at most 20 percent share, in the fresh food markets in the major cities (Gale, 2004). In most places, the wet-markets are still dominant, due to (usually) lower prices, not paying taxes, freshness and variety. In China, the penetration is slower because consumers have traditional patterns of daily purchase of fresh products that only slowly are dismantled under the impetus of retail market transformation.

There are several signs, however, that this is changing, perhaps faster than most market analysts figure. Over the past several years, major chains have begun a policy of pricing the fresh product "staples" (such as basic greens, some fruit, chicken, perch, and pork) at the same prices as in the wet-markets. According to Reardon et al. (2004), the expansion of the fresh food market share reflects the strong intention of supermarket chains to become competitive in fresh products.

As FFV sales have risen, one hypothesis is that there will be major changes in fresh foods procurement systems. According to interview of leading supermarket chains, the shifts in FFV procurement started over the past few years is accelerating. There are also a lot of discussions about the types of changes that want to be made. In other countries, it is

often hypothesized that the demands of supermarket procurement means that smaller, poorer, more remote farmers will be left out in favor of larger farmers that are closer to cities, producers that are better able interact with the procurement firms that are making new and stringent demands on buyers. Interestingly, while we do see increasingly specialization, the specialization has been taking place mostly in the poorer, more remote areas. Unfortunately, our survey data did not include questions on channels of procurement so it is unclear if the rise in specialization is a response to the rise of traditional wholesale markets or the rise of supermarket-driven procurement.

V. Conclusions

In this paper, we have shown the rapid transition that China's economy has made in the past several decades. Production has shifted from a Socialist economy based of commune and team farming to a smallholder, individual farming mode of production. Prices have been transformed from accounting-based numbers to values determined by supply and demand which in many cases reflect the scarcity value of the resource. There has been in a number of ways a steady improvement in agricultural commodity markets that has occurred in China during the past decade. Regardless of using descriptive statistics or more formal techniques, our results are consistent with the emergence of a small holder-based set of markets for almost all commodity. Moreover, markets are robust, even when looking across long distances and at different time periods. Transaction costs also appear to have continued to fall.

Although people that visit rural China are not surprised, such a picture of markets may be surprising when juxtaposed against the policy background. During this period when we have measured the steady increase in performance of markets, there has been a unbroken cycle of reform and retrench. Hence, despite attempts to slow down or stop the operation of markets during this time commodity markets have steadily strengthened in rural China.

The power of markets to continue to integrate despite policy intervention attempts perhaps more than anything shows the power of China's gradual method of transition. As argued by McMillan (1997), China's market reform has really been one of entry-driven competition. In case of China entry has come from both the commercialization of the state and the emergence of a private trading sector. In doing this, China enfranchised millions of individuals to be involved in commodity trade. While this has produced the rise in integration and fall in transaction costs that has been documented in the paper, it also has eroded the power of the state to control the markets with the traditional command and control methods. Our results suggest that if the nation's leaders want to control markets in the future, they are going to have to devise new ways to intervene, ones that use indirect methods instead of trying to suppress traders. There are now just too many traders to deal with as shown by the integration trends that continued to increase even when the nation tried stop trading.

Indeed, one of the real lessons of our work is that both China's leaders and domestic and foreign traders and other observers should realize that rural China now has among the

least distorted and most integrated agricultural markets in the world. Of course, for poverty alleviation and other purposes this is often a two-edged sword. However, with good markets, if policy makers make good investments and execute good policies, those that are involved with the production and consumption activities will benefit and such policies can be executed with a minimum amount of distortion.

Need for Institutions to Assist Farmers in a Market-Driven World

Although well-functioning markets are valuable to farmers, they also can be a two-edged sword. When markets become competitive, they compete returns to factors down to their long-run scarcity values. In China's agriculture, of course, this means that although returns are be low for the typical farmer since land holdings are so low for the scarce commodities, and the returns to labor are so low, because farmers are endowed with so much labor. As a consequence, it is important to try to develop ways that farm households are better able to take advantage of marketing opportunities and capture more of the value-added supply chain.

