

Regoverning Markets

Small-scale producers in modern agrifood markets

Agrifood Sector Studies

Restructuring agrifood markets in China: The horticulture sector (A)

Jikun Huang, Xiaoxia Dong, Yuhua Wu, Huayong Zhi,
Xianfang Nui, Zhurong Huang, Scott Rozelle

Center for Chinese Agricultural
Policy, Chinese Academy of
Sciences / Stanford University

**Restructuring agrifood markets in China:
The horticulture sector (A)**

**Jikun Huang, Xiaoxia Dong, Yuhua Wu, Huayong Zhi,
Xianfang Nui, Zhurong Huang
Centre for Chinese Agricultural Policy, Chinese Academy of
Sciences**

**Scott Rozelle
Stanford University**

2007

Regoverning Markets

Regoverning Markets is a multi-partner collaborative research programme analyzing the growing concentration in the processing and retail sectors of national and regional agrifood systems and its impacts on rural livelihoods and communities in middle- and low-income countries. The aim of the programme is to provide strategic advice and guidance to the public sector, agrifood chain actors, civil society organizations and development agencies on approaches that can anticipate and manage the impacts of the dynamic changes in local and regional markets.

Agrifood Sector Studies

These studies look at specific agrifood sectors within a country or region. Research studies have been carried out in China, India, Indonesia, Mexico, South Africa, Turkey, Poland and Zambia, covering the horticulture, dairy and meat sectors. Part A of the studies describes the observed market restructuring along the chains. Part B explores the determinants of small-scale farmer inclusion in emerging modern markets. Using quantitative survey techniques, they explore the impacts on marketing choices of farmers, and implications for rural development.

The studies were coordinated by:

Jikun Huang, Center for Chinese Agricultural Policy (CCAP), China (contact:

jkhuang.ccap@igsnr.ac.cn)

Thomas Reardon, Michigan State University (MSU), USA (contact: reardon@msu.edu)

Other publication series from the Regoverning Markets programme

Innovative Practice

This series of country case studies provides examples of specific innovation in connecting small-scale producers with dynamic markets at local or regional level. Based on significant fieldwork activities, the studies focus on four drivers of innovation: public policy principles, private business models, collective action strategies by small-scale farmers, and intervention strategies and methods of development agencies. The studies highlight policy lessons and working methods to guide public and private actors.

Innovative Policy

These are short studies addressing a specific policy innovation in the public or private sector that improves the conditions for small-scale producers to access dynamic markets at national, regional and global level.

Country Studies

These provide a summary of market changes taking place at national level within key high-value agrifood commodity chains.

Policy Briefs

These are short policy-focused summaries targeted at each stakeholder group.

Further information and publications from the Regoverning Markets programme are available at: www.regoverningmarkets.org.

The authors:

Jikun Huang, Xiaoxia Dong, Yuhua Wu, Huayong Zhi, Xianfang Nui, Zhurong Huang
Center for Chinese Agricultural Policy, Chinese Academy of Sciences

Scott Rozelle
Stanford University

Acknowledgments:

Funding for this work was provided by:
UK Department for International Development (DFID)
International Development Research Centre (IDRC), Ottawa, Canada

The views expressed in this paper are not necessarily those of the funding agencies.

Citation: (2007), Jikun Huang, Xiaoxia Dong, Yuhua Wu, Huayong Zhi, Xianfang Nui, Zhurong Huang, Scott Rozelle (2007) *Restructuring agrifood markets in China: The horticulture sector (A)*, Regoverning Markets Agrifood Sector Studies, IIED, London.

Permissions: The material in this report may be reproduced for non-commercial purposes provided full credit is given to the authors and the Regoverning Markets programme.

Published by:

Sustainable Markets Group
International Institute for Environment and Development (IIED)
3 Endsleigh Street
London WC1H 0DD
www.iied.org
Tel: +44(0)20 7388 2117, email: regoverning.markets@iied.org

Cover design: smith+bell

Contents

Summary	1
Main Findings	2
1. Introduction	4
1.1 The role of the agricultural economy	4
1.2 Important agrifood sub-sectors	5
1.3 Study objectives and key research questions	7
1.4 Organization of the report	9
2. Data	10
2.1 The five data sets	10
2.2 Why tomatoes and cucumbers?	14
3. Changes in national and regional food systems in China: wet markets, supermarkets and wholesaling	15
3.1 Evolution of China's markets: the national picture.....	15
3.2 Changing markets within major consuming and producing regions: the meso view.....	18
3.3 Supermarket procurement: the meso view	20
3.4 Commodity-specific marketing channels: tomatoes and cucumbers in Beijing and Shandong Province	23
3.5 Drivers of change	24
4. Production and marketing changes in Chinese villages	26
4.1 Nature of the study sites	26
4.2 Trends and constraints in production and input.....	27
4.3 Marketing channels in the horticulture economy: incentives, institutions, infrastructure and constraints.....	32
5. Summary and implications	35
References	38

Summary

In this report, we seek to meet the specific objectives of the first two modules of the first component of the Regoverning Markets programme. The key goal of Component 1 in China is to prepare evidence-based policy advice concerning the implications and opportunities for vegetable producers during a boom in demand for horticultural produce and a restructuring of upstream markets. Therefore, the research in Component 1 concentrates on identifying the determinants and consequences of restructuring the horticulture sector in China. The analysis is conducted on three levels: macro (policy issues and the national business environment), meso (the different chain segments and villages) and micro (household level). Due to space limitations and the timing of the research, the linkages between the first two levels are analysed in this paper. The micro study will be conducted in the upcoming phase.

The research for this report is structured in two modules: a) the national meso level and b) the local meso level. Module 1 identifies the key policy issues, broad vegetable supply chain issues and key stakeholders, setting the stage for the analysis in Modules 2 and 3. The goal of Module 1 is to analyze the evolution of China's restructured supply chain at the national level over the past ten years or so. Against this background, Module 2 presents a more in-depth study of the changes resulting from the restructuring of China's rural communities and markets. This research will provide the context for the forthcoming micro-level study in Module 3. The main focus of the research based on Module 2 is how market supply chains are operating and evolving in villages, wholesale markets and supermarkets.

The main questions answered in Modules 1 and 2 of this survey of the horticulture industry in China are:

1. What is the nature of the restructuring of the food industry in general?
2. How have changes affected the most downstream (retail) segments?
3. Has the composition of markets in the downstream segment of supply chains changed?
4. What is happening to the middle segments of supply chains – the wholesale markets?
5. Is there any evidence of change in wholesale markets?
6. Are most of the changes between traders in the wholesale markets and downstream actors, or between traders in the wholesale markets and upstream actors?
7. Is there any evidence of innovative institutions in China's downstream supply channels?
8. What are the drivers of these changes, or the forces that keep traditional institutions in place?

9. What are the trends among farmers trying to enter the horticulture market, and what constraints do they face?
10. Are there any marketing constraints keeping farmers out of horticulture markets?
11. What are the technological, managerial, and organizational practices/behaviour associated with farmers' choice of market channel?
12. What are the interactions between the market and production practices among producers and local food industry segments, labour, land and other inputs and financial services markets?

Main Findings

The main findings in this report are summarized below:

- Upstream segments of the marketing chain have evolved dramatically in the past 20 years as the basis of the food system in China has shifted from food rationing in the cities to wet markets and small shops. China now has the fastest growing supermarket and food sectors in the world, and is an exporter of horticultural commodities. It should be noted, however, that the retail sector is very competitive.
- Midstream, the wholesale sector is also evolving in some fundamental ways, although less rapidly than the retail sector. The number of wholesale markets has not risen very fast, but they are getting bigger, particularly the key players. In addition to this consolidation, there is evidence of specialization and the emergence of markets dedicated to providing more high quality products. The nature of the actors involved is also changing, as the previously predominant small traders are joined by an emerging set of more permanent small and large wholesalers. Some of the latter have formal and informal ties with supermarket chains, although it should be noted that even the large wholesalers are relatively small, and markets are very competitive, with literally thousands of actors. On the buying side there has been much less change: most goods are still bought directly from farmers by the employees or agents of small trading firms and wholesalers, or from farmers selling their commodities in markets.
- The main drivers of this evolution are rising incomes, urbanization and the liberalization of the domestic market and international trade. China's markets are being driven by rapidly growing demand in an unregulated environment that allows for easy entry at all levels of the marketing chain.
- At the village level, we find that fruit and vegetable production is increasing rapidly, in line with national trends. The meso-level data reveal that most of the net increase in production of the commodities targeted by our case study, tomatoes and cucumber, is due to new producers rather than expansion by existing producers.

- Production is extremely small-scale, and most of the perceived production constraints are related to the market (unprofitability and more lucrative options in the labour markets). There are few regulatory, institutional or physical constraints.
- Marketing is dominated by farmers selling to small traders and small wholesalers. As with the national meso-study, there is no penetration of new retailing institutions. Buyers play no role in providing technology, inputs, technical advice or credit; there is no formal contracting; and there are few constraints apart from the poor information and high transaction costs that are primarily associated with the small size of farms in China.
- In such an environment, small farmers dominate. We see that there is no real difference in the nature of the production and marketing constraints facing poor or remote farmers. As already noted in previous work (quoted in the paper), poor farmers benefit and horticultural crops make a positive contribution to poor people's incomes.

There are a number of tasks facing policy-makers in such an environment. Although markets at all levels are competitive and small farmers are helping provide food for cities in an efficient and inexpensive way, in the coming years China will face considerable challenges in meeting the growing demand for food safety. On the production side, policy-makers may need to consider appropriate policy instruments that can foster cooperatives and focus on producing safer pesticides. Regulating the production and import side of the pesticide industry may be the best way of cleaning up vegetable production.

Policy-makers also need to address the most critical aspect of marketing constraints: how to get better information to farmers. This is not going to be easy, as it will require more programmes on cable TV and radio providing up-to-date, detailed and unbiased price data. Forecasting supply and making recommendations will be difficult, if not impossible. Although farmers have not complained about horticultural crops becoming unprofitable due to over-supply, more information on the total area planted and year-on-year changes would be welcome and might help academics begin an annual update of the state of the economy for major commodities. Cooperatives could help overcome high transaction costs in certain cases; but overall, it is essential to continue monitoring the situation to ensure that there is fair access to markets.

1. Introduction

1.1 The role of the agricultural economy

Table 1 shows that average annual growth rates for the agriculture sector stayed at about five per cent throughout the entire reform period. As this sector grew more slowly than the rest of the economy, the more rapid expansion of the industrial and service sectors during the reform era changed the basis of the rural economy from agricultural to industrial production.

Although its contribution to national economic development has declined over the last 50 years, agriculture is still significant in terms of gross value added, employment, capital accumulation, urban welfare, foreign exchange earnings and poverty alleviation (see Table 1, row 1). Before 1980, agriculture accounted for over 30 per cent of national GDP and half of China's export earnings. By the mid 1990s, its share in the economy and total exports had fallen to below 20 per cent (NSBC 2001), and by 2000 it accounted for only 16 per cent of GDP. A similar shift can be seen in the figures for employment (CNSB 2005), as the number of people employed in agriculture fell from 81 per cent in 1970 to 50 per cent in 2000. This sharp shift in the structure of employment also shows that China is moving from being a predominantly rural society to an urban one. Furthermore, although the growth rate of agricultural trade rose in the 1980s and has remained high since 2000 (see Table 1, rows 5 to 7), it is still declining as a share of total trade (Huang, Otsuka and Rozelle 2006). Imports and exports are rising at more or less the same pace.

It is common to see the importance of agriculture decline in developing economies. China is a densely populated country, where farm sizes averaged less than one hectare as early as the 1950s. Population growth and limited land resources will shift its comparative advantage from land-intensive economic activities like agriculture to labour-intensive manufacturing and industrial activities (Anderson 1998).

Performance of the agricultural sector

One of the main accomplishments of China's development and national food security policies has been the growth of agricultural production since the 1950s (Huang, Rozelle and Otsuka 2006). Apart from the famine years of the late 1950s and early 1960s, production growth rates have outpaced the rise in population (Table 1, column 1).

After 1978, decollectivization, price increases and the relaxation of trade restrictions on most agricultural products helped fuel the take-off of China's food economy.

Between 1978 and 1984, grain production increased by 4.7 per cent per year and fruit output rose by 7.2 per cent (see Table 1, column 2). The oilseed, livestock and aquatic product sectors grew most rapidly, respectively expanding in real value by 14.9 per cent, 9.1 per cent and 7.9 per cent.

However, the growth of the food and agriculture sectors decelerated in the mid-1980s, once the one-off gains in efficiency derived from shifting responsibility for food production to households were played out (Table 1, columns 3 to 6). The slowdown was most pronounced for grain crops, whose growth rates fell below those of the pre-reform and early reform periods, even though production of rice, other grains and cash crops continued to expand after 1985. In the meantime, rapid economic growth, urbanization and the development of the food market have boosted demand for meat, fruit and other non-staple foods. These changes have stimulated sharp shifts in the structure of agriculture (Huang and Bouis 1996; Huang and Rozelle 1998). For example, the share in the value of livestock output more than doubled from 14 per cent to 30 per cent between 1970 and 2000; and that of aquatic products rose even more rapidly. One of the most significant signs of structural change in the agricultural sector is the reduced share of cropping in total agricultural output, which fell from 82 per cent to 56 per cent.

Within the cropping sector, the importance of the three major crops, rice, wheat and maize, has waxed and waned. The share of major cereal grains increased from 50 per cent in 1970 to a peak of 57 per cent in 1990, and then gradually declined to less than 50 per cent in 2001 (NSBC 2002). Most of this decline is due to a reduction in the amount of land under wheat. The area share of rice declined marginally, while the sown area of maize grew by about 50 per cent between 1970 and 2000. There is a correlation between this rise in maize, China's main feed grain, and the rapid expansion of livestock production in China during the same period. In fact, the pace of growth is so fast, especially compared to rice, that maize will soon become China's largest crop in terms of both sown area and production.

In addition to this increase in land under maize, other cash crops such as edible oil crops, sugar and tobacco have also expanded. In the 1970s, the area share of edible oil grew by two to three hundred per cent. Field interviews reveal that poor people are more reliant on cropping for their livelihoods than on livestock and fishery. Within the cropping sector, poorer farmers produce more grain (particularly maize) than cash crops. These figures may indicate that the poor benefited less than better-off farmers from the diversification of agricultural production during the reform period.

1.2 Important agrifood sub-sectors

While China's entire agricultural economy has performed well in terms of growth over the past two decades, this study will focus on vegetables because of the particularly rapid increase in vegetable production. China's producers responded to the rise in consumer demand and new policy environment in a way that would have been difficult to predict, increasing the sown area of vegetables by more than eight million hectares (or 20 million acres) between 1990 and 2000 (see Figure 1, Panel A). The area under vegetable production more than doubled during this time. In fact, as Figure 1 shows, the amount of land in China under vegetables increased so fast that it grew by an area equivalent to California roughly every two years. Production of almost every major type of vegetable crop increased, with the area under tomatoes and garlic, for example, nearly trebling during the 1990s.

Although most producers still invest very little in their farms, investment is increasing as production rises, especially in greenhouse technologies. Field visits revealed a huge range of technologies in terms of sophistication: from the many dirt-wall-backed structures covered with cheap plastic and warmed by coal-burning pot-bellied stoves, to the less common state-of-the-art, integrated climate-controlled greenhouse facilities.

Similar shifts can be seen with fruit (see Figure 1, panel B). The area under fruit almost doubled from about 5 million hectares in 1990 to nearly 10 million hectares in 1995. Growth slowed down the late 1990s, when farmers began to invest in upgrading their orchards through grafting, pulling and replanting, and improved agronomic care. Although China is known as a country that is short of land and which has tended to plant grain above any other crops, on a percentage basis it allocates a far greater share of land to fruit than any other major country: over five per cent, compared with two per cent in the US and the EU, for example. However, while it is important, fruit plays a secondary role in our study.

Specialization in China's villages

Few authors have attempted to quantify the gains from market liberalization. This may be due to the short period covered by analyses, and the inability of standard methodologies, measures and indicators of market liberalization to separate the efficiency gains of market reform from overall gains in the reforming economy. In the literature on this topic, three papers claim to have empirically isolated the effect of liberalization reforms on the emergence of markets and productivity of farmers. In deBrauw et al. (2004) it is shown that increasing marketization has a positive effect on productivity, and other authors have found similar results (Lin 1992; Fan 1997). All three of these papers conjecture that such gains are partly due to increasing specialization, but give no empirical basis for this.

In order to try to understand whether or not specialization has occurred since the mid-1990s, when markets began to emerge, we conducted a nationally representative survey of 400 communities in 100 counties and six provinces. Community leaders were asked the following question with regard to 1995 and 2004: “Are farmers in your village specializing in any particular crop or livestock commodity?” If the answer was affirmative, we asked which commodity they specialize in; and if farmers in the community specialized in a cropping activity, we asked for the area sown to the speciality commodity.

The results of our survey show that specialization has been occurring in China’s agricultural sector, with the percentage of villages specializing in an agricultural commodity increasing in every province since 1995 (see Table 2, columns 1 and 2). On average, 30 per cent of villages in China were specializing in 2004, up from 21 per cent in 1995. Although the percentage of villages that specialize has risen in every sample province, some (such as Liaoning, Inner Mongolia and Shanxi) have risen faster than others (Hebei, Henan and Shaanxi). The share of land sown to speciality crops also rose across our sample average, from 14 per cent of the total sown area in 1995 to 24 per cent in 2004 (columns 3 and 4). Over half of the specialization has been in villages that specialize in vegetables. 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 increase in specialization.

There are several reasons to focus on the horticultural economy, in addition to its rapid growth. First, it is part of the ongoing structural transformation of rural China as the nation shifts from primarily grain-based agriculture to agriculture that is more consistent with its comparative advantage. Second, the vegetable sector is highly commercialized, and will make a good case study to examine the penetration of markets into rural China after decades of Socialism. Third, the restructuring of the downstream part of the food economy makes it particularly interesting to examine what is happening with vegetables. In the rest of the world, there is considerable controversy over who will produce the fruit and vegetables that will be sold to consumers in new retail formats. Will it be the large, better-off farmers, or the smaller, poor farmers who benefit? A fourth, related reason, is that studying the vegetable economy in China may allow us to look at changes in the mid-stream stages of the marketing supply chain—i.e., the wholesale market, since supplying Beijing’s horticultural needs may require a fair bit of bulking and breaking to get vegetables from tens of millions of farmers to hundreds of millions of consumers.

1.3 Study objectives and key research questions

It is important to understand the marketing supply chain of vegetables from field to plate, given the rapid and dynamic growth of horticultural crops in the Chinese

economy, their significance in farmers' portfolios, their place in China's export schedule and their priority in consumer diets. This understanding will allow policy-makers to make better decisions in their efforts to improve vegetable production, boost exports and provide consumers with a safe, inexpensive and reliable supply.