In a modern society which is dominated by markets and assets and information are mostly in the hands of private individuals and enterprises, the government is going to be unable to look out for the needs of farmers, especially in the pursuit of farm production and marketing activities. Hence, the government needs partners to carry out its task of trying to ensure farmers can make a living from agriculture in an economy dominated by markets. This is especially true when farmers have little land and a lot of labor and markets function well. Acting together in some cases can allow individual farmers to overcome the high costs of technology acquisition and marketing. As such it is important at this point of its development that China begins to encourage the development of truly independent non-state organization, including those organizations that will act as information networks, business support groups, marketing systems and credit cooperatives. In looking at the experience of Japan, Korea and Taiwan, the rural economy in China is in need of the emergence of active and strong Farmer's Professional Association (FPAs) to help the rural population carry out a number of the productive and consumption-oriented activities that are needed for rapid growth. This role, however, needs to be understood because of the pervasiveness of markets and the rise of institutions, such as supermarkets, that potentially could radically change relative prices faced by farmers as well as access to marketing channels.

Surprisingly, although the role of FPAs in rural China is beginning to be discussed again in academic and policy making circles, such institutions in China are still relatively low profile and little is known about them. It has been stated that there are more than 100,000 farmer associations in China (World Bank, 2003). The Ministry of Agriculture claims that the current association includes millions of farmers (Zhou, 2003). The source of these numbers, however, is unclear. Any numbers that are reported also have to be treated with caution since the structure of most is still ill-defined and there are no standards on which reports from FPAs are based..

To overcome the absence of information on such a key part of China's future development process, the main goal of this section is to report on the results of a survey

designed to provide a picture of the current status of FPAs in China. In this section, we try to establish a baseline of the size of the FPA movement in China, its rate of growth and the scope of their activities and seek to find what factors are inducing the emergence of FPAs.

Data. Our analysis is based on a unique set of data on the institutions and development investments in rural China collected by the authors in 2003 (detail can be found in Shen et al., 2004). The survey covered 6 provinces and 36 counties in a nearly nationally representative sample. The sample provinces were each randomly selected from each of China's major agro-ecological zones. In total when visiting 36 counties, our enumerator teams visited 216 townships and surveyed 2459 village leaders.

After answering questions about the economic, political and demographic conditions of their villages in 1997 and 2003, the respondents answered a set of 25 questions about the activities of FPAs (if there were any) that were operating in or around their villages. The questionnaire was designed to elicit information about the size of the association, its coverage, its main functions, information about its charter, registration rules and internal organization. The survey also included a section that attempted to understand how the actions of government agencies affected the start up of the associations.

Farmer's Professional Associations in China. Although the sample size was relatively small (only 0.35 percent of China's villages), with a number of assumptions the random nature of our sample allows us to make an estimate of total FPA activity in China. When we account for the probability of observing each of our villages according to their population proportion (that is weighting our descriptive statistics by the sizes of the population of township, county and region of each observation), our survey finds that 10.2 percent of China's villages have FPAs (Table 6, column 1, row 1). Using the weighted statistics and extrapolating from our sample to the rest of China, we estimate by about 75 thousand villages at least nominally have FPAs. About 6.93 million households, nominally have an association with an FPA (row 2). Interestingly, these numbers of unqualified FPAs are surprisingly close to the figures reported by the Ministry of Agriculture which has reported during various speeches and interviews that about 100,000 villages had FPAs, which includes 4 to 5 percent of China's households. Many FPAs also are found to be fake, set up by either leaders or entrepreneur.

In studying FPA (which we do in our other work—Shen et al. 2005), there are a number of findings and implications of our work. FPAs do exist in China; however, they are still in a fairly early stage of emergence. Although the level of participation is low, in recent years the pace of emergence has risen rapidly and appears to be accelerating. We also find that although FPAs summarily are in richer villages, there are substantial numbers poorer areas. There is a non-linear relationship between income and FPA participation. There is correlation of FPAs and the distance from a major economic center. If households in more remote areas are going to start FPAs, they will require substantially more help than in the past.