In order to meet this overall goal, we need to achieve the specific objectives of the first two modules of the first component of the Regoverning Markets programme. The key goal of Component 1 in China is to prepare evidence-based policy advice concerning the implications and opportunities for vegetable producers during a boom in demand for horticultural produce and a restructuring of upstream markets. Therefore, the research in Component 1 concentrates on identifying the determinants and consequences of restructuring the horticulture sector in China. The analysis is conducted on three levels: macro (policy issues and the national business environment), meso (the different chain segments) and micro (household level). Due to space constraints and the timing of the research, the linkages between the first two levels are analysed in this paper. The micro-study will be carried out in the forthcoming phase.

The research for this report is structured in two modules: a) the national meso-level and b) the local meso-level. Module 1 identifies the key policy issues, broad vegetable supply chain issues and key stakeholders, setting the stage for the analysis presented in Modules 2 and 3. The goal of Module 1 is to analyze the evolution of China's restructured supply chain at the national level over the past ten years or so. Having set the scene, the objective of Module 2 is to present a more in-depth study of the changes occurring within China's rural communities and markets due to restructuring. The research in Module 2 will also provide the context for the forthcoming micro-level study in Module 3. More specifically, the research based on Module 2 is primarily used to study how marketing supply chains are operating and evolving in villages, wholesale markets and supermarkets.

Modules 1 and 2 of this survey of the horticulture industry in China answer the following main questions:

1. What is the nature of the restructuring of the food industry in general?
2. How have changes affected the most downstream (retail) segments?
3. Has the composition of markets in the downstream segment of supply chains changed?
4. What is happening to the middle segments of supply chains – the wholesale markets?
5. Is there evidence of change in wholesale markets?
6. Are most of the changes between traders in the wholesale markets and downstream actors, or between traders in the wholesale markets and upstream actors?

7. Is there any evidence of innovative institutions in China's downstream supply channels?
8. What are the drivers of these changes, or the forces that keep traditional institutions in place?
9. What are the trends among farmers trying to enter the horticulture market, and what constraints do they face?
10. Are there any marketing constraints keeping farmers out of horticulture markets?
11. What are the technological, managerial and organizational practices/behaviour associated with farmers' choice of market channel?
12. What are the interactions between the market and production practices among producers and local food industry segments, labour, land and other inputs and financial services markets?

Therefore, the aim of Module 1 and 2 studies is to examine these questions in the context of China's horticultural sector, and the tomato and cucumber commodity markets in particular.

In answering these questions, several hypotheses will be tested:

- A. The rise of the Chinese economy, which triggered a boom in demand for fruit and vegetables, has changed markets in China.
- B. Changes in the downstream segments have been much greater than changes in the upstream segment.
- C. Due to the nature of markets and the production sector in China, intense competition is helping to shield farmers in the downstream segment from changing markets. In the context of an economy in which all farmers have land, this also means that there are few marketing constraints preventing farmers from participating in horticultural markets

1.4 Organization of the report

Section 2 describes the sources of our data and survey / interviewing techniques. The third section is divided into three parts. The first part, which is based on information from the national statistical compendium and interviews, presents a general picture of the restructuring of China's food marketing, and tries to understand how vegetables fit into the overall marketing equation. The second part, which is based on the meso-level surveys in Beijing's wholesale markets and supermarkets, Shandong wholesale markets and information on marketing from the village focus groups, seeks to provide a detailed picture of marketing channels in Greater Beijing (one of China's major municipalities) and Shandong Province (the primary province

for horticultural production). The third part briefly discusses the drivers of these changes. The fourth section, which is also based on the village-level surveys, examines four elements: a) trends in tomato/cucumber production; b) the constraints facing new producers of tomatoes and cucumbers; c) trends in marketing from the farmer's point of view; and d) constraints to farmers trying to market their tomatoes and cucumbers. The last section is devoted to discussing the implications of our findings.

2. Data

2.1 The five data sets

The data for this study come from five sources. Four of the data sets were collected by the project team for the Regoverning Markets study, so the only data derived from published statistics are those used to build up a picture of national supply chains over the past two decades. Most of these data are published in Chinese, in statistical compendiums that are available to the public.

We collected four sets of data for the meso part of the study, three of which relied on surveys and one on interviews. In August and September 2006, members of the project team visited six supermarket chains and interviewed managers of the vegetable and fruit procurement divisions to determine how they source their fruit and vegetables in general, and tomatoes and cucumbers in particular. As these interviews were conducted after the three meso-level studies had been completed and analyzed, we were able to show the procurement managers data from our studies and demonstrate our understanding of the marketing channels in Beijing and Shandong. In the past, when we did not have such information, managers usually told us that most of the produce came from their own farms. This time, however, when we broke down the marketing channels, we discovered that they actually had very few of their own production bases and were in fact buying from wholesale markets. They were able to tell us about the different types of wholesalers that were supplying them.

We conducted a wholesale market survey in the Beijing area to try to track the flows in and out of Beijing of fruit and vegetables in general, and tomatoes and cucumbers in particular. We began to select the sample by creating a map of all the wholesale markets in the Greater Beijing Area (Figure 2), based on interviews with traders in a number of markets we had visited on a pre-survey trip and additional information from experts in the Beijing marketing bureau. The map was checked with respondents, and considered complete when we were unable to identify any additional markets.

During the pre-test, we also collected information on the size of the markets. We discovered that Beijing has three large wholesale markets accounting for about 85 per cent of the volume of trade, and 37 small wholesale markets that account for the remaining 15 per cent. All the large markets are located in suburban areas outside the city. We divided the small markets into two groups: those inside the fifth ring road (city-centre or small urban wholesale markets), and those outside the fifth ring road (in the suburbs). We discovered that the volume of sales in the more numerous small urban wholesale markets (25 in total) was relatively low, compared with the substantially greater volume in small suburban markets. On the basis of this information, we estimated that the smaller suburban wholesale markets account for ten per cent of the volume of sales in Beijing, while the smaller urban wholesale markets account for only five per cent of overall sales volume. Therefore, the constructed totals for Beijing are weighted as follows: 85 per cent for large wholesale markets, ten per cent for small suburban wholesale markets and five per cent for small urban wholesale markets. Having established these weights, one of each of the three types of wholesale market was randomly selected for inclusion in our survey.

After choosing the sample markets, our project team enumerators visited each market and randomly chose a subset of traders to be interviewed. This was done by dividing the market into spatial sections and randomly selecting one trader from each section. We surveyed a total of 20 traders in the large wholesale market — ten selling tomatoes and ten selling cucumbers (Appendix Table 1), and 20 wholesalers in the smaller suburban and urban wholesale markets (ten in each market), again selecting 10 tomato wholesalers and 10 cucumber wholesalers. The survey was primarily concerned with the source and destination of their goods and the nature of their transactions: who purchased for them (members of their own firm, agents or traders in spot markets); terms of payment (credit, cash, etc.); and whether or not there was any contract.

In Shandong, we conducted meso-level surveys in villages to get a representative sample of the major tomato- and cucumber-growing villages in the province. The first step involved creating two sampling frames of county-level tomato production and county-level cucumber production to enable us to choose five sample counties for each crop (Figures 3 and 4). Using our knowledge of the total production environment for each crop in Shandong, we ranked all 140 counties in the province according to the level of crop-sown area per farm population, and retained the top 74 counties for each crop. These accounted for about 90 per cent of total tomato or cucumber production in Shandong province. We then divided these 74 counties into the following five groups: two high-production county regions, two medium-production county regions and one low-production county region. Ranking from high to low production, each production region accounted for about ten per cent, 15 per cent, 20 per cent, 25 per cent and 30 per cent of the rural farm population in the

74 sample counties. The next step was to randomly select one county from each of these five groups. The farm population in each set of counties provided the data for our weighting system, which is used to create point estimates for provincial averages (that is, the majority or 90 per cent of production villages) for the tomato and cucumber studies.

Once the sample counties were chosen, the next step was to select the townships. This was done through a similar stratified random process, although the number of towns differed according to the type of county: five townships were selected in each of the two high-production counties (two high-production townships, two medium and one low production); three townships were selected in each of the two medium-production counties (one high-production township, one medium and one low); and only two townships were selected in the low-production county (one high production and one low production). The survey teams visited a total of 18 townships for each crop.

Finally, after the sample townships were selected, a similar stratified random process was used to select villages. Three villages were selected in the high-production county and high-production township (one high-production, one medium production and one low-production village). Two sample villages (one high and one low production) were chosen in the high-production county medium-production township, the medium-production county high- and medium-production townships, and the low-production county high-production township. Only one village was selected from the low-production township for each county. Thus, for each crop, we interviewed a total of 35 villages (22 in high-production counties, ten in medium-production counties and three in low-production counties) in five counties and 18 townships. A schematic depiction of the county, township and village samples for each crop is shown in Appendix Figure 1.

Having collected the data on crop areas and farm population from all the sample villages, townships and counties, we could construct weights based on farm population in order to create point estimates of our variables that are representative of the province. The weight for k^{th} village in j^{th} township in i^{th} county, P_{ijk} , is defined as:

$$P_{ijk} = w_i \cdot w_{ij} \cdot w_{ijk}$$

Where w_i is the weight for i^{th} category county, its value equals the share of i^{th} category county's farm population in the total farm population of all the counties (74 counties in this study). The sum of w_i equals one. w_{ij} is the weight for j^{th} township in i^{th} county; its values correspond to the shares of the farm populations from j^{th} category of townships in i^{th} county. w_{ijk} is the weight for k^{th} village in j^{th} township in i^{th} county; its values correspond to the shares of farm populations from k^{th} category village in j^{th} township in i^{th} county. The sum of P over i , j and k equals one.

After choosing the villages, the enumeration team visited each community and ran two data collection activities. One enumerator conducted a two-hour, sit-down survey with the village leader, village accountant and a farmer with experience in vegetable production, to gather information about farming and the general economic characteristics of the village, and build up a profile of local markets and neighbouring marketing venues. Respondents also provided information on the history of horticultural production in the village, previous policy and other government-initiated efforts to extend fruit and vegetable production (including tomato and cucumbers) into the village. In general terms, the main task of the village leader survey was to create a set of data describing the production and marketing environment in which farmers from the village operate. We also asked the village leader, the accountant (typically a farmer, but not necessarily involved in horticulture) and the vegetable producer about the production technology and marketing channels for tomatoes and cucumbers. These data were primarily used as a check with which to compare the focus group data (described in the next paragraph).

We also ran a focus group for each crop (tomato and cucumber) in 20 of the 35 sample villages, to elicit information and opinions from farmers who are engaged or wish to be engaged in tomato and cucumber production. Of these 20 villages, 12 came from two high-production counties, six from medium-production counties, and two from low-production counties. Farmers were randomly chosen from a stratified sampling frame created using the village residency roll (a list of every household with land in the village). The exercise was designed to exclude village leaders and their family members, and generate three groups of farmers – the largest, medium-sized and smallest tomato/cucumber producers. A seven-person focus group was established, comprising two large-scale farmers, two medium-scale farmers, two small-scale farmers and one with no experience producing either tomatoes or cucumbers. As the majority of households involved in horticultural production spend most of their time living and working in the village, the attrition rate between sample selection and participation in the focus group was low (less than ten per cent).

Members of the team leading discussions with the focus group elicited a broad range of information on production, technology, marketing and constraints from respondents. This was recorded by second members of the team. Using a semi-structured set of interview questions to ensure that each group supplied information on the same set of topics, the focus group process provided detailed information about the history of tomato/cucumber production in the village, marketing history, choice of technologies and interactions with buyers and input suppliers. Group members were questioned intensively about marketing channels for produce, as we wanted to get as much information as possible about how farmers in the village typically market their output, and the nature of their buyers' customers. Asking

about the years 2000 and 2005 helped us understand any changes that had occurred in the marketing of horticultural produce at the village level in that period. Producers and non-producers of tomatoes/cucumbers were also asked a set of directed questions about constraints to participation in the horticulture sector.

Finally, the meso-level study included a set of interviews and surveys with traders in local wholesale markets. Our research with the Shandong village leaders and focus groups produced different results from two sets of village and household surveys conducted in Greater Beijing as part of another research project in 2005. The sources we interviewed reported that the vast majority of farmers took their horticultural produce to local wholesale markets and sold it to wholesale traders operating there. This type of marketing channel allowed us to conduct a follow-on survey of the second link in the supply chain, by interviewing traders in two representative wholesale markets. We chose one large cucumber market in Cangshan County and one large tomato market in Shouguang County for this survey (Appendix Table 1), interviewing a total of 25 traders in all – 15 cucumber traders in Cangshan County and five tomato and five cucumber traders in Shouguang County. The sample was selected in the same way as the sample for the Beijing wholesale survey, by spatially selecting a set of random traders, who were asked a set of questions about where their supplies came from, where they were sold on to and how they did business with their suppliers and buyers (terms of contract, etc.).

2.2 Why tomatoes and cucumbers?

Our choice of vegetables as the general area of study in the Regoverning Markets study is a natural one, given the rapid expansion of the vegetable sector after 1990 as the Chinese economy took off and the policy environment became less rigid (see section 3.5 below for more details on the drivers of change). The area planted to vegetables more than doubled in the 1990s, from 6.3 million hectares to 15.2 million hectares (Table 2b, column 2), increasing its share of the total cropped area from four per cent to nearly ten per cent (column 5 = column 2 divided by column 1). This trend continued after 2000.

Because the vegetable sector includes so many different varieties, we decided to focus on two commodities: tomatoes and cucumbers. This choice was based on two criteria. First, tomatoes and cucumbers are produced in every province of China, making the results of interest to policy-makers across the nation. Second, in the 1990s production of these two commodities increased even faster than the growth rates observed in the vegetable sector in general. While the total area under vegetables more than doubled (increasing by about 140%), the area under tomatoes and cucumbers rose by more than 500 per cent: from 0.2 to 1.0 million hectares under tomatoes, and 0.2 to 1.2 million hectares under cucumbers (see Table 2b, columns 3

and 4). By the year 2000, tomatoes and cucumbers accounted for 15 per cent of the total area under vegetables.

Interestingly, two factors slowed the growth of the area under tomatoes and cucumbers after 2000, although one of these did not reduce the volume of output (in terms of value or weight). First, while the total area under vegetables continued to grow (from 15 million hectares in 2000 to 18 million hectares in 2004; see Table 2b, column 2), the area under tomatoes and cucumbers levelled off (see Table 2b, columns 3 and 4). There are several reasons for this. One is the emergence of competing vegetable crops, as demand for other vegetables increased with rising incomes. Another is the boom in 'indoor' tomato and cucumber production since the late 1990s, as more and more farmers invested in greenhouse facilities that allow them to increase production on less space (producing two to three or more crops per year and achieving higher yields).

The same general set of criteria led us to choose Shandong province. First, vegetables are important there, and becoming increasingly so. Although it is just one of 30 provinces, and has only seven per cent of all the cultivated land in China (Table 2c, column 1), by the end of the 1990s Shandong accounted for more than 11 per cent of the total area under vegetables in China (column 2) — and certainly more of its production, given the relatively high yields in the province. More importantly, over time, its share of the total national area under vegetables has increased rapidly, from 5.7 per cent in 1990 to more than ten percent in the second half of the 1990s. Similarly, its share of tomato and cucumber production is even higher than its share of vegetable production (Table 2c, columns 3 and 4), and tomato and cucumber production also accounts for a greater share of the total crop area (Table 2c, column 6 and 7). In short, the choice of tomatoes and cucumbers was dictated by their pervasiveness across China, their importance and growth, and indications that the sector is dynamic (shifting from field-based to greenhouse-based production).

3. Changes in national and regional food systems in China: wet markets, supermarkets and wholesaling

There have been great changes in the downstream segments of the vegetable marketing chain over the past one or two decades, as is the case for many other sectors in China. These can be most succinctly summarized as changes in the number and size of marketing venues, and shifts in the composition of the different formats. We will look at two sets of data: national data from published sources, and regional data for two municipalities / provinces from our meso-level surveys.

3.1 Evolution of China's markets: the national picture

Between 1950 and 1980, China's economic development strategy was based on planning. The first ten years of the reform era launched by Deng Xiaoping in the early 1980s saw the economic landscape of China transformed by an explosion of market activity. Wet markets (or markets frequented by consumers who buy directly from farmers or small traders) increased rapidly between 1980 and 1990 (Table 3, column 4), when the total number of marketing venues nearly doubled from around 40,000 in 1980 to about 75,000 in 1990. Since the total value of exchange transactions rose even faster (by nearly 10 times, from 23.2 billion in 1980 to 213.2 billion in 1990 (Table 4, column 4, rows 1 to 3), the average value of transactions also rose in real terms. The number of markets and value of exchange transactions increased rapidly in both rural and urban markets (Tables 3 and 4, columns 5 and 6).

Although wet markets continued to grow in both number and size during the 1990s, the pace of growth decelerated (Tables 3 and 4, columns 4 to 6) as other marketing formats emerged. The number of wholesale markets more than tripled in the 1990s (Table 3, columns 1 to 3), and as with wet markets in the previous decade, they also became bigger as the value of exchange transactions rose even more quickly than the number of markets (with a 30-fold increase from \$11.4 billion to \$331.1 billion (Table 4, column 1, rows 3 to 13).

The rise of the supermarket

The 1990s also saw the emergence of supermarkets in China (Table 3, column 7). In fact, its very first supermarket was completed in 1990. This was the only one built that year, but construction gathered pace at such a rate through the 1990s that there were more than 32,000 supermarkets by the year 2000. As the volume of sales outstripped the rate of proliferation (Table 4, column 7), it became clear that the average size of stores was increasing along with the number of supermarkets.

China's rapidly shifting vegetable market entered a new phase after 2000, when the number of wet markets began to decline after constantly rising for two decades. The value of sales transactions in wet markets stagnated, especially in rural areas; while the value of sales in wholesale markets continued to rise and supermarkets expanded massively in terms of both number and sales value. Official statistics indicate that a fundamental shift is under way in the downstream segment of China's horticulture markets.

Despite the rapid rise of the supermarket sector in China through the first period of expansion in the 1990s and early 2000s, there is little evidence of consolidation. Data from the top 90 supermarket chains in China (CFFA 2003) show that total sales from these largest enterprises only account for about three per cent of total urban food sales. The rate of consolidation increased slightly between 2001 and 2002, but as in many other service and commerce sectors in China, relatively low barriers to entry

mean that there are literally thousands of firms competing across the nation, and hundreds of firms in each city. Moreover, although the number of wet markets in China is falling, they have not disappeared. Therefore, competition is fierce across the entire supermarket landscape, not only among supermarket chains, but also between supermarkets and wet markets.

With a country as big as China, it is important to remember that changes in downstream segments of the supply chain happen at different rates (Table 5). Data for 2001 and 2002 on the 90 top supermarket chains (the only data available on a by-province basis) reveal that supermarkets started to emerge earlier and are growing faster (in absolute terms) in richer coastal areas. In 2001 and 2002, more than 80 per cent of the top supermarkets' sales are concentrated in coastal regions. However, it should be remembered that growth rates in the central and western regions are also quite high (45 per cent in Central China and 26 per cent in Western China), and that since 2002 many large supermarket chains have reported that they are beginning to expand their operations inland. In short, through 2000 the supermarket revolution was still primarily a coastal phenomenon. There is no reason to believe that the same pattern will not be repeated in inland areas – indeed, it seems that it already is, given the rise of smaller supermarkets in most Chinese cities.

Other users of vegetables

Data from official sources also show that the story of China's vegetable economy is one of fresh vegetables. Although there is considerable activity in the processing sector, the total number of processing firms has remained relatively stagnant while the horticultural economy has expanded rapidly (Table 3, column 8). Because of this (and difficulties in accessing data systematically), the rest of our report focuses on the dominant fresh vegetable sector.

Although average per capita expenditure on food in urban areas has been relatively stagnant over the past five years, there has been a change in the composition of the food basket. Grain consumption has fallen precipitously in urban areas, while the consumption of animal products has risen (Huang and Rozelle 1998; Ma et al. 2006). One of the main drivers of this trend is the vast array of restaurants that have opened in China's cities over the last decade. These have reduced the share of food consumed at home and increased the share of household food expenditure spent on food away from home, or FAFH (Ma et al. 2006). Furthermore, surveys of food consumed in restaurants also show that those who eat out consume large volumes of vegetables. These trends may be important in the way that markets change.

3.2 Changing markets within major consuming and producing regions: the meso view

While data from national sources show that the composition of market venues is changing (from wet markets to supermarkets), the meso data provide an even more convincing illustration of the dynamic and shifting nature of downstream markets themselves (and not just their relative share in total production or consumption). Using data from the Beijing statistical bureau and our own wholesale market surveys and interviews, an examination of the meso level (in this case, Greater Beijing) reveals the existence of several trends. The first is the consolidation of markets in large municipalities like Beijing. According to data collected by the Beijing statistical bureau, the number of market sites (in this case, a combination of large wet markets and wholesale markets) is falling (Table 6, column 1). This is happening in both urban and suburban areas (columns 2 and 3), even though demand for fruit and vegetables is rising – which means that the average size of markets in Beijing is increasing.¹

In fact, although our interviews also suggest that most of the remaining markets have grown over time, the real shift is the tremendous rise in the importance of Xinfadi, Beijing's primary fruit and vegetable market. Even though it was large in the early 1990s, it did not provide more than one third of Beijing's fruit and vegetables at the time (a smaller volume than is consumed today). However, by 2005 more than 8,000 tons of vegetables flowed through Xinfadi on a typical day, making it the largest wholesale market in Asia. In fact, its sales volume is equivalent to the entire volume of vegetables consumed by the residents of Beijing in a single day.² Given the increasing importance of Xinfadi, it is not surprising to find that the volume of vegetables passing through many of the remaining smaller wholesale markets was dropping, especially in small urban wholesale markets.

Information from our surveys of officials in Beijing's wholesale markets (who could tell us about the total volume of trade in all vegetables, not just tomatoes and cucumbers) also reveals that the destination of goods sold on Beijing's wholesale markets is evolving in response to changing retail patterns among Chinese consumers (Table 7). In 2000, traditional buyers easily accounted for the greatest volume of sales by wholesale traders, with 62.3 per cent of their sales going to small retailers, 12.6 per cent to wholesalers and 10.8 per cent to small traders. Only 10.4

¹ Note that the 40 markets in Figure 2 are included in the number of markets in Table 6; 25 of the urban markets in 2004 are wholesale markets; 15 of the suburban markets are wholesale markets.

² Although the volume of vegetables going through Xinfadi is equivalent to the entire vegetable consumption of Beijing, about 35 per cent of its sales are to wholesale markets outside Beijing, meaning that other wholesale markets around northern China source their supplies from Xinfadi. Therefore, the rest of the wholesale markets in Beijing (the 39 other small urban and suburban wholesale markets) provide the remaining 35 per cent of Beijing's supply.

per cent went to supermarkets or restaurants (3.6 per cent and 6.8 per cent respectively). However, between 2000 and 2005, the volume of these markets' sales to small retailers, wholesalers and small traders dropped from 85.7 per cent to 74.8 per cent, while sales to supermarkets and restaurants increased to 20.2 per cent (9.3 per cent and 10.9 per cent respectively). It is clear that changes in the ways that Beijing residents buy and consume their food are having an impact on the destination of vegetables sold by wholesale market traders .

Importantly, however, consolidation at the level of wholesale markets in China does not mean that markets are becoming any less competitive. In fact, China's wholesale markets have remained remarkably competitive at the trader level. To see this, one only has to examine the nature of the firms operating in China's wholesale markets. For example, although over 8,000 tons of vegetables are sold each day in Xinfadi market, the largest single trader only moves 25 tons per day. Taken in terms of trucks per day, this means that the largest trader in the market buys and sells about five large trucks of vegetables per day. When one visits the market, however, it is clear that over 1,000 trucks move in and out of it each day. According to our survey, each trader handles an average of one or two tons of vegetables per day, which amounts to less than one large truck per day – meaning that there are more than 1,000 vegetable traders operating in this market alone. This is in stark contrast to many vegetable markets in the US, which have recently been increasingly dominated by two or three extremely large enterprises.

The profile of a typical trading company in Beijing's wholesale market is consistent with a small volume of sales. In fact, almost all the traders we met operated in small family- or friend-based firms of two to six people. Typically, two or three members of a six-person firm will man the wholesale market slots in urban wholesale markets (such as those in Xinfadi vegetable market). Some firms, especially the more established ones, will have a permanent space; while smaller firms may have a space one day but then go several days without one. When they do have one, they leave the market once they have emptied their truck or sold all their vegetables. In the meantime, the remaining members of the firm go out to purchase vegetables from farmers in surrounding villages or wholesale markets in other parts of the country (so one person from a wholesale firm in Xinfadi may go to a wholesale market in Shandong). Sometimes the wholesale buyer goes to villages and purchases directly from farmers, or will purchase a load of vegetables from small independent traders who buy from farmers and sell to wholesalers. When the buyer has got enough to fill a truck the load is shipped to Xinfadi, where it is sold on to all the different buyers in Beijing (small retailers, supermarkets, restaurant owners, etc.).

Thus, our research shows that the nature of wholesale markets in China is shielding farmers from the effects of the radical shifts occurring in the downstream retail sector. Although wholesale markets themselves are getting bigger, moving to the

suburbs and consolidating, they are still made up of tens of thousands of individual traders in thousands of trading firms. This picture is consistent with the findings of Dong et al. (2006) based on household data, that China's horticulture economy is dominated by thousands of small traders who go to villages to procure vegetables from the farmers themselves. In Beijing, farmers also reported that if they go to the local market to sell their vegetables they also sell to small traders. This is consistent, given that there are no really large traders in even the largest wholesale market in Asia.

Figures 5 and 6 present a schematic drawing of Beijing's marketing channels. Figure 5 shows the basic channels in the flow of vegetables from farm to consumer, and Figure 6 illustrates our best guess of the shares of vegetables flowing through the different channels. What is most notable is the fact that the wholesalers' supply chains run almost exclusively between wholesalers and farmers (84.5 per cent) or wholesalers and their agents (4.5 per cent), who are themselves just small traders purchasing directly from farmers. According to our interviews, virtually all of the transactions between farmers and people in the wholesale markets are done without contract on a spot market, vegetable for cash basis. Only ten per cent of the produce supplied to Beijing wholesale markets comes from other wholesale markets.

3.3 Supermarket procurement: the meso view

Although it is consistent with previous work by the authors (Dong et al. 2006), the picture derived from interviews with wholesalers differs dramatically from widespread accounts of supermarkets using their growing presence to set up contracts to purchase directly from farmers. The evidence we gathered suggests that this is not the case. First, although it is difficult to verify the share of each day's total vegetable sales that passes through supermarkets, a conservative guess would put this at around 15 per cent. According to our data (Table 7, column 2, row 6), wholesale markets in Beijing sold about 9.3 per cent of their vegetables to supermarkets in 2005. Therefore, one plausible scenario is that supermarkets get about two thirds of their vegetables from local wholesale markets and one third from other sources.

In the rest of this section, we will examine any evidence that can help us answer two questions. First, is it plausible that two thirds of supermarket vegetables are purchased from local wholesale markets, and if not, is it more or less than this? Second, where else do fruit and vegetable supplies come from apart from local wholesale markets?

Perhaps the most compelling evidence of the supermarkets' dependence on local wholesale markets comes from the supermarkets themselves. At first glance, the account of direct sales from wholesale markets to supermarkets (reported from the

supermarket's point of view) given in an interview with a procurement manager at a Beijing supermarket chain seems remarkably consistent with the results of the wholesaling survey (presented in Table 7). Interviewees in Beijing supermarkets reported that supermarket procurement agents purchase 63 per cent of their vegetables direct from small wholesalers or small product delivery companies (wholesalers renting offices in or near wholesale markets) in Beijing's wholesale markets (Table 8, rows 1 and 2). Although such information was sometimes given grudgingly (it is not perceived as 'modern' practice), we were told that supermarkets have no option but to rely on wholesale markets if they want to remain competitive.

In other words, the interviews revealed that supermarkets largely depend on wholesale markets for their vegetable supplies. In some instances we were told that buyers often just buy in the wholesale market, often in a section specializing in relatively high quality fruit and vegetables. Although this specialization is new, it should be noted that the structure of the market remains the same in terms of the size and nature of the trading firms. As in traditional wholesale markets, the quality section of the market is dominated by small private firms that buy from farmers and sell to agents. Interviewees also told us that they rarely have any problems procuring sufficient quantities of good quality vegetables .

While supermarkets procure nearly two thirds of their vegetables directly from wholesale markets, this does not mean that markets are stagnant. In fact, our data contain evidence that China's markets are evolving steadily, especially in the downstream segment. Our supermarket interviews show that a significant share of vegetables (22 per cent) is procured from large farm product delivery companies (Table 8, row 3). These differ from traditional wholesalers (and small farm product delivery companies) in several fundamental ways. First, they are larger, averaging around 20 to 25 employees. Second, they often have a higher-profile shop front in the market. They also have formal contractual relations with supermarkets, although the exact nature of these arrangements was not made clear during the interviews. Although the contractual jargon suggests a fairly long-term arrangement based on quantities and qualities, it seems that most actually operate on the basis of established relationships, and are flexible. In other words, prices are frequently spot market prices, and quantities and qualities are established on a rolling basis, depending on the supermarkets' daily or weekly needs and the availability of produce in wholesale markets. Thus, large farm product delivery companies often seem to act as buying agents for supermarkets in the wholesale market. Perhaps the most fundamental difference is that many of the transactions between large farm product delivery companies and supermarkets are on a credit basis, which gives the supermarkets some degree of leverage over the delivery companies during negotiations. The emergence of these large farm product delivery companies clearly represents an evolution in Beijing's wholesale markets.

Although the emergence of long-term, quasi-contractual relationships between supermarkets and large farm product delivery companies seems indicative of change among downstream actors, our interviews with supermarkets confirm the hypothesis that the competitive nature of wholesale markets in China shields upstream markets from these changes (or at least, has done so far). Most pertinently, when examining the procurement practices of large farm product delivery companies, it can be seen that the vast majority of purchases are done through conventional channels. The companies' employees and agents (who are just freelance small traders) all purchase vegetables directly from farmers in ways that are indistinguishable from those of traditional (small) wholesalers' employees and agents. In other words, the terms and nature of the procurement transaction is exactly the same from the farmers' point of view, regardless of whether their buyer comes from a wholesaler, a small farm product delivery company or a large farm product delivery company. Therefore, in most downstream segments of China's vegetable markets there is little evidence that markets are evolving. The same is true for the market share (12 per cent) held by supermarkets that send their own employees or agents to buy directly from farmers (Table 8, row 4).

However, this is not to say that there is a total lack of experimentation. Whether it is window dressing or due to a genuine desire to understand alternative (future) sources of supply, we found that a small proportion of vegetables in Chinese supermarkets come from novel sources. For example, large farm product delivery companies procure five per cent of all their vegetables from their own production bases, and in some cases actually control production. However, production bases are generally villages that have a long-term relationship with the large farm product delivery company, supplying a certain product in return for preferential treatment (reliable procurement or perhaps even a price premium). Our interviews also revealed that two per cent of the vegetables in Beijing's supermarkets come from farmers with contractual relationships with supermarkets, and one per cent from the supermarket's own production base). While this is interesting (and often brought to the attention of the press and visitors escorted or introduced by supermarkets), it should be remembered that this is a very small proportion of the total volume of vegetables. According to our estimates, since supermarkets sell 15 per cent of all vegetables in Beijing at the very most, the farmers who are contracted to produce for and supply supermarkets account for only 1.2 per cent of Beijing's total supply (or $15\% * [5+2+1] = 1.2\%$).

Therefore, to summarize our analysis from the supermarkets' point of view, the data on wholesale markets indicate that China's supply chains are evolving. However, this evolution is uneven. There are twofold changes in the downstream sector: first changes in the composition of sales, which are being driven by shifts in demand due to the rise of supermarkets and restaurants. The next section will show that the emergence of export markets has contributed to this change. Second, the

relationships between new retail institutional actors (such as supermarkets) and wholesale markets are changing. The best example of this is the emergence of large farm product delivery companies. However, both the supermarket interviews and the wholesale market data also show that most of the changes in China's markets (at least in Beijing) stop at the wholesale market. As far as farmers are concerned, 98.8 per cent of their produce is still purchased by small traders and the employees and agents of wholesalers and large or small delivery companies and supermarkets – who they see as indistinguishable from one another. The terms and nature of the relationship are the same, regardless of who does the procuring: the transaction is made on a spot market basis, without credit and with few other strings attached. According to our Beijing meso-level survey, there are three stories in China – one at the far downstream end (where there is a lot going on at the retail level); one at the nearer segment of the downstream end (where, while most business continues as usual, noticeable and measurable changes are occurring); and one at the upstream end (where there is little change and traditional marketing channels are nearly universal).

3.4 Commodity-specific marketing channels: tomatoes and cucumbers in Beijing and Shandong Province

The results of the commodity-specific wholesale studies on tomato and cucumber supply chains in both Beijing and Shandong support the findings of the analysis based on all horticultural crops. In both study years – 2000 and 2005 – well over half of all tomatoes and cucumbers were moved through traditional supply channels (see Tables 9 to 12).

However, as with horticultural crops in general, the composition of sales in Beijing's wholesale markets is changing in response to the rise of supermarkets, restaurants and other forces (such as increased agricultural exports out of Shandong Province). Traders in the wholesale markets of Beijing and Shandong saw sales of tomatoes and cucumbers to supermarkets (?) rise by an average of five to six percentage points, in most cases more than doubling their share of total sales. And apart from the cucumber markets in Shandong, there was a similar increase in the shares of tomato and cucumber sales to restaurants (an average of four percentage points). In the case of Shandong, shares of tomatoes and cucumbers sold to the export market rose sharply. Taken together, sales to these new downstream channels (supermarkets, restaurants and exports) increased by more than ten to 15 percentage points.

What is happening can clearly be seen by mapping the main trends in the evolution of the market in China in a schematic chart (see Figures 7a/7b to 10a/10b). The downstream markets described in the previous paragraph are shifting, but farmers are shielded from these shifts by the nature of the national market, as wholesale

markets in both Shandong and Beijing are dominated by hundreds, if not thousands, of traders. In fact, as the left hand side of the charts show, cucumber and tomato wholesalers in Beijing and Shandong purchase over 85 per cent of their goods directly from farmers: over 90 per cent of the share in Beijing tomato and cucumber markets, and 100 per cent in Shandong tomato markets. Clearly, the small trading firms that make up China's wholesale markets are sufficiently small for it to be profitable to send an agent to procure from China's small tomato and cucumber farmers, go themselves (the Beijing mode) or purchase from farmers that go to the wholesale markets (the Shandong mode). Schematic charts based on the information on marketing channels provided by villagers (Figures 9a/9b and 10a/10b) and wholesalers (Appendix Figures 2 and 3) show a similar pattern.

In addition to this general finding, a study of tomato and cucumber marketing trends over time and comparison of Shandong and Beijing show that markets are dynamic. First, it is clear that markets in Shandong (one of China's main production areas) mainly act as wholesale markets, while those in Beijing are more connected with local consumers. This is a sign that markets in China have become specialized, in contrast to the self-sufficiency movements of the 1970s. In addition to this, there are more markets in more townships and districts of Shandong than in Beijing, because of the density of markets and growth in vegetable production. This is probably the main reason for the change in patterns of procurement by wholesalers. In Beijing, most wholesales travel to local villages and buy from the farmer, while in Shandong, farmers harvest their vegetables and take them to the market.

There are also signs that markets in Shandong are becoming increasingly specialized. When we were in Shandong we were told that traders from other provinces are capitalizing on its relatively high brand name by shipping their vegetables to Shandong and selling them on from there. This could also be a strategy by local traders to ensure that they always have enough produce for their customers, even if it has to be brought in from other provinces. This was particularly true for cucumbers, as a large share of the cucumbers for wholesale markets in Shandong comes from other wholesale markets (see Figures 10a and 10b).

3.5 Drivers of change

Clearly, the proximate changes in markets that we are observing in China (or at least in Shandong and Beijing) are due to the emergence of new retailing venues and marketing opportunities. As we saw, the supermarkets' increased share of the retail market shows up as an increase in their share of wholesalers' total sales. Likewise, the documented rise in eating away from home (Ma et al. 2006) appears in almost all the vegetable markets as a rise in the restaurants' share of wholesale market sales. The same is true for export markets. In other words, our data clearly identify the

proximate sources of change in wholesale markets as changes in the retail segments of the markets.

Although this is interesting, this section is not concerned with the proximate sources of change, but with the ultimate drivers of change. Therefore, it will consider one set of in-depth analysis. Due to space constraints and the very complex nature of the topic, the examination will be brief and based on descriptive analysis.

Macro-drivers of change

One of the key elements in uncovering the ultimate drivers of change is identifying the sources of proximate causes. In other words, since we know that changes in wholesale markets are linked to changes in the retail end of the markets, the question we need to answer here is: what are the drivers of supermarkets, restaurants and exports?

Table 13 briefly reviews the macro-trends of several indicators that are almost certainly at the heart of the forces changing China. First and foremost is China's rapid economic growth (column 1), which saw per capita GDP rise by more than 750 per cent between 1978 and 2004. This increase in economic activity has been translated into real and substantial rises in income for almost all urban residents and most rural residents. It is well known that such rises in income are accompanied by a rise in the opportunity cost of time (and demand for convenience) and increased demand for safety and reliability. In other words, we can be virtually certain that GDP and income trends are the main drivers of the emergence of supermarkets and restaurants. This in turn means that rises in GDP are probably the major ultimate driver of market change.