It is difficult currently to determine what is aiding the emergence of FPAs and what is blocking their emergence. Interestingly, we find little spontaneous (or strong) relationship between specialization and marketization (for small businesses) and FPA emergence. It could be that our measures are just not very sensitive. However, it could be that the environment is such that household can not easily or spontaneously begin FPAs. If procurement channels of supermarkets are demanding specialization, it is unclear if FPAs will emerge in a way that will aid producers in those areas that need technical and marketing assistance.

On the other hand, the government clearly has a big influence on the emergence of FPAs—of all types. The pervasiveness of government influence may mean that they have been a disruptive force (since many do not function) or it may mean that FPAs need the government to initiate them. Such a finding may mean those in charge of the rural economy may consider to adopt a system like that used in other countries in which government employees are hired with the explicit job to be an advocate for the starting and operating of FPAs. Such an official would be rewarded to the rapid expansion of FPAs as long as they developed in a way that were pro-farmer and positively affect rural welfare.

Although the impetus to meet and act as a group must be from the farmers themselves, the government can create an environment in which FPA can thrive. *First*, leaders need to develop laws and regulations that promote and protect FPA. The legal status of groups needs to be clear. FPA need to have the ability to enter into contracts and take loans. Also beneficial would be regulations that enable farmers to organize themselves into locally-run credit cooperatives. FPA need the authority to be able to act for the members of their group as well as to be subject to well-designed regulations that protect the membership from the leadership, including the way in which the leadership is selected and monitored. FPA leaders tell us the lack of formal, annual membership fees is hurting their efforts to expand, since every effort to act as an FPA often must be accompanied by an assessment of fees on members.

Finally, the experience of FPA in other countries has shown that even when a favorable legal and regulatory framework exists, an independent catalyst (that is, someone or group outside the government) is often needed to get FPA started, expand and perform better. While China has a number of FPA-promoting agencies, these institutions are controlled by the Government. Alternative models should be sought to create catalysts that are first and foremost responsive to the needs of farmers' and FPAs. The main role of such an advocacy organization is not to control FPA, but to facilitate their creation and provide information that allows its members to promote the interest of the association. This imperative to develop FPAs, of course, is connected closely with the changes that are occurring to the marketing supply chain. As supermarkets emerge further and change the way people buy food and begin to send different signals to the market, it will be even more critical to give farmers a platform from which they can confront the growing market.

Table 1. Percentage of market pairs that test positive for being integrated based on Dickey Fuller test in Rural China, 1988 to 2000.

Commodity	1989-1995	1996-2000
Maize	28	89
Rice, Yellow River Valley (mostly japonica rice)	25	60
Rice, Yangtze Valley and South China (mostly indica rice)	25	47

Sources: Park et al. (2002), Rozelle et al., 2003 and Huang et al., 2003.

Table 2. Cointegration tests on Northeast maize production and major consumption markets with Dalian market

Dalian with major maize markets in Northeast China, 1998-2003		Dalian with major maize consumption provinces, 1999-2003	
Market	Test statistics	Market	Test statistics
Center Heilongjiang	-3.34**	Hubei	-2.46*
East Heilongjiang	-3.49**	Jiangsu	-2.71*
West HLJ/Dalian	-3.16**	Fujiang	-5.09**
Center Jilin	-3.49**	Guangdon	-6.15**
East Jilin	-3.24**		
West Jilin	-3.33**		
Center Liaoling	-3.98**		
West Liaoning	-3.84**		

Notes: Augmented Dicky-Fuller test was implemented over the pair markets, * and ** represent 5% and 1% significant levels. The first 2 columns are based on a weekly price series between August 10, 1998 and February 24, 2003, the last 2 columns are based on monthly price series at the provincial level from 1999 to 2003.

Table 3. Percentage of villages and sown area with specialization by region.

	Percentage of villages[a]		Percentage of sown area[b]	
	1995	2004	1995	2004
Average	21	30	14	24
Hebei	18	19	20	24
Henan	22	23	4	9
Shanxi	51	74	11	22
Shaanxi	4	5	23	32
Inner Mongolia	9	17	38	40
Liaojing	15	32	13	29

[a].Villages are counted as "specializing" if they answered "Yes" to the question: "Are farmers in your village specializing in any particular crop or livestock commodity?

[b] Only including sown area of villages that specializing in crop sectors.

Source: Author's survey, 2004

Table 4. Percentage of villages and sown area with specialization by income, distance to county seat, and possession rate of telephones.

	Percentage of villages		Percentage of sown area	
	1995	2004	1995	2004

Richest 25%	14	28	14	28
Poorest 25%	18	23	8	22
Closest to county seat 25%	24	33	22	28
Further to county seat 25%	20	43	8	28
Higher percentage of households with telephones	22	25	17	24
Lower percentage of households with telephones	15	26	10	29

Source: Author's survey, 2004

Table 5. The development of supermarkets in China, all chains, 1994-2002.

Year	Stores		Sales		
	Number	Annual increase (%)	US Dollars (billions)	Annual increase (%)	Share in total national retails (%)
1994	2500	-	0.4	-	0.2
1995	6000	140	1	167	0.4
1996	10000	67	4	275	1
1997	15000	50	5	40	2
1998	21000	40	12	138	3
1999	26000	24	18	50	5
2000	32000	23	26	47	6
2001	40500	27	37	40	8
2002	53100 *	31	55	49	11

Source: CCFA, 2003

Note: Dollars were calculated from the RMB with exchange rate at 8.3 RMB per dollar during 1994-2004.

Table 6. Percentage of villages and farm households participated in Farmer's Professional Associations (FPAs) in China, 2003.

	Total FPAs	Formal FPAs	Functional FPAs
Percentage of villages	10.2	7.5	7.5
Percentage of households	2.9	1.8	2.1
Proportion of FPAs in different income quartiles			
Less than 900 yuan	26	22	21
901 to 1580 yuan	15	14	15
1581 to 2430 yuan	21	23	24
Greater then 2430 yuan	39	41	40
Total	100	100	100

Note: total FPAs include all reported FPAs without any qualifications. Formal FPA's is a term that designates FPAs in villages that meet three of the four criteria, including being registered, being chartered, having formal membership requirements and/or charging annual fees. Functional FPA's is a term that designates FPAs in villages that meet three criteria, including *not* being registered as a commercial entity in Marketing Administration Bureau, *not* being mainly set up to run a commercial business and *not* being dominated by a government official in the making of major decisions.

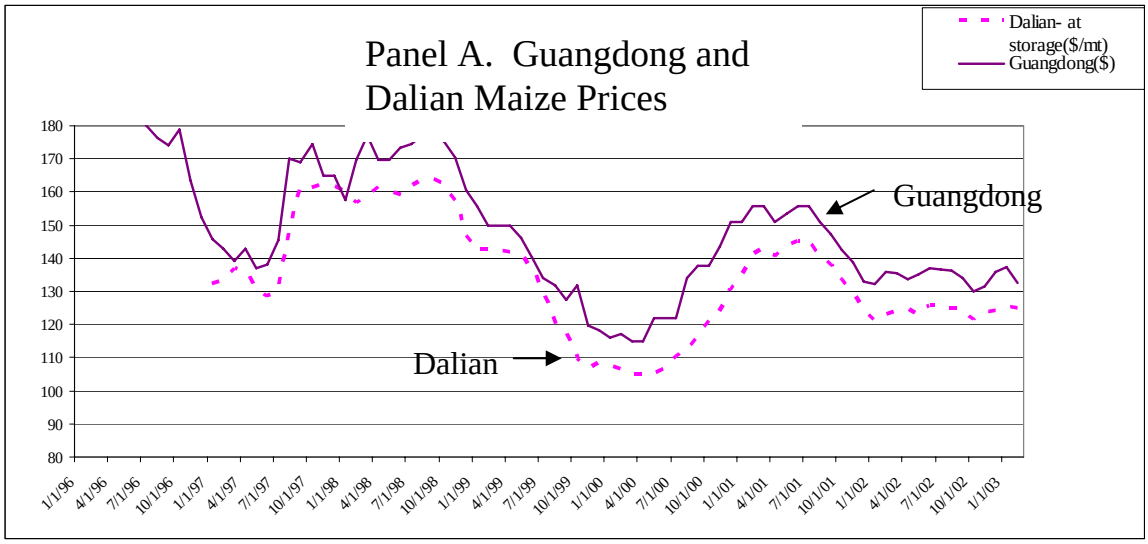
Source: Shen, Rozelle, Zhang, and Huang (2005).