China is also going through the process of urbanization (Table 13, column 2). Between 1978 and 2004, the share of the population living in cities rose from 17 per cent to more than 40 per cent. Given the size of China's population, it has been argued that this is one of the largest shifts in human population in the history of the world (outside wartime shocks). As with increased income, higher rates of urbanization tend to raise the opportunity costs of time and reinforce the rise of supermarkets and restaurants.

Finally, the liberalization of China's agricultural trade and reform of direct foreign investment have triggered large increases in agricultural trade flows and FDI inflows. These will not only make more products available (reinforcing supermarket trends), but also increase opportunities to export agricultural products.

4. Production and marketing changes in Chinese villages

In this section we turn our attention to China's villages, and examine the state of horticultural production and marketing from the farmer's point of view. To do so, we begin by using our meso-level data to demonstrate the nature of the study sites, showing how they compare with typical villages in China and Shandong. The second subsection examines trends in production (area and yields) and inputs (seeds, fertilizer, extension services, etc.). Information from the surveys of village leaders and farmer focus groups is used to identify the major constraints preventing farmers growing tomatoes and cucumbers from expanding or becoming more profitable. The third subsection looks at the marketing behaviour of tomato and cucumber farmers, first establishing who they sell to and under what terms, and then trying to identify an additional set of marketing constraints affecting their decisions and profitability.

4.1 Nature of the study sites

The meso-level data demonstrate that although typical villages in our tomato and cucumber study are highly representative of China and Shandong as a whole, they also have characteristics that one would expect of villages that produce horticultural crops (Table 14). For example, their size in terms of population, number of households and family size clearly fall within the range of villages across China and Shandong (rows 1 to 3). However, while every village in Shandong is smaller than those in the rest of China in terms of total land area and average farm size, most horticultural villages in Shandong are larger than the average village in Shandong (rows 4 and 5). In contrast, land quality in Shandong is higher than in the rest of China in terms of irrigated area (62 per cent of cultivated land is irrigated in Shandong, compared with only 42 per cent in China as a whole); and the level of irrigation in our tomato and cucumber villages is even higher [than the average for Shandong](#) (over 90 per cent in tomato-producing villages and over 75 per cent in cucumber-producing villages; see row 6).

In terms of income and economic structure, our villages are slightly above the average for Shandong in terms of per capita income, and even further above the average for China as a whole (Table 14, row 7). This income advantage is somewhat surprising given that a higher percentage of households in the study villages are involved in agriculture than in the rest of China, and fewer are in the off-farm sector than in the rest of China or Shandong (rows 8 and 9). These trends can be explained by several rival hypotheses. One is that horticultural crops are planted by relatively well-off farmers, as is often noted in the literature. The second is that farmers involved in horticulture were initially poor and have become relatively well off through horticultural production. This would be consistent with findings from the

authors' previous research on horticultural producers in the Greater Beijing area. Finally, it is possible that farmers in these villages are relatively well off due to other income sources, but those involved in horticulture are not above average. This is possible, as we have already seen that a large proportion of households in these villages do not participate in horticulture. While these issues cannot be addressed by the meso-level study, they clearly need to be considered in Module III.

Interestingly, despite having a higher proportion of farmer cooperatives (known as Farmer Professional Associations, or FPAs) than the rest of China, very few farmers operate through cooperatives. Furthermore, Shen et al. (2006) report that there is little collective action in many of the villages that nominally have FPAs. This indicates that, in general, China's farmers tend to make most production and marketing decisions on their own, or rely on informal associations within their villages.

4.2 Trends and constraints in production and input

Our meso-level data reveal that production trends (Tables 15 to 17) are similar to those found in secondary sources (Tables 2b and 2c), reflecting the structural changes observed in cropping. Information from the village-level surveys and focus groups shows that production in the tomato and cucumber study villages is rising over time (Tables 15, rows 1 to 3 and Table 16, rows 1 to 3). For example, the share of cultivated land devoted to vegetables in our typical sample tomato village rose from nine to 18 per cent between 1995 and 2005 (Table 15, column 2), with a greater proportion planted to tomatoes in both the field and the greenhouse (columns 3 and 4). The land in sample tomato villages being given over to vegetables in general, and tomatoes in particular, was previously under grain. This clearly represents a shift in cropping structure that would be expected in an economy that is marketizing, i.e. moving towards more labour-intensive horticultural crops and away from more land-intensive grain

A similar shift can be seen in the cucumber villages (Table 16), where the share of land allocated to vegetables rose from 22 per cent in 1995 to 39 per cent in 2005 (column 2). The share of cultivated land under cucumbers and use of greenhouses also increased (columns 3 and 4); and as in the tomato villages, higher vegetable (and cucumber) production was balanced by a fall in grain production.

The sample villages producing tomatoes and cucumbers differ greatly in terms of the intensity and growth of vegetable production (as intended). The share of vegetables in the high-production villages started higher, grew faster and therefore ended higher. For example, producers in the high tomato-production area began with 13 per cent of their land under vegetables in 1995, and ended with 24 per cent under vegetables in 2005 (Table 15, rows 4 to 6). In low-production villages, the total

cropped area under vegetables rose from six per cent in 1995 to eight per cent in 2005 (rows 10 to 12). Similar patterns were found in the cucumber-producing villages (Table 16, rows 4 to 12).

A comparison of the trends in total vegetable production with those in tomato and cucumber production in the study villages shows a shift towards diversification in the cucumber villages that is not evident in the tomato villages (see Table 15 for tomato-producing villages and Table 16 for cucumber-producing villages). In high-producing cucumber villages, the proportion of land under vegetables increased more rapidly than the share of land under cucumbers (Table 16, columns 3 and 4). This contrasts with the situation in the high- and medium-production tomato villages (but not the low-production ones), where the share of land under tomatoes grew more than the overall increase in the share of land under vegetables (Table 15, columns 3 and 4). Although it is not shown here, our focus groups reported that farmers in cucumber villages were increasingly moving into various new crops, which they find out about by visiting markets, talking to buyers (who do not provide any new seeds or technologies) and interacting with other farmers inside and outside their villages.

Production trends derived from data on the number of households cultivating tomatoes and cucumbers in each sample village also show that the area under vegetables is expanding rapidly, and that this is due to new producers rather than an increase in farm size (Table 17). In fact, the share of households producing tomatoes and cucumbers nearly doubled between 1995 and 2005, rising from 15 per cent to 25 per cent for tomato-producing households, and 17 per cent to 24 per cent for cucumber-producing households (columns 2 and 5). During this period, the area planted to tomatoes increased by about 20 per cent, and to cucumbers by about five per cent (columns 3 and 6). Thus, our data show that production in Shandong is mainly driven by new small farmers and, to some degree, by a moderate rise in crop areas, rather than the emergence of large farmers and rapid expansion of their farmland.

Discussions with the focus groups also clearly showed that not only has the area under tomatoes and cucumbers expanded, but also that yields have increased significantly. They reported that farmers in 71 per cent of sample tomato villages and 66 per cent of sample cucumber villages were claiming higher yields. The most commonly cited factors for tomato farmers were access to new seeds and investing in greenhouse facilities. Cucumber farmers also stated that they had increased the use of fertilizer over time, and believed that their field management practices had improved as they gained more experience (using trellising technologies, etc.).

Inputs and other services

It has been shown that accessing new varieties improves productivity among grain farmers (Jin et al. 2002). Our data show a significant growth in the number of varieties used by tomato and cucumber farmers in sample villages between 2000 and 2005, more than doubling from two to three varieties in 2000 (Table 18 row 1), as farmers adopted around one new variety each year (rows 2 and 3) and dropped old varieties (row 4). Importantly for this study, as it made the sample representative of the province, farmers in every village purchased all their new seed from small private horticultural seed peddlers (row 5) rather than buyers, as is the practice in other parts of the world (row 6).

In fact, buyers are conspicuously absent from Shandong's tomato and cucumber economy. They are not involved in the provision of new seed (or seed of any kind) or fertilizer, as tomato and cucumber farmers buy all their fertilizer from small private fertilizer traders (Table 18, rows 7 and 8). Nor do they play any role in providing extension services and technical advice, which is made available for a fee (six per cent of villages are charged for extension advice; see rows 8 and 9) or free of charge (from friends, neighbours or the local government extension agent; see rows 10 to 12).

Another area where the output marketing chain plays no role is credit, even though focus groups reported that tomato and cucumber producers in many villages are gaining access to credit (Table 18, rows 13 to 16). This is provided by banks (14 per cent of tomato producers and no cucumber producers), rural credit cooperatives, or RCCs (67 per cent of tomato-producing villages and 69 per cent of cucumber-producing villages) and informal credit channels – typically loans from family and friends (43 per cent of tomato-producing villages and 44 per cent of cucumber-producing villages). Although the large share of producers gaining access to credit from rural credit cooperatives may signal that government policy now seeks to improve farmers' liquidity, this may be peculiar to Shandong province and other relatively well-off coastal provinces, and not be typical of other, poorer parts of China. However, it is consistent with earlier findings by Wang and Park that there is sufficient liquidity in agricultural areas of China, especially better-off areas, to provide enough capital for its labour-intensive agriculture.

Production constraints

Despite the rapid rise of vegetable production in Shandong province, farmers cited a number of factors that limit their production. Three sets of constraints were identified. The first set includes factors hindering the expansion of tomato and cucumber production: the single most binding constraint and the top three identified by farmers. The second set consists of factors limiting yields on existing areas under

tomatoes and cucumbers; and the third set are factors identified as the reason why certain farmers in the focus group did not produce vegetables.

Constraints limiting expansion by horticulture producers

Farmers in our sample clearly identified the lack of better technology as the main constraint limiting expansion (Table 19, columns 1 and 2). Over 70 per cent of tomato farmers and 75 per cent of cucumber farmers said they felt that current varieties perform poorly in terms of yield, crop quality and resistance to pests. Technology was a bigger problem for poor tomato farmers (eight per cent) than richer ones (50 per cent), who cited poor quality inputs (especially pesticides) as the second main constraint. Rich and poor cucumber farmers were equally affected by technological constraints, with 75 per cent of each group citing this as the greatest limiting factor.

When asked about the other top two constraints to production, quality of inputs and natural disasters were at the top of the list for both tomato and cucumber farmers (Table 19, columns 3 and 4). They reported that they find it difficult to choose appropriate insecticides and pesticides from the huge range available all over China, some of which are badly manufactured (known as “fake pesticides”), and some of which are unsuitable for the purpose for which they are bought. Hail, heavy rain and frost are the main natural constraints to production in Shandong. These generally affect farmers to the same extent, regardless of whether they are rich or poor.

There are several factors that deserve mention for *not* being a constraint (Table 19). None of the focus groups in poor counties believe that credit is a binding constraint, due to the existence of traditional informal credit networks in rural areas and the emergence of government lending programmes in recent years. And only a very few focus groups identified lack of appropriate seed or the price of inputs as important constraints to expanding production. Almost all inputs are readily available, thanks to the numerous traders in China’s agricultural economy (although quality may be an issue, as noted above).

Chinese farmers expect the government to address these constraints, and many do not seem to have considered the possibility that this could be done by the private sector. The vast majority of farmers we spoke to about solving problems with pests, improving technologies and increasing the quality of inputs believe that these are matters for the extension services. This is perhaps to be expected, given that inputs are almost exclusively supplied by the private sector, purchased on the free market from small traders. Furthermore, as the next section reveals, virtually all buyers of tomatoes and cucumbers are small traders, small wholesalers or wholesalers’ agents,

who have little interest in or means of providing farmers with technology, credit or extension services.

Yield constraints

The focus groups also identified several constraints to yields, in addition to those limiting the expansion of land under horticultural production or even barring entry into production. Disease and insect pests were cited as by far the most serious problems. Some farmers complained about the expense of using manure (which is in increasingly short supply due to fewer pigs being raised in relation to the amount of land under vegetables); others cited poor quality fertilizers that did not always provide the correct mix of nutrients.

Constraints limiting entry into horticultural production

An entirely different set of constraints emerged when we asked farmers to explain why they were not engaged in horticultural production (Table 20). Easily the two most common responses were that off-farm work is more lucrative, and that the family would be short of labour they tried to produce tomatoes and cucumbers (rows 1 and 2). Because it is always difficult to hire agricultural labour (except for the most repetitive tasks requiring little care or attention), and because off-farm labour opportunities are available for almost anyone in China (and especially Shandong) who is willing and able to go to the city, finding available family labour not required for other activities is by far the greatest constraint preventing more households from entering horticultural production.

Many of those who do have enough labour for tomato and cucumber production believe that other activities such as cropping or rearing livestock are more profitable (Table 20, rows 3 and 4). In all, 39 per cent of non-tomato producing farmers stated that they either believe that it is more profitable to plant an alternative crop, or that it is unprofitable to plant tomatoes (which virtually amounts to the same thing, since these are farming households). Therefore, the top four constraints cited by non-tomato/cucumber producers are really limitations that have been imposed by market-generated values (or prices): either labour markets make the opportunity costs too high, or output markets make relative profitability too low. This is important, since one interpretation is that it is really the market that is the primary determinant of who is producing and who is not, rather than policy barriers or institutional or resource constraints. Importantly, physical constraints such as the absence of land markets, unavailability of credit and lack of appropriate technology play a much smaller role than market-based constraints.

4.3 Marketing channels in the horticulture economy: incentives, institutions, infrastructure and constraints.

Unlike the upstream, retail segment of the market, which has changed radically, or the wholesale marketing link in the supply chain, which has seen moderate changes, change in the downstream segment of China's tomato and cucumber marketing chains has been very modest. Indeed, from some perspectives it could be said that there has been almost no change in the way that farmers market their tomatoes and cucumbers (Table 21, rows 1 and 2). If it is assumed that farmers who sell their produce in the village sell to small traders, who then sell to small traders operating in wholesale markets (the "small wholesalers" described in section 3.2 above), then 99 per cent of tomato producers and over 90 per cent of cucumber producers sold their output to small traders in both 2000 and 2005. In other words, marketing channels were remarkably stagnant during this period. Horticultural producers in Greater Beijing sell almost all of their output to small traders, and this trend is even more pronounced in Shandong Province, China's most important province for horticultural production.

However, this is not to say that there has been no change at all. In fact, there are two ways of demonstrating that a small evolution is under way in the first link of the marketing chain. First, as we can see from Table 21, there was a slight increase in the number of villages whose farmers took their tomatoes to market between 2000 (77 per cent) and 2005 (84 per cent). Second, we can also see that the share of cucumber sales to processing firms rose from one per cent to three per cent. It is possible that these developments are harbingers of future change.

Second, it should be remembered that although the volume of tomatoes and cucumbers that farmers sold in wholesale markets was virtually the same in both years, the marketing venues they are selling into (wholesale markets) are themselves changing. As we saw in section 3.2 above, large food product delivery companies are now emerging, parts of some markets are differentiating by quality, and buyers in these markets are altering their buying patterns. From this point of view, marketing channels are changing, in ways that may prove even more revolutionary than the shifts among categories.

However, what is indisputable (in this study as in the study of Greater Beijing procurement channels at the farm gate by Dong et al. 2006) is that changes in the downstream segments of the market are far less significant than those in the upstream segment. Although the nature of the actors in wholesale markets is mutating, wholesale markets are still dominated by thousands of mostly small traders and their even smaller agents. Upstream retailers have virtually no direct engagement in these markets (Table 21, rows 3 to 7). There are no supermarkets,

almost no processors and, from the farmer's point of view, almost no identifiable preferred suppliers or exclusive supply agents from supermarkets or other upstream retailers. Indeed, at the level of the farm gate (and first link in the supply chain), China's tomato and cucumber markets are best characterized as the sale by hundreds of thousands of atomistic producers to thousands (or tens of thousands) of atomistic small traders and small wholesalers.

Other characteristics of markets: contracts, infrastructure and information

One of the most striking characteristics of China's horticultural sector is its laissez-faire nature. Farmers have had to pay very few taxes since 2000 or 2001, when the government eliminated the Special Products Tax once collected from certain farmers in horticulturally productive regions. Small traders are untaxed, and wholesalers typically pay only a small flat fee to use marketing facilities (including stall space). Furthermore, apart from the largest transactions between large farm product delivery companies and their biggest buyers, horticultural crops, including tomatoes and cucumbers, are seldom assessed for value added tax (VAT). When the lack of licensing and regulation in the fruit and vegetable trade is considered in conjunction with the tax environment (or, more precisely, the 'absence of tax' environment), it is not hard to see why there are so many entrants in the tomato and cucumber markets and why they are so competitive.

Another characteristic of China's tomato and cucumber market is the lack of contracts (Table 22). We did not come across any formal contracts in our sample regions: not a single case of a buying agency with a formal written contract regarding the production or marketing of tomatoes or cucumbers. Villagers in only six per cent of the tomato villages and nine per cent of the cucumber villages believed that buyers had any commitment to purchase the farmers' output, and even then this was an oral contract (i.e. there was nothing in writing). Further enquiries in the villages with oral contracts revealed that the price was determined by the market, and that neither party was obliged to buy or sell any given quantity. In other words, there was no contract. These were long-term business relationships in which there was an expectation that farmers from the village would sell to the buyer, who in turn was expected to buy from them. If we use the alternative definition of "long-term business relationships" instead of "oral contracts," it can be argued that there is zero contracting (either written or oral) in the sample villages in Shandong.

Table 23 illustrates in a number of ways why China's tomato production has expanded so fast, and why it is possible for markets to operate so competitively. The infrastructure that helps markets work better has improved according to a number of indicators. For example, the average village is only two kilometres from the nearest county road (which in Shandong is typically an all-weather, paved asphalt road) (row 1); and between 2000 and 2004 farmers in the sample tomato- and cucumber-

producing villages gained better access to the nearest highway (major road to county seat, prefectural capital or regional commercial centre) and markets (rows 2 to 4). Communications have improved even more rapidly. The number of farmers with access to landlines, cell phones and cable television – important sources of market information – increased dramatically (rows 5 and 6). In fact, when explicitly asked about the rise of communication technologies, 91 per cent of tomato-producing villages and 73 per cent of cucumber-producing villages reported that the emergence of cell phones and other communication facilities has significantly improved their ability to market horticultural crops.

Given this set of marketing channels, infrastructure improvements and the predominance of markets and small traders, it is unsurprising that the farmers' main sources of information are the market itself and their neighbours (who get most of their information from the market; see Table 24, rows 1 and 2). The third most important source of information, especially for cucumber-producing villages, is the media, particularly cable channels and radio programmes (row 3). Very few villages cited buyers, brokers, cooperatives or the government as useful sources of information (rows 4 to 7), meaning that farmers have to find marketing information themselves. They usually do this through market networks (which are fairly close and getting closer, both in space and time) and informal networks that rely on neighbours and the media.

Marketing constraints

Despite the rise of communication technology and greater density of markets, focus groups in the sample villages cited lack of information as the most severe constraint to marketing (Table 25, columns 1 and 2, row 1). The other constraints they identified are all closely related to this primary one. While the "lack of a market" sometimes means there are high transaction costs because farmers have to travel long distances to sell their produce (row 2), it could also mean that they lack information if they rely on the markets for information (see Table 24). Scale was also cited as a constraint (row 3). There are two aspects to this as well, for not only does it mean that transaction costs for selling output per unit of sales is too high; but also that farmers lack information because it is not worth spending a lot of time finding out about prices. In other words, three of the constraints identified as being the most severe related to high transaction costs. Perhaps even more fundamentally, they are also due to lack of information.

Interestingly, price variation and government regulation were not often cited as constraints (Table 25, rows 4 and 5). Although China's prices do fluctuate, it may be that the highly diversified nature of farming livelihoods (multiple crops, off-farm jobs and business activities) is enough to dampen the effect of variable prices. Nor does there seem to be a perception that China's markets are being harmed by over-

regulation, lending weight to our characterization of China's vegetable markets as relatively laissez-faire.

One rather surprising finding was that farmers in richer areas seem to feel more disadvantaged when negotiating with buyers than farmers in poorer ones, reporting that they were 'cheated' during the sales transaction (Table 25, row 6). This might be symptomatic of poor information, and may also be a function of the nature of markets. Although we have conjectured that markets are competitive because of their small nature and the number of actors on the buying side, it would appear that there is a lack of competition in the villages that cite this as a constraint.

The analysis of the top three constraints is consistent with the analysis of the top constraint (Table 25, columns 3 and 4). Clearly, constraints associated with high transaction costs and poor information are cited the most frequently.

5. Summary and implications

The main findings in this report are:

- Upstream segments of the marketing chain have evolved dramatically in the past 20 years as the basis of the food system in China has shifted from food rationing in the cities to wet markets and small shops. China now has the fastest growing supermarket and food sectors in the world, and is an exporter of horticultural commodities. It should be noted, however, that the retail sector is very competitive.
- Midstream, the wholesale sector is also evolving in some fundamental ways, although less rapidly than the retail sector. The number of wholesale markets has not risen very fast, but they are getting bigger, particularly the key players. In addition to this consolidation, there is evidence of specialization and the emergence of markets dedicated to providing more high quality products. The nature of the actors involved is changing too, as the previously predominant small traders are joined by an emerging set of more permanent small and large wholesalers. Some of the latter have formal and informal ties with supermarket chains, although it should be noted that even the large wholesalers are relatively small, and markets are very competitive, with literally thousands of actors. On the buying side there has been much less change: most goods are still bought directly from farmers by the employees or agents of small trading firms and wholesalers, or from farmers selling their commodities in markets.
- The main drivers of this evolution are rising incomes, urbanization and the liberalization of the domestic market and international trade. Indeed, China's

- markets are being driven by rapidly growing demand in an unregulated environment that allows for easy entry at all levels of the marketing chain.
- At the village level, we find that fruit and vegetable production is increasing rapidly, in line with national trends. However, the meso-level data reveal that most of the net increase in production of the commodities targeted by our case study, tomatoes and cucumber, is due to new producers rather than expansion by existing producers.
 - Production is extremely small-scale, and most of the perceived production constraints are related to the market (unprofitability and more lucrative options in the labour markets). There are few regulatory, institutional or physical constraints.
 - Marketing is dominated by farmers selling to small traders and small wholesalers. As with the national meso-study, there is no penetration of new retailing institutions. Buyers play no role in providing technology, inputs, technical advice or credit; there is no formal contracting; and there are few constraints apart from the poor information and high transaction costs that are primarily associated with the small size of farms in China.
-
- In such an environment, small farmers dominate. We see that there is no real difference in the nature of the production and market constraints facing poor or remote farmers. As already noted in previous work (quoted in the paper), poor farmers benefit and horticultural crops make a positive contribution to poor people's incomes.

Implications

There are a number of tasks facing policy-makers in such an environment. Although markets at all levels are competitive, and small farmers are helping provide food for cities in an efficient and inexpensive way, in the coming years China will face considerable challenges in meeting the growing demand for food safety. On the production side, policy-makers may need to consider appropriate policy instruments that can foster cooperatives and focus on producing safer pesticides. Regulating the production and import side of the pesticide industry may be the best way of cleaning up vegetable production.

Policy-makers need to address the most critical aspect of marketing constraints: how to get better information to farmers. This is not going to be easy, as it will require more programmes on cable TV and radio providing up-to-date, extremely detailed and unbiased price data. Forecasting supply and making recommendations will be difficult, if not impossible. Although farmers have not complained about horticultural crops becoming unprofitable due to over-supply, more information on

the total area planted and year-on-year changes would be welcome and might help academics begin an annual update of the state of the economy for major commodities. Cooperatives could help overcome high transaction costs in certain cases; but overall, it is essential to continue monitoring the situation to ensure that there is fair access to markets.

References

- Anderson, K. and C. Peng, K. (1998) Feeding and fuelling China in the 21st Century. *World Development*. 26 (8), p.1413-29.
- Beijing Municipal Bureau of Statistics (2001-2005) *Beijing statistical yearbook*. Beijing: China Statistics Press.
- CCFA (China Chain Store and Franchise Association) *China chain store almanac, 2002, 2003*. Beijing: China Commerce Press.
- deBrauw, A., Huang, J. and Rozelle, S. (2004) The sequencing of reform policies in China's agricultural transition. *The Economics of Transition*, Vol.12, No.3, p.427-465.
- Fan, S. (1997) Production and productivity growth in Chinese agriculture: new measurement and evidence. *Food Policy* 22 (3 June) p. 213-228.
- Hu, D., Reardon, T., Rozelle, S., Timmer, P., and Wang, H. (2004) The emergence of supermarkets with Chinese characteristics: challenges and opportunities for China's agricultural development. *Development Policy Review* [forthcoming].
- Huang, J. and Bouis, H. (1997) Structural changes in the demand for food in Asia. *Food, agriculture and the environment discussion paper* 11, International Food Policy Research Institute: Washington D.C., U.S.A.
- Huang, J. and Rozelle, S. (1997) Market development and food demand in rural China. *China Economic Review*, Vol 8, No. 1 (1997) p. 25-45.
- Huang, J., Otsuka, K. and Rozelle, S. edited by Jian Chen and Shujie Yao (2006) China's rural economy and the path to a modern industrial state, globalization, competition and growth in China, p. 244-272, first published in 2006 by Routledge.
- Lin, J. Y. (1992) Rural reforms and agricultural growth in China. *Am. Econ. Rev.* 82. p. 34-51.
- Ma, H., Huang J., Fuller, F. and Rozelle, S. (2006) Getting rich and eating out: consumption of food away from home in urban China, *Canadian Journal of Agricultural Economics*, Vol. 54 (2006) p.101-119.
- Ministry of Agriculture (2005-1985) China agricultural statistics yearbook, Beijing: China Agriculture Press.
- National Bureau of Statistics of China (NSBC) (2001) Market statistical yearbook of China, Beijing: China Statistics Press.
- National Bureau of Statistics of China (NSBC) (1978-2005) China statistics yearbook, various issues, Beijing: China Statistics Press.
- Rozelle et al. (2006).

Shen, M., Rozelle, S. and Zhang, L (2006) Farmer's professional associations in rural China: state-dominated or new state-society partnerships? *Modern China* [forthcoming].

Wang, H., Dong, X., Huang, J., Rozelle, S. and Rearton, T. (2006) Producing and procuring horticultural crops with Chinese characteristics: why small farmers are thriving and supermarkets are absent in rural China, contributed paper presented at IAAE conference on 13-18 November 2006, Gold Coast, Australia.

Yu, H. (2003) Research on management of fresh food in supermarkets in China. Unpublished MSc. thesis, Chinese Academy of Agricultural Sciences, Beijing.

Zhou, Y. (2001) in Tan, X. and Xin X. et al. (eds) (2001) Vegetable market in Zhongguo Zhuyao Nongchanpin Shichang Fenxi, *China's main agricultural commodities market analysis*, Beijing: China Agricultural Press.

Table 1. Annual growth rates for the Chinese economy, 1970-2004 (shown as %)

	Pre-reform	Reform period			
	1970-78	1979-1984	1985-1995	1996-2000	2001-2004
Gross domestic products	4.9	8.8	9.7	8.2	8.7
Agriculture	2.7	7.1	4.0	3.4	3.4
Industry	6.8	8.2	12.8	9.6	10.6
Services	N/A	11.6	9.7	8.3	8.3
Foreign trade	20.5	14.3	15.2	9.8	25.8
Imports	--	12.7	13.4	9.5	26.7
Exports	--	15.9	17.2	10.1	25.0
Population	1.80	1.40	1.37	0.91	0.63
Per capita GDP	3.1	7.4	8.3	7.2	8.1
Agricultural GDP	2.7	7.1	4.0	3.4	3.4
Production:					
Grain	2.8	4.7	1.7	0.03	-0.2
Cotton	-0.4	19.3	-0.3	-1.9	6.5
Soybean	-2.3	5.2	2.8	2.6	2.4
Oil crops	2.1	14.9	4.4	5.6	0.6
Fruit	6.6	7.2	12.7	8.6	29.5
Meat	4.4	9.1	8.8	6.5	4.6
Fishery	5.0	7.9	13.7	10.2	3.5
Planted area:					
Vegetables	2.4	5.4	6.8	6.8	3.8
Orchards (fruit)	8.1	4.5	10.4	1.5	2.2

Note: Figures for GDP (in real terms) in 1970-1978 show the growth rate of national income in real terms. Growth rates are computed using the regression method. Figures for individual commodities and groups of commodities are based on production data.

Sources: NSBC 1985-2005 and MOA 1985-2005

Table 2a. Percentage of specializing villages and sown area 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 deemed to specialize' if they answer "Yes" to the question: "Do farmers in your village specialize in any particular crop or livestock commodity?"

^b Only includes sown area of villages that specialize in crop sectors.

Source: Huang et al. 2005

Table 2b. Vegetable production in China, 1990-2004

	Area (in millions of hectares)				Share of total crop area (%)		
	Cropped	Vegetables	Tomato	Cucumber	Vegetables	Tomato	Cucumber
1990	148.4	6.3	0.20	0.18	4.2	0.13	0.12
1991	149.6	6.5	0.22	0.19	4.3	0.15	0.13
1992	149.0	7.0	0.19	0.32	4.7	0.13	0.21
1993	147.7	8.1	0.24	0.22	5.5	0.16	0.15
1994	148.2	8.9	0.25	0.27	6.0	0.17	0.18
1995	149.9	9.5	0.53	0.52	6.3	0.35	0.35
1996	152.4	10.5	0.52	0.69	6.9	0.34	0.45
1997	154.0	11.3	0.75	0.82	7.3	0.49	0.53
1998	155.7	12.3	0.84	0.93	7.9	0.54	0.60
1999	156.4	13.3	0.93	1.07	8.5	0.59	0.68
2000	156.3	15.2	1.03	1.17	9.7	0.66	0.75
2001	155.7	16.4	0.69	0.85	10.5	0.44	0.55
2002	154.6	17.4	0.62	0.71	11.3	0.40	0.46
2003	152.4	18.0	0.80	0.94	11.8	0.52	0.62
2004	153.6	17.6	0.82	0.93	11.5	0.53	0.61

Sources: MOA, China Agricultural Statistics Materials, various years

Table 2c. Importance of vegetable production in Shandong, 1990-2004

	Shandong area share of production in China (%)				Area share of total crops in Shandong (%)		
	Crops	Vegetables	Tomato	Cucumber	Vegetables	Tomato	Cucumber
1990	7.3	5.7	12.7	15.7	3.3	0.24	0.25
1991	7.4	6.0	15.6	17.5	3.6	0.31	0.31
1992	7.3	6.4	17.2	12.5	4.1	0.31	0.37
1993	7.3	7.9	22.7	26.1	5.9	0.50	0.53
1994	7.3	9.4	26.3	26.3	7.7	0.61	0.64
1995	7.2	9.0	11.9	12.7	7.9	0.58	0.62
1996	7.2	10.3	10.2	12.1	9.9	0.48	0.76
1997	7.1	11.2	14.3	14.8	11.5	0.97	1.11
1998	7.2	10.8	12.2	11.5	11.9	0.92	0.96
1999	7.2	11.1	11.5	10.7	13.1	0.95	1.01
2000	7.1	11.7	11.9	12.8	16.0	1.10	1.35
2001	7.2	11.3	14.7	13.9	16.4	0.90	1.05
2002	7.1	11.4	16.9	18.9	17.8	0.96	1.21
2003	7.1	11.3	11.5	13.7	18.6	0.84	1.18
2004	6.9	11.2	11.2	13.9	18.5	0.86	1.21

Sources: MOA, *China Agricultural Statistics Materials*, various years

Table 3: Number of markets and food processing enterprises in China, 1980-2004

	Wholesale			Wet markets			Supermarket	Food processing ¹
	Total	Rural	Urban	Total	Rural	Urban		
1980	-	-	-	40809	37890	2919	0	-
1985	-	-	-	61337	53324	8013	0	-
1990	1340	795	545	72579	59473	13106	1	-
1991	1509	-	-	74675	60784	13891	-	-
1992	1858	1101	757	79188	64678	14510	-	-
1993	2081	1229	852	83001	66551	16450	-	-
1994	2471	1530	941	84463	66569	17894	2500	-
1995	3517	2100	1417	82892	63000	19892	6000	-
1996	3844	2299	1545	85391	64559	20832	10000	-
1997	4038	2311	1727	87105	64753	22352	15000	-
1998	4243	2363	1880	89177	65050	24127	21000	15726
1999	4249	2393	1856	88576	63593	24983	26000	14810
2000	4532	2578	1954	88811	62416	26395	32000	14085
2001	4351	-	-	86454	59755	26699	40500	13688
2002	-	-	-	82498	55969	26529	53100	13700
2003	-	-	-	81017	54011	27006	-	14386
2004	-	-	-	-	-	-	-	15576

¹ Food processing includes both food processing and beverage manufacturing

Sources: NSBC, *Market statistical yearbook of China*, various years; *China yearbook*, various years; Yu 2003; Zhou 2001; Hu et.al. 2004

Table 4. Value of marketing transactions in China's markets, 1980 to 2003 (in billions of yuan, in real terms)

	Wholesale			Wet market			Supermarket
	Total	Rural	Urban	Total	Rural	Urban	
1980	-	-	-	23.2	20.9	2.3	0
1985	-	-	-	62.5	50.6	11.9	0
1990	11.4	-	-	214.2	131.4	82.8	-
1991	15.2	-	-	259.1	152.5	106.6	-
1992	22.0	8.0	14.0	348.8	192.4	156.4	-
1993	34.3	13.5	20.8	528.0	274.8	253.2	-
1994	67.4	26.2	41.2	887.5	436.0	451.5	3.4
1995	140.6	50.9	89.7	1145.3	535.0	610.3	8.3
1996	188.3	65.8	122.5	1452.1	673.1	779.0	29.5
1997	230.6	78.7	152.0	1721.8	786.2	935.7	41.8
1998	283.6	94.4	189.2	1960.1	868.9	1091.2	99.2
1999	268.3	87.7	180.5	2145.1	927.1	1218.0	148.4
2000	331.1	105.5	225.6	2399.1	1035.5	1363.6	217.3
2001	337.9	-	-	2465.4	1050.4	1415.0	304.3
2002	-	-	-	2566.8	1070.8	1496.0	451.9
2003	-	-	-	2618.4	1091.9	1526.5	-

Note: Trade values are measured in 2003 prices, deflated by consumer price index

Source: NSBC, Market statistical yearbook of China, various years; Hu, et al. 2004

Table 5. Sales and number of store units of the top 90 Chinese supermarket chains in the Eastern, Central and Western regions of China, 2001 and 2002

	2001		2002	
	Sales (billion US\$)	No .of stores	Sales (billion US\$)	No .of stores
Eastern China	11.0	6246	15.2	9822
Central China	2.2	1146	3.0	1658
Western China	0.2	253	0.3	319
Total	13.4	7645	18.5	11799

Note: Eastern China: Beijing, Tianjin, Shandong, Jiangsu, Liaoning, Shanghai, Zhejiang, Fujian and Guangdong provinces. Central China: Heilongjiang, Jilin, Hebei, Henan, Shanxi, Anhua, Jiangxi, Hubei, Hunan, Sichuan, Chongqing, Yunnan and Guizhou provinces. Western China: Shanxi, Ningxia, Gansu, Qinghai, Tibet, Xinjiang and Inner Mongolia.

Source: CCFA 2002 and 2003

Table 6. Number of wholesale and wet markets in Beijing, 2000-2004

	Total	Urban	Suburbs
2000	386	69	317
2001	356	60	296
2002	327	56	271
2003	321	53	268
2004	324	-	-

Source: NSBC, Beijing statistical yearbook, various years

Table 7. Wholesale vegetable market channels in selected markets in Beijing, 2000 and 2005

Buyers	Beijing		Xinfadi		Baliqiao		Dongjiao	
	2000	2005	2000	2005	2000	2005	2000	2005
Small traders	10.8	9.3	12.1	10.5	4.5	3.7	0	0
Small retailers	62.3	55.7	64.7	58.5	61.3	44.4	24.9	29.8
Wholesalers	12.6	9.8	14.2	10.2	5.0	11.5	0	0
Specialist suppliers	0	0.01	0	0.02	0	0	0	0
Processing firms	0.1	0.1	0	0.08	0.50	0.24	0	0
Supermarkets	3.6	9.3	2.7	8.5	9.6	13.9	8.2	13.7
Consumers	3.8	4.6	0.0	0.8	10.1	14.8	54.6	48.8
Restaurants	6.8	10.9	6.2	11.1	8.9	11.4	12.3	7.8
Group purchasing	0.1	0.3	0.1	0.4	0	0	0	0

Note: Group purchasing includes government units, enterprises, etc. (mostly purchasing for special occasions when employees are given boxes of fruit and vegetables as an in-kind bonus).