Table 7. The number of FPAs established in the sample areas, 1980 to 2003.

	Number	Cumulative percentage
1980	1	0.3
1986	1	1
1990	5	2
1991	1	3
1992	4	4
1993	2	5
1994	15	10
1995	4	11
1996	6	13
1997	9	17
1998	38	30
1999	42	44
2000	28	54
2001	55	73
2002	52	91

2003	27	100
Total Number of FPAs	290	100

Source: Shen, Rozelle, Zhang, and Huang (2005).



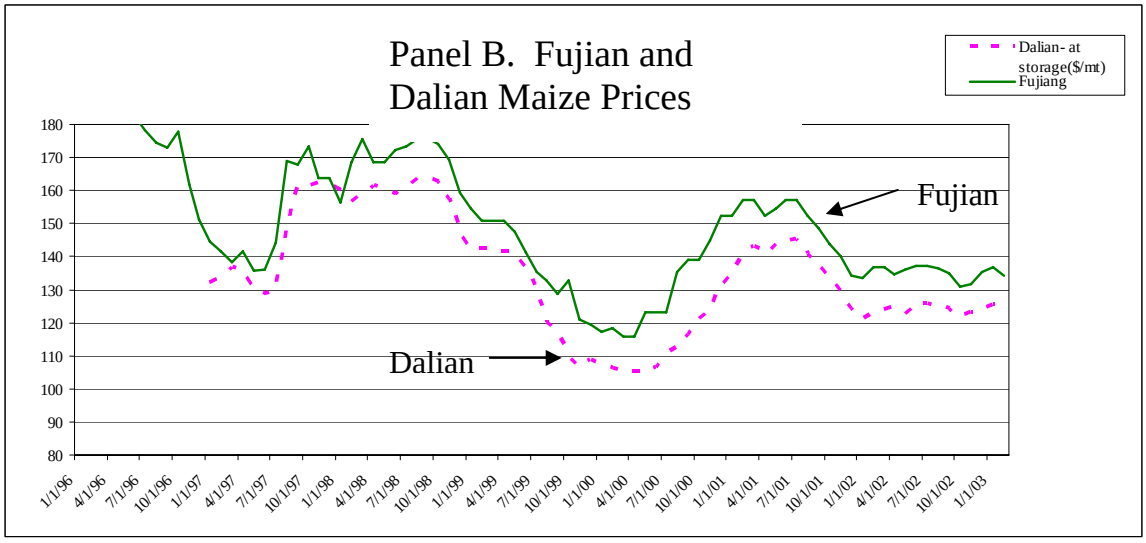


Figure 1. Maize prices in Guangdong, Fujian and Dalian (RMB/mt), 1996 to February 2003