Source: authors' survey

Table 8. Sources of vegetable procurement by supermarkets in Beijing in 2006

Vegetable procurement by supermarkets	Share (%)
1 Direct purchases from 'wholesalers' in Xinfadi and other small urban and suburban wholesale markets	20
(These firms typically employ 2-6 people. Most do not have a fixed site in the market, but do business from their trucks. All transactions are on a spot market basis)	
<u>Sources of supply</u>	
1.1 Procured by themselves from farmers	8
1.2 Procured by agents from farmers	12
2 Direct purchases from 'small farm product delivery companies'	43
These firms are similar in size and nature to regular wholesalers (i.e., are the same as 1 above). In fact, in the market 'small farm product delivery companies' are indistinguishable from 'wholesalers'. The nature of their dealings with supermarkets (working on a spot market basis, not issuing receipts and not having contracts with either supermarkets or suppliers) and their sources of supply are similar. The only difference is that these firms rent a shop in or near the wholesale market.	
<u>Sources of supply</u>	
2.1 Procured by themselves from farmers	10
2.2 Procured by agents from farmers	3
2.3 Procured by themselves from wholesalers in Xinfadi	30
3 Procured from 'large farm product delivery companies'	22
These firms are wholesalers, with the same sources of supply as any other wholesaler. They do most of their purchasing through agents, who are really just small traders selling to a single buyer—but with no contract. The biggest difference is their size: these firms typically employ more than 30 people. Because of their size, they are taxed by local authorities and pay taxes on some of their transactions. Most, but not all, have contracts with supermarkets, although the nature of such contracts appears to be fairly loose and most of the relationship is based on mutual performance. Some sales are made on a credit basis. Apart from a small amount (5%) that comes from their own production bases, most of their supply channels (and terms of procurement) are indistinguishable from those of 'wholesalers' and 'small farm product delivery companies'.	
<u>Sources of supply</u>	
3.1 Procured directly from farmers	6
3.2 Procured by agents from farmers	9
3.3 Procured from 'small farm product delivery companies'	1
3.4 Procured from wholesalers	1
3.5 From their own production bases	5
4 Supermarkets procuring direct from farmers without contract	12
<u>Sources of supply</u>	
4.1 Either through agents or employees (themselves nearly all former small traders).	
5 Supermarkets procuring direct from farmers with contracts	2

6 Supermarkets' own production base

1

Source: authors' survey

Table 9. Wholesale tomato market channels in selected markets in Beijing, 2000 and 2005

Buyers	Beijing		Xinfadi		Baliqiao		Dongjiao	
	2000	2005	2000	2005	2000	2005	2000	2005
Small traders	2.1	0.9	0	0.3	21.4	6.7	0	0
Small retailers	71.7	63.3	72.9	66.8	61.8	40.3	70.0	50.0
Wholesalers	14.7	11.6	17.3	13.6	0	0	0	0.4
Specialist suppliers	0	0.04	0	0.04	0	0	0	0
Processing firms	0	0.2	0	0.2	0	0	0	0
Supermarkets	2.3	8.2	2.7	7.5	0	17.9	0	0
Consumers	1.5	6.8	0.02	2.0	0.4	30.1	30.0	42.8
Restaurants	7.7	8.9	7.2	9.5	16.4	5.0	0	7

Source: authors' survey

Table 10. Wholesale cucumber market channels in selected markets in Beijing, 2000 and 2005

Buyers	Beijing		Xinfadi		Baliqiao		Dongjiao	
	2000	2005	2000	2005	2000	2005	2000	2005
Small traders	13.5	14.5	15.6	16.8	2.8	2.4	0	0
Small retailers	59.8	51.0	62.3	53.4	61.3	46.3	15.0	20.4
Wholesalers	11.9	8.5	13.3	8.1	5.6	16.5	0	0
Processing firms	0.06	0.04	0	0	0.6	0.4	0	0
Supermarkets	3.8	10.0	2.7	9.1	10.6	12.2	10.0	20.0
Consumers	4.1	3.4	0.04	0.04	11.1	8.1	60.0	51.6
Restaurants	6.6	12.0	5.9	12.0	8.1	14.3	15.0	8.0
Group purchasing	0.1	0.5	0.1	0.6	0	0	0	0

Note: Group purchasing includes government units, enterprises, etc. (mostly purchasing for special occasions when employees are given boxes of fruit and vegetables as an in-kind bonus).

Source: authors' survey

Table 11. Tomato wholesale marketing channels in Shouguang county in Shandong, 2000 and 2005.

Buyers	2000	2005
Small traders	23.3	20.7
Small retailers	10.8	11.0
Wholesalers	49.2	44.6
Processing firms	0.8	2.5
Exporters	2.7	5.5
Supermarkets	1.9	5.0
Consumers	4.5	3.2
Restaurants	6.2	7.1
Group purchasing	0.5	0.4

Note: Group purchasing includes government units, enterprises, etc. (mostly purchasing for special occasions when employees are given boxes of fruit and vegetables as an in-kind bonus).

Source: authors' survey

Table 12. Cucumber wholesale marketing channels in selected markets in Shandong Province, 2000 and 2005

Buyers	Total		County		Township	
	2000	2005	2000	2005	2000	2005
Small traders	0.5	4.2	3.9	21.2	0	0
Small retailers	18.6	16.2	18.3	18.5	18.6	15.6
Wholesalers	57.8	47.9	69.8	56.3	56.2	45.9
Specialist suppliers	0	0.08	0	0.4	0	0
Processing firms	0	3.0	0	0	0	3.7
Exporters	1.2	7.7	0	0	1.3	9.6
Supermarkets	9.8	14.3	0.8	2.2	11.0	17.3
Consumers	0.9	0.6	6.5	0.7	0.2	0.6
Restaurants	11.0	6.0	0.7	0.8	12.7	7.3

Source: authors' survey

Table 13. Driving forces behind the restructuring of downstream agrifood marketing in China, 1978-2004

	GDP per capita (1978=100)	Urban share (%)	population Agricultural trade (billion US\$)	FDI (billion US\$)
1978	100	17.9	-	-
1980	106.1	19.4	-	-
1985	175.5	23.7	11.8	4.1
1990	255.6	26.4	19.2	3.5
1991	288.4	26.9	20.1	4.4
1992	323.6	27.5	22	11.0
1993	360.4	28.0	21	27.5
1994	394.0	28.5	28.1	33.8
1995	188.2	29.0	26.2	37.5
1996	427.1	30.5	22.6	41.7
1997	460.3	31.9	24.8	45.3
1998	491.5	33.4	23.6	45.5
1999	521.8	34.8	21.8	40.3
2000	559.2	36.2	26.8	40.7
2001	596.7	37.7	27.8	46.9
2002	642.0	39.1	30.4	52.7
2003	698.5	40.5	40.1	53.5
2004	760.0	41.8	51.1	60.6

Sources: NSBC, China statistical yearbook, various issues

Table 14. Characteristics of typical villages in China, Shandong and sample tomato and cucumber sites.

	China	Shandong	Tomato		Cucumber	
	average	average	villages		villages	
	2004	2004	2000	2005	2000	2005
Population (persons/village)	1444	818	920	919	1324	1369
Households (households/village)	383	238	250	259	377	397
Family size (persons/household)	3.8	3.4	3.6	3.5	3.5	3.5
Cultivated land (hectares/village)	199	89	103	97	104	104
Farm size (ha)	0.35	0.25	0.4	0.4	0.1	0.3
Irrigated area share (%)	42	62	92	93	73	76
Farm size (ha)	0.35	0.25	0.4	0.4	0.1	0.3
Per capita income (yuan)	2936	3507	2943	4023	2648	3778
Share of agricultural income (%)	47.6		80	75	80	77
Off-farm employment (%)	34	34	21	30	25	27
Share of farmers participating in4 vegetable FPAs		-	7	8	2	11

Sources: NSBC, China statistical yearbook, 2005; authors' survey. Information on 'farming wage' at national level is from CCAP database, based on own household survey work. Information on 'share of farmers participating in FPAs' in the whole of China from Zhang et al. 2005

Table 15. Structure of crop production in sample tomato villages in Shandong, 1995-2005 (shown as % of total cultivated area in villages)

Type of village ^a	Grain	Vegetables			Other
		Total	Tomato	Greenhouse tomatoes	
Average					
1995	69	9	2.4	1.4	22
2000	69	14	4.5	3.5	17
2005	65	18	5.7	4.9	17
High-production counties					
1995	84	13	3.5	2.8	4
2000	77	19	6.4	6.4	4
2005	73	24	7.2	7.2	2
Medium-production counties					
1995	67	9	1.9	1.5	24
2000	74	15	4.0	3.9	11
2005	67	21	7.0	6.9	12
Low-production counties					
1995	59	6	2.3	0.0	35
2000	57	8	3.5	0.3	35
2005	54	8	2.3	0.02	37

Source: authors' survey

^a High-, medium- and low-production counties are categorized according to production per farm, as discussed in detail in section 2.1 (sampling). "Average" is the weighted average of all sample villages.

Table 16. Structure of crop production in sample cucumber villages in Shandong, 1995-2005 (shown as % of total cultivated area in villages)

Type of sample ^a	Grain	Vegetable			Others
		Total	Cucumber	Greenhouse cucumber	
Average					
1995	67	22	7.4	5.4	10
2000	56	30	8.7	5.7	14
2005	51	39	10.3	8.4	11
High-production county					
1995	74	15	6.1	5.4	11
2000	63	24	7.3	4.9	13
2005	57	28	8.8	5.4	15
Medium-production county					
1995	52	38	11.4	7.3	10
2000	38	42	12.1	8.1	21
2005	33	58	15.1	14.3	8
Low-production county					
1995	85	4	2.6	2.4	11
2000	79	16	4.7	2.8	6
2005	72	18	4.2	2.0	10

Source: authors' survey

^a High-, medium- and low-production counties are categorized according to production per farm, as discussed in detail in section 2.1 (sampling). "Average" is the weighted average of all sample villages.

Table 17. Structure of crop production in sample tomato and cucumber villages in Shandong, 1995-2005 (shown as % of total number of households in the village)

Type of sample ^a	Tomato			Cucumber		
	Average area per household (ha)	Share of households planting the crop (%)	Area per household planting the crop (ha)	Average area per household (ha)	Share of households planting the crop (%)	Area per household planting the crop (ha)
Average						
1995	0.016	15	0.10	0.026	17	0.10
2000	0.032	25	0.10	0.032	22	0.13
2005	0.036	25	0.12	0.038	27	0.15
High-production county						
1995	0.027	21	0.15	0.024	27	0.07
2000	0.055	35	0.12	0.036	28	0.10
2005	0.049	28	0.13	0.046	37	0.11
Medium-production county						
1995	0.014	19	0.07	0.037	21	0.15
2000	0.031	30	0.11	0.036	25	0.16
2005	0.046	34	0.15	0.046	33	0.17
Low-production county						
1995	0.010	4	0.11	0.009	4	0.03
2000	0.016	10	0.09	0.022	12	0.10
2005	0.010	10	0.04	0.019	10	0.16

Source: authors' survey

^a High-, medium- and low-production counties are categorized according to production per farm, as discussed in detail in section 2.1 (sampling). "Average" is the weighted average of all sample villages.

Table 18. New varieties, seed, fertilizer and extension and credit services in sample tomato and cucumber villages in Shandong, 2000 and 2005

	Tomato	Cucumber
Number of varieties per village in 2000	2.7	2.4
Number of varieties per village in 2005	5.8	4.0
New varieties introduced between 2000 and 2005	2.4	2.0
Varieties dropped by farmers between 2000 and 2005	1.1	0.8
Sources of seed (%):		
Purchased seeds	100	100
Supplied by buyers	0	0
Sources of fertilizer (%):		
Purchased fertilizer	100	100
Supplied by buyers	0	0
'Fee-paying' extension services (%)	0	6.5
Extension technicians	0	6.5
Buyers	0	0
'Non fee-paying' extension services (%)	74	69
Relatives or friends	18	27
Extension personnel	94	73
Buyers	0	0
Access to credit (yes or no) (%)	91	75
If yes, sources of credit (%):		
Banks	14	0
RCC	67	69
Relatives or friends	43	44
Buyers	0	0

Source: authors' survey

Table 19. Production constraints identified by farmers in sample tomato and cucumber in villages in Shandong, 2005

	Top constraint (%)		Top three constraints (%)	
	Tomato	Cucumber	Tomato	Cucumber
Average of all villages				
Lack of appropriate seed	4	0	9	0
Quality of inputs	9	13	30	50
Price of inputs	4	0	4	0
Technology	70	75	83	88
Credit (high fixed input)	0	6	0	6
Natural disasters	4	6	22	25
Other	0	0	4	19
Richer villages (those in villages with above-average income)				
Lack of appropriate seed	10	0	10	0
Quality of inputs	20	13	70	25
Price of inputs	10	0	10	0
Technology	50	75	80	88
Credit (high fixed input)	0	13	0	13
Natural disasters	0	0	30	25
Other	0	0	0	25
Poorer villages (those in villages with below-average income)				
Lack of appropriate seed	0	0	8	0
Quality of inputs	0	13	0	85
Price of inputs	0	0	8	0
Technology	85	75	85	88
Credit (high fixed input)	0	0	0	0
Natural disasters	7	13	15	25
Other	0	0	8	13

Source: authors' survey

Note: The sum of the percentages for the top constraint (columns 1 and 2) does not always equal 100, because some villages reported that they did not face any major constraints. The sum of the percentages for the top three constraints (columns 3 and 4) exceeds 100 because villages gave up to three answers.

Table 20. Constraints preventing farmers from cultivating tomatoes and cucumbers in sample villages in Shandong, 2005

	Tomato	Cucumber
Off-farm income makes vegetable production unattractive	39.1	43.8
Not enough labour	47.8	56.3
Planting other crops is more profitable	13.0	31.3
Unprofitable to plant tomatoes	26.1	18.8
Not enough land	4.3	18.7
Insufficient capital	4.3	6.3
Inappropriate technology	8.7	12.5
Unsuitable soil quality and climate	4.3	0

Source: authors' survey

Note: The sum of the percentages exceeds 100 because villagers gave more than one answer.

Table 21. Procurement channels at the farm gate: clients buying from tomato and cucumber producers in Shandong sample village, 2000 and 2005 (shown as %)

	Tomato villages		Cucumber villages	
	2000	2005	2000	2005
Small traders	22	15	14	14
Wholesalers	77	84	77	78
Specialist suppliers	0	0.004	0.4	0.3
Processing firms	0	0.2	1	3
Supermarkets	0.1	0.3	0	0.1
Associations	0	0	0	2
Exporters	0	0	2	1
Consumers	1	0.4	5	1

Source: authors' survey

Note: Data derived from answers given by farmers in the focus group to the question: "To whom did you sell your tomatoes/cucumbers?"

Table 22. Contracting arrangements and price determination in sample tomato- and cucumber-producing villages in Shandong, 2005 (shown as%)

	Cucumber villages			Tomato villages		
	Formal contracts	Oral contracts	No contract	Formal contracts	Oral contracts	No contract
Ratio of different kinds of contract	0	6	94	0	9	91
Services provided by buyers						
Seed	--	0	0	--	0	0
Fertilizer	--	0	0	--	0	0
Credit	--	0	0	--	0	0
Extension	--	0	0	--	0	0
Price determination						
Determined by market	--	6	94	--	9	91
Determined between buyer and seller prior to sale	--	0	0	--	0	0

Source: authors' survey

Table 23. Marketing infrastructure in tomato- and cucumber-producing villages in Shandong, 2000 and 2005

	Tomato villages		Cucumber villages	
	2000	2005	2000	2005
Distance from nearest county road (km)	2	2	2	2
Distance from nearest highway (km)	16	14	31	19
Distance from nearest wet market (km)	5	4	3	2
Distance from nearest wholesale market (km)	10	9	5	4
Share of farmers owning landline telephones or cell phones (%)	44	81	32	71
Share of farmers with cable television (%)	25	61	5	20

Source: authors' survey

Table 24. Quality of tomato- and cucumber-producers' marketing information in sample villages in Shandong Province, 2005

	Tomato villages	Cucumber villages
Source of marketing information		
Local markets	74	69
Neighbours	69	50
Media	13	31
Buyers	9	19
Brokers	13	6
Cooperatives	4	6
Government	4	0

Source: authors' survey

Table 25. Production constraints identified by farmers in tomato- and cucumber-producing villages in Shandong Province, 2005

	Top single constraint (%)		Top three constraints (%)	
	Tomato	Cucumber	Tomato	Cucumber
Average income:				
Insufficient information	30	27	30	27
Lack of markets	9	13	22	27
Small-scale production (high cost/unit to sell)	4	7	13	13
Price variability	13	7	13	13
Government regulation	0	0	0	20
'Unfair transactions'	9	13	9	13
Others	0	0	4	0
Above-average income:				
Insufficient information	23	13	23	13
Lack of markets	8	25	23	50
Small-scale production (high cost/unit to sell)	8	0	8	0
Price variability	8	13	8	13
Government regulation	0	0	0	38
'Unfair transactions'	15	25	15	25
Other	0	0	0	0
Below-average income:				
Insufficient information	40	43	40	43
Lack of markets	10	0	20	0
Small-scale production (high cost/unit to sell)	0	14	20	29
Price variability	20	0	20	14
Government regulation	0	0	0	0
'Unfair transactions'	0	0	0	0
Other	0	0	10	0

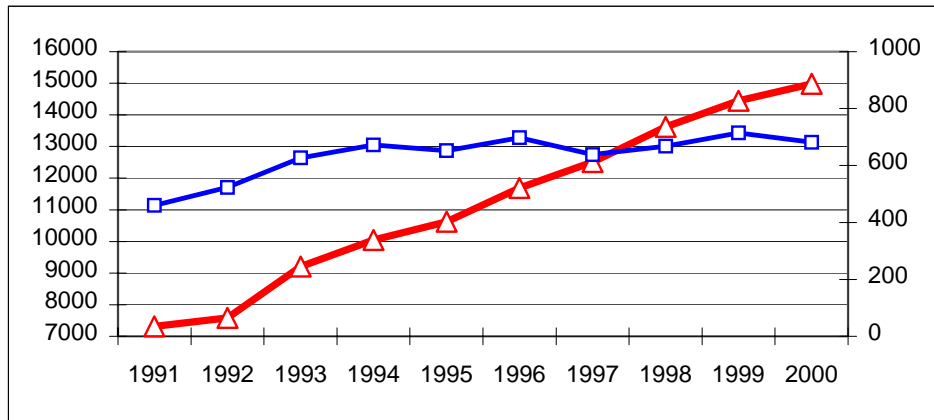
Note: 'Unfair transactions' means farmers believe that they were cheated during the sales transaction.

Source: authors' survey

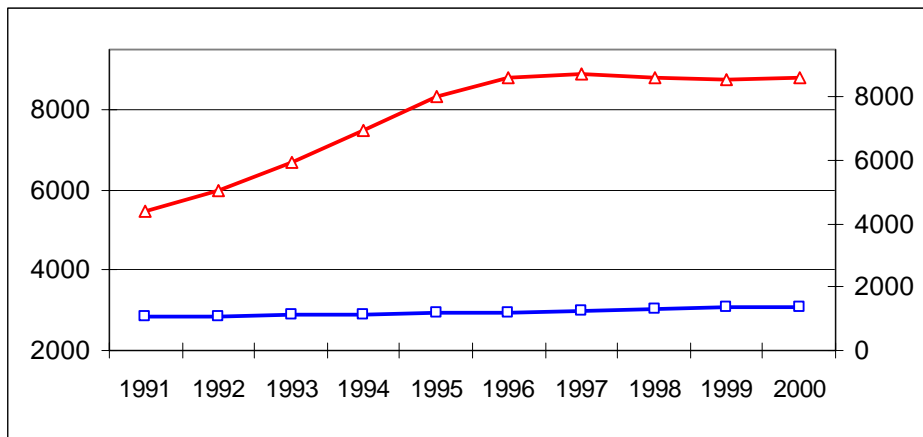
Note: The sum of the percentages for the top constraint (columns 1 and 2) does not always equal 100 because some villages that reported they did not face any major constraints. The sum of the percentages for the top three constraints (columns 3 and 4) exceeds 100 because villages provided up to three answers.

Figure 1. Sown area of vegetables and fruit in China (red line in each panel) and California (blue line in each panel), 1991 to 2000 (in thousands of hectares) – is this correct?

Panel A. Vegetables (scale on left-hand axis relates to China; scale on right-hand axis relates to California)



Panel B. Orchards



Data source: Rozelle et al. 2006

Figure 2. Distribution of wholesale markets selling agricultural produce in Greater Beijing, 2005

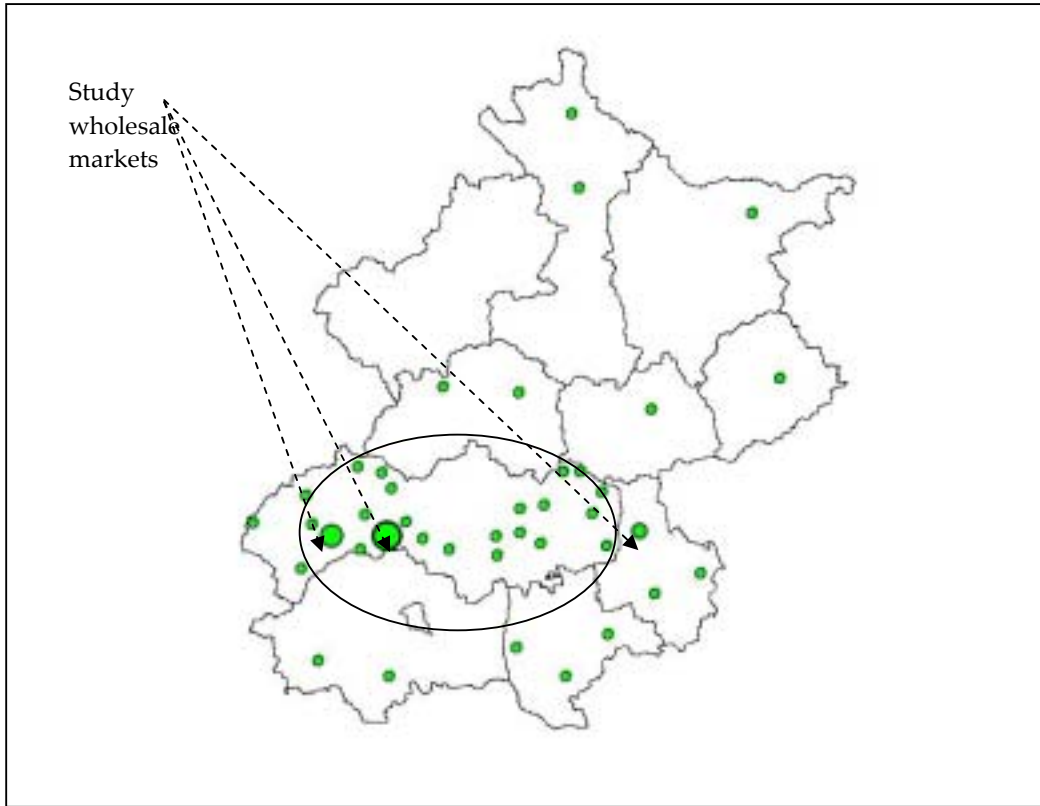
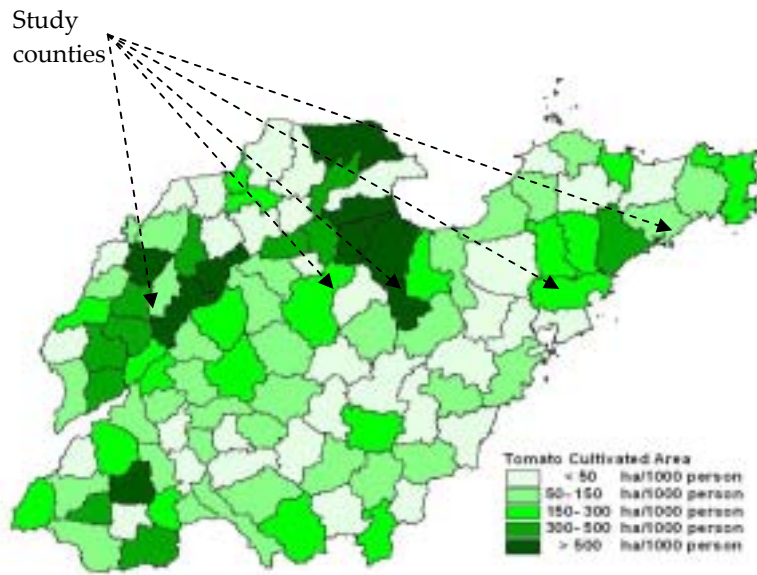
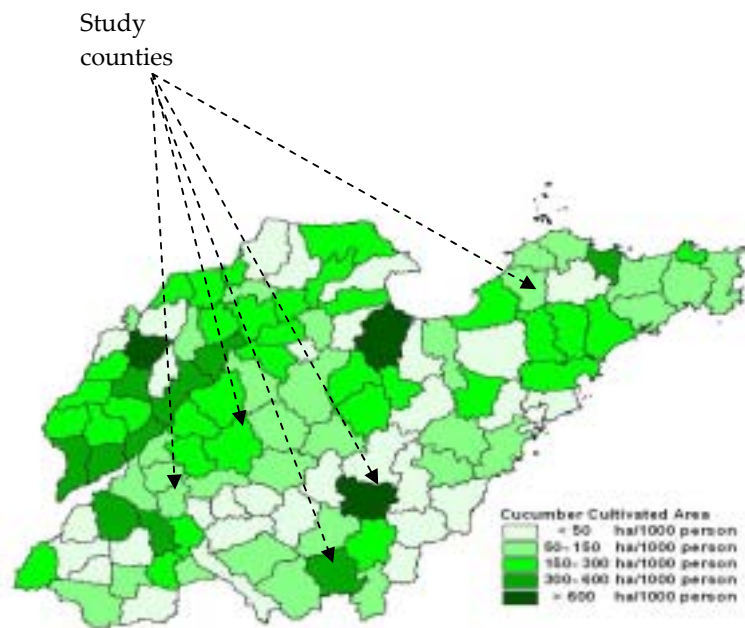


Figure 3. Distribution of per capita area under tomatoes in the counties of Shandong, 2005



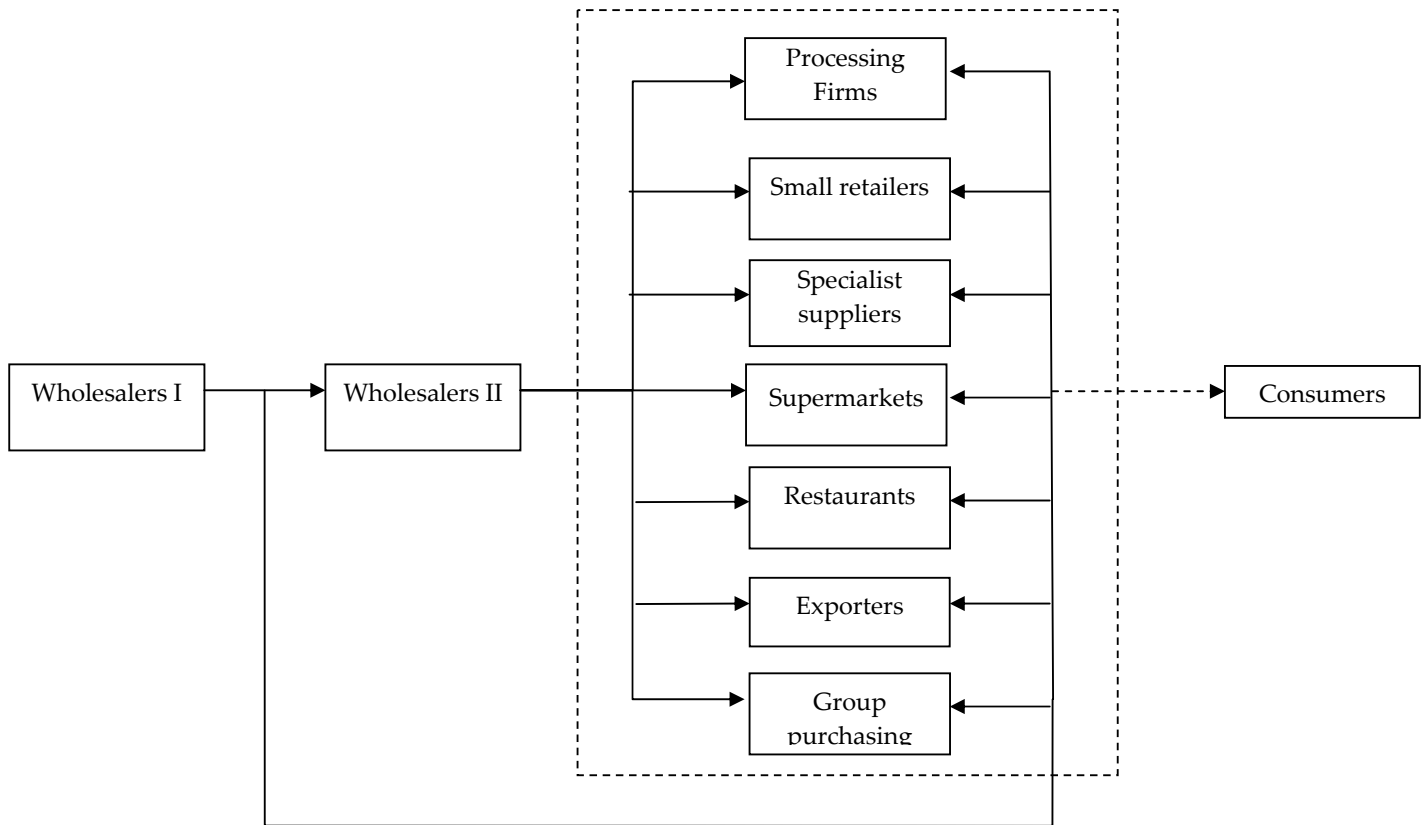
Data source: provided to the authors by the Shandong Agricultural Bureau, Jinan, China

Figure 4. Distribution of per capita area under cucumbers in the counties of Shandong, 2005



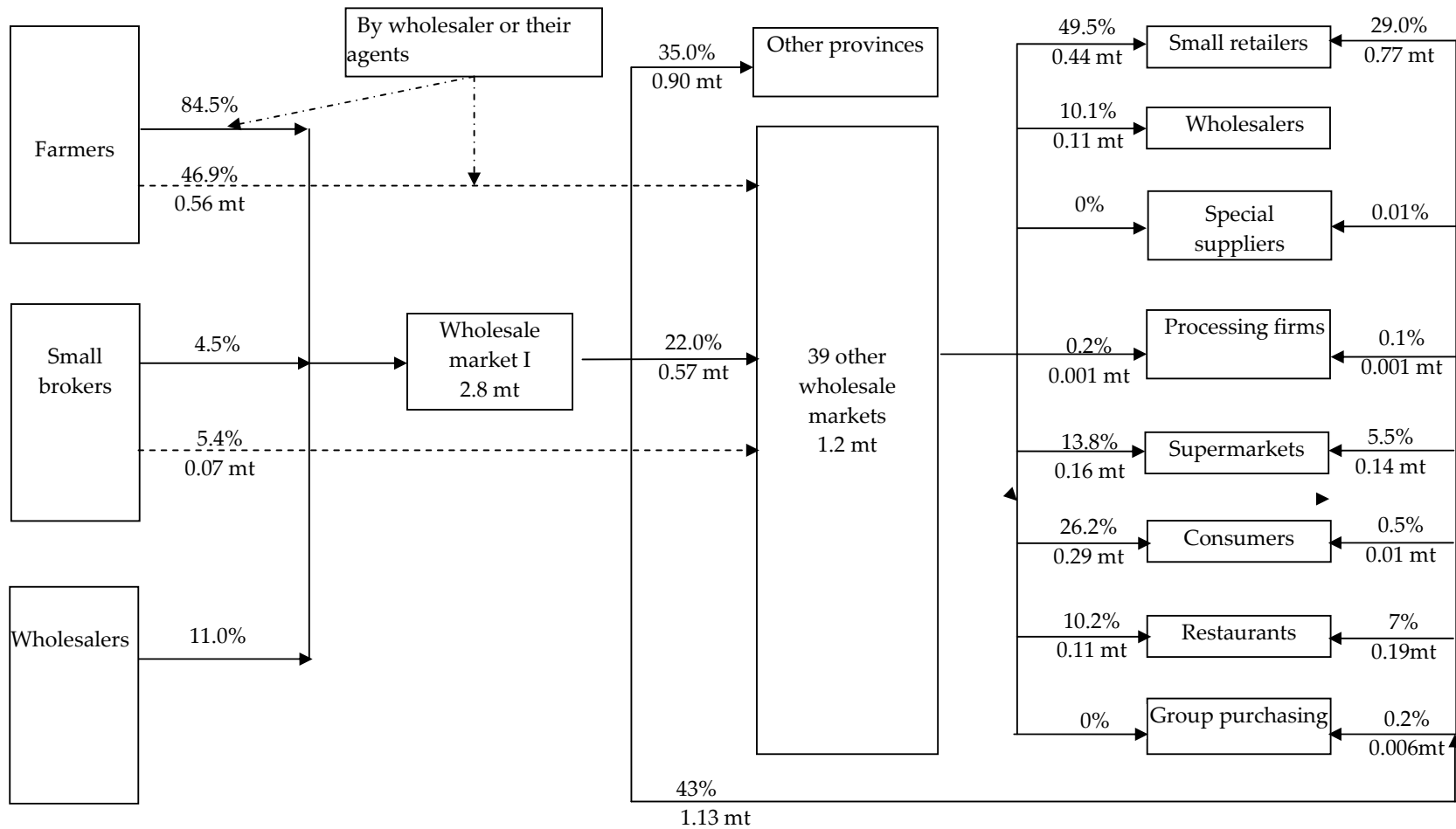
Data source: Provided to the authors by the Shandong Agricultural Bureau, Jinan, China

Figure 5. General vegetable marketing chains in China



Note: Group purchasing includes government units, enterprises, etc. (mostly purchasing for special occasions when employees are given boxes of fruit and vegetables as an in-kind bonus).

Figure 6. Vegetable marketing chains in Beijing



Note: Group purchasing includes government units, enterprises, etc. (mostly purchasing for special occasions when employees are given boxes of fruit and vegetables as an in-kind bonus).