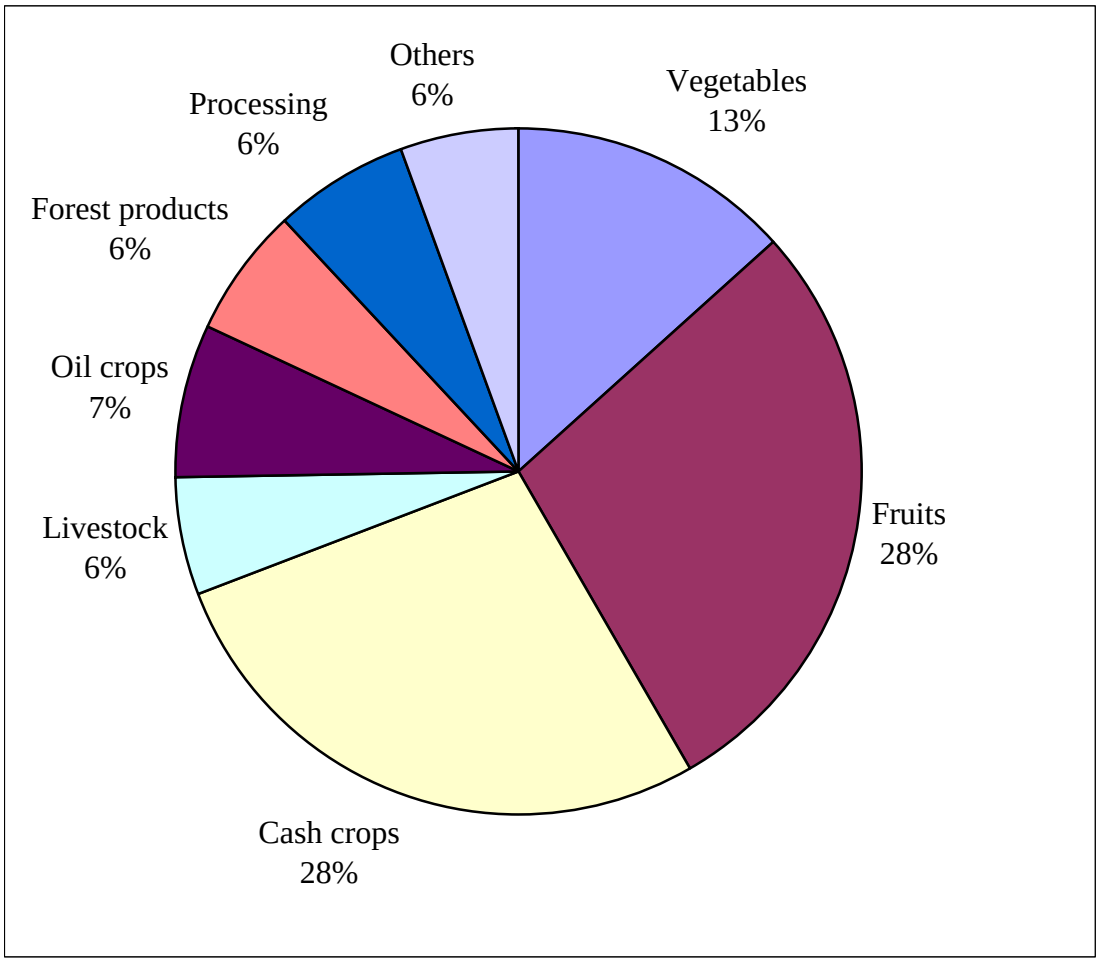


Figure 2. The composition of rural China's specialized crops and livestock commodities in 2004.

Source: Authors' survey.

Appendix Table 1. Documentation of villages that specializing in specific commodities

	1995	2004
Fruits	35	46
Apples, cherries, plums, pear and pomegranates	19	21
Dates	8	9
Peaches and apricot	4	6
Grapes	4	5
Oranges	0	1
Other miscellaneous fruits	0	4
Vegetables	29	34
Mushrooms and other fungi	11	7
Cucumbers, tomatoes and eggplant	6	7
Chilly peppers, sweet peppers and radishes	4	6
Celery, chives and green onions	3	2
Carrots, cabbage and cauliflower	2	4
Potatoes and lotus roots	1	3
Other miscellaneous vegetables	2	5
Cash crops	20	49
Floral products and herbal medicines	2	27
Mulberry trees/silk cocoon rearing, tea, tobacco, cotton	7	12
Sugar cane, tobacco and cotton	11	10
Forest products	10	15
Chestnuts, walnuts, and hazelnut	6	10
Other miscellaneous oil-bearing trees	4	5
Oil crops	9	11
Peanuts	4	5
Sunflower seeds	3	4
Sesame	2	2
Livestock	6	12
Beef cattle	3	4
Dairy cows	1	2
Apiculture	1	1
Goats	1	2

Poultry	0	3
Others	2	2

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