Figure 7a. Tomato marketing chains in Beijing in 2005

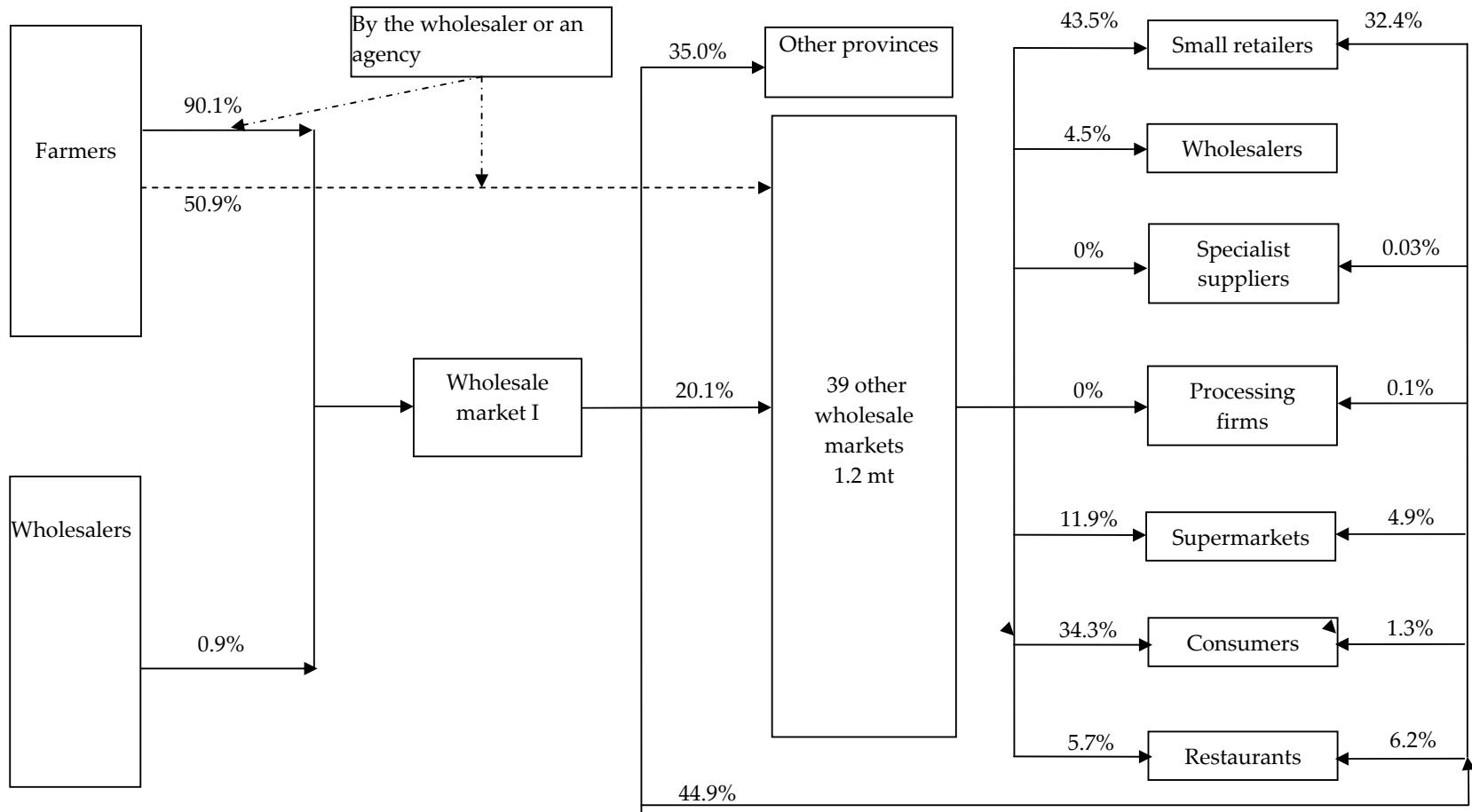


Figure 7b. Tomato marketing chains in Beijing in 2000

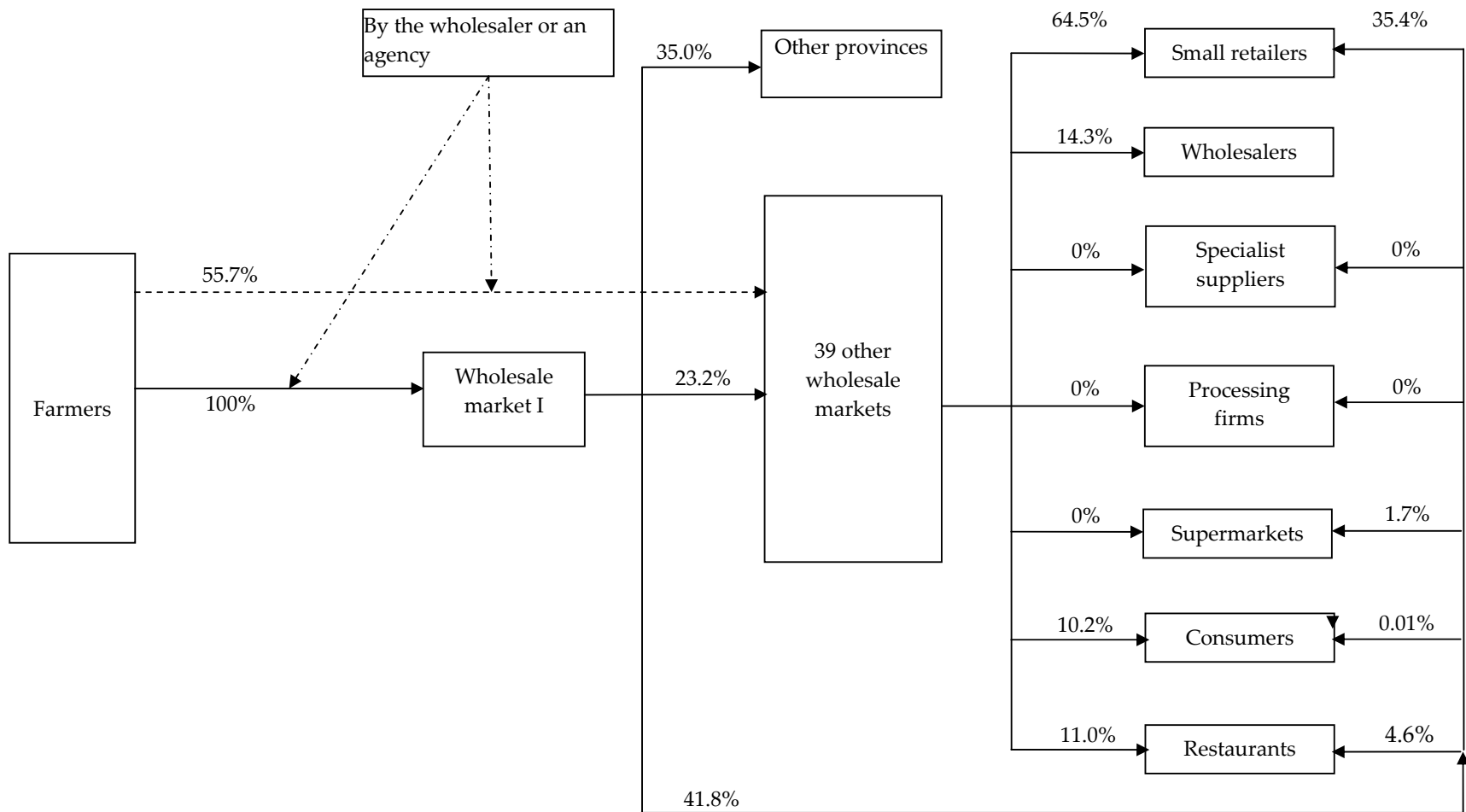


Figure 8a Cucumber marketing chains in Beijing in 2005

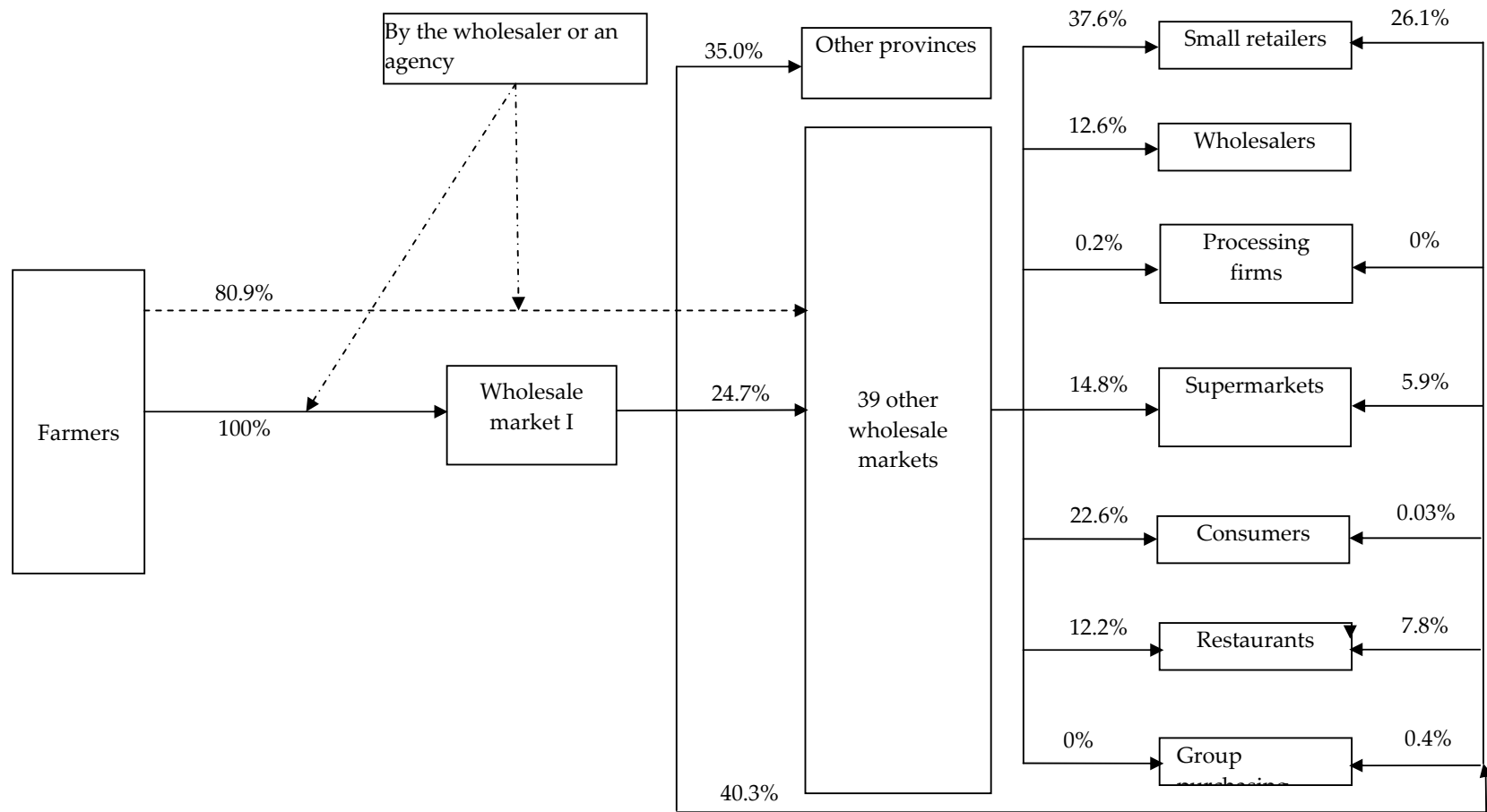


Figure 8b. Cucumber marketing chains in Beijing in 2000

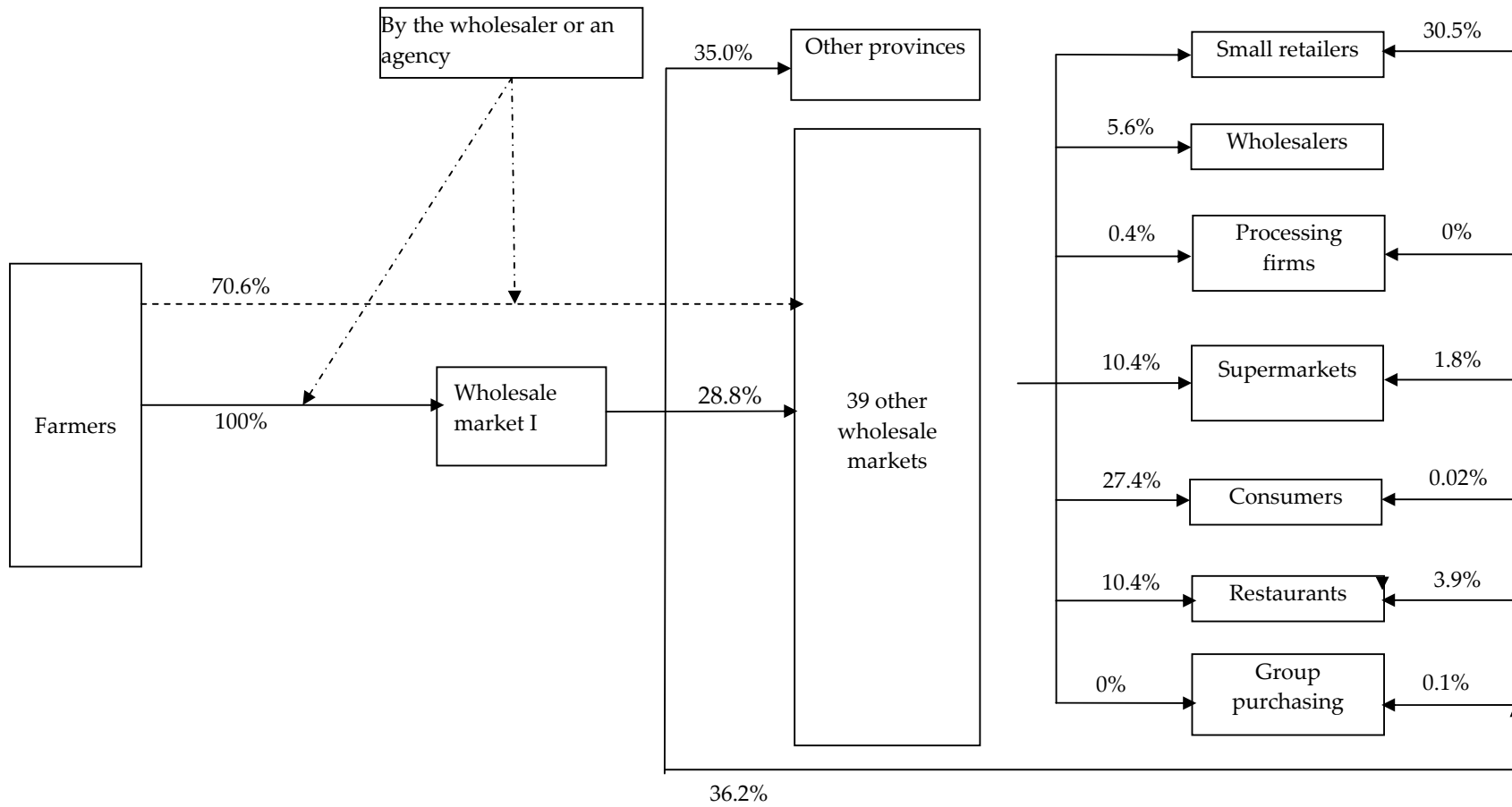
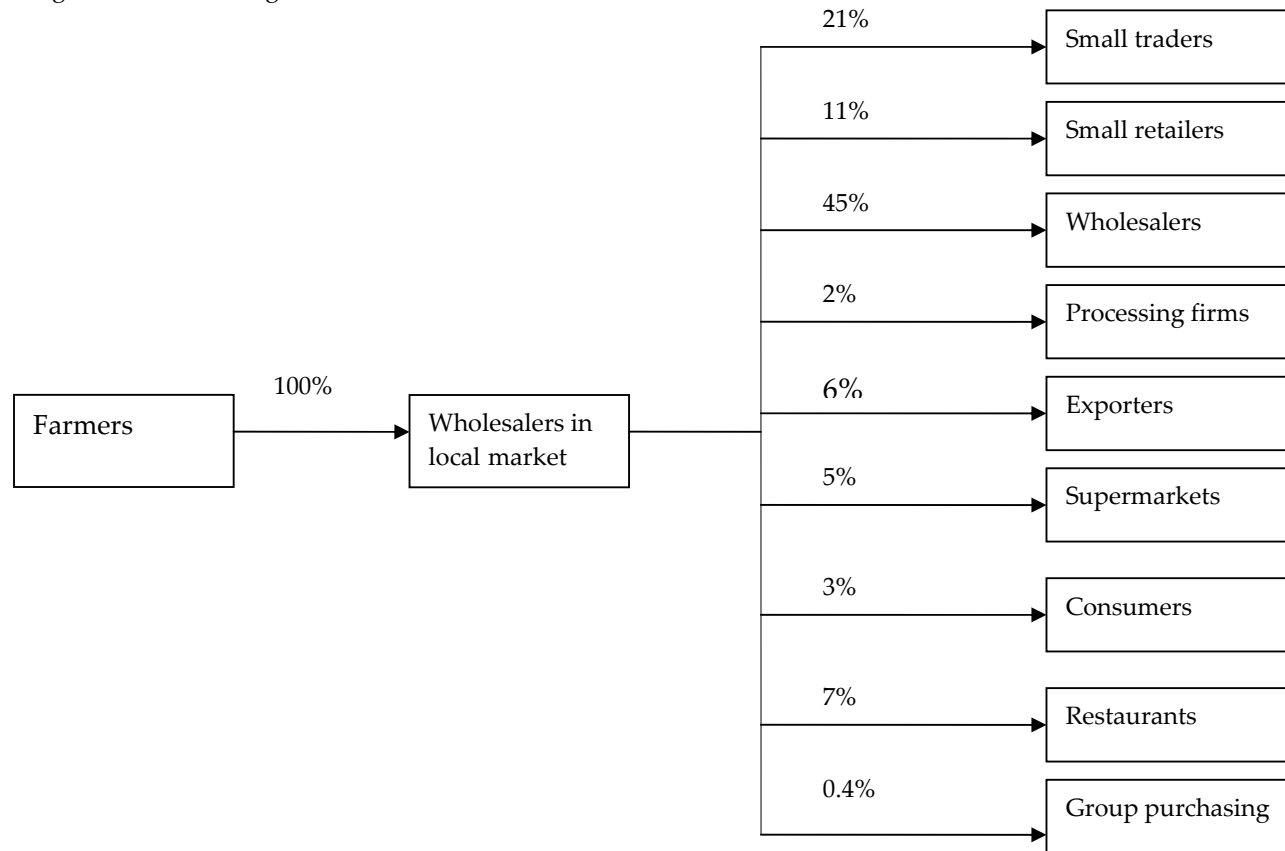
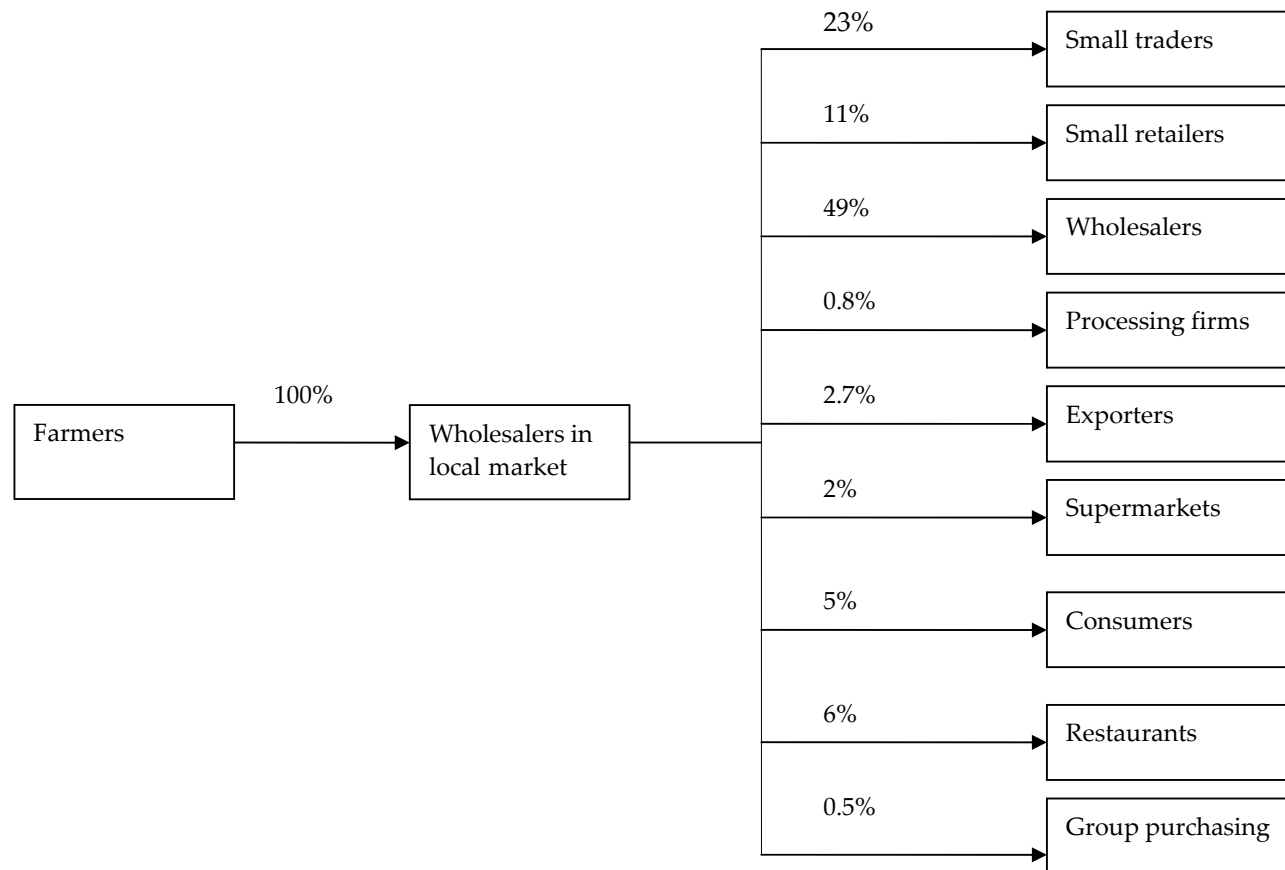


Figure 9a. Tomato marketing chain in Shandong in 2005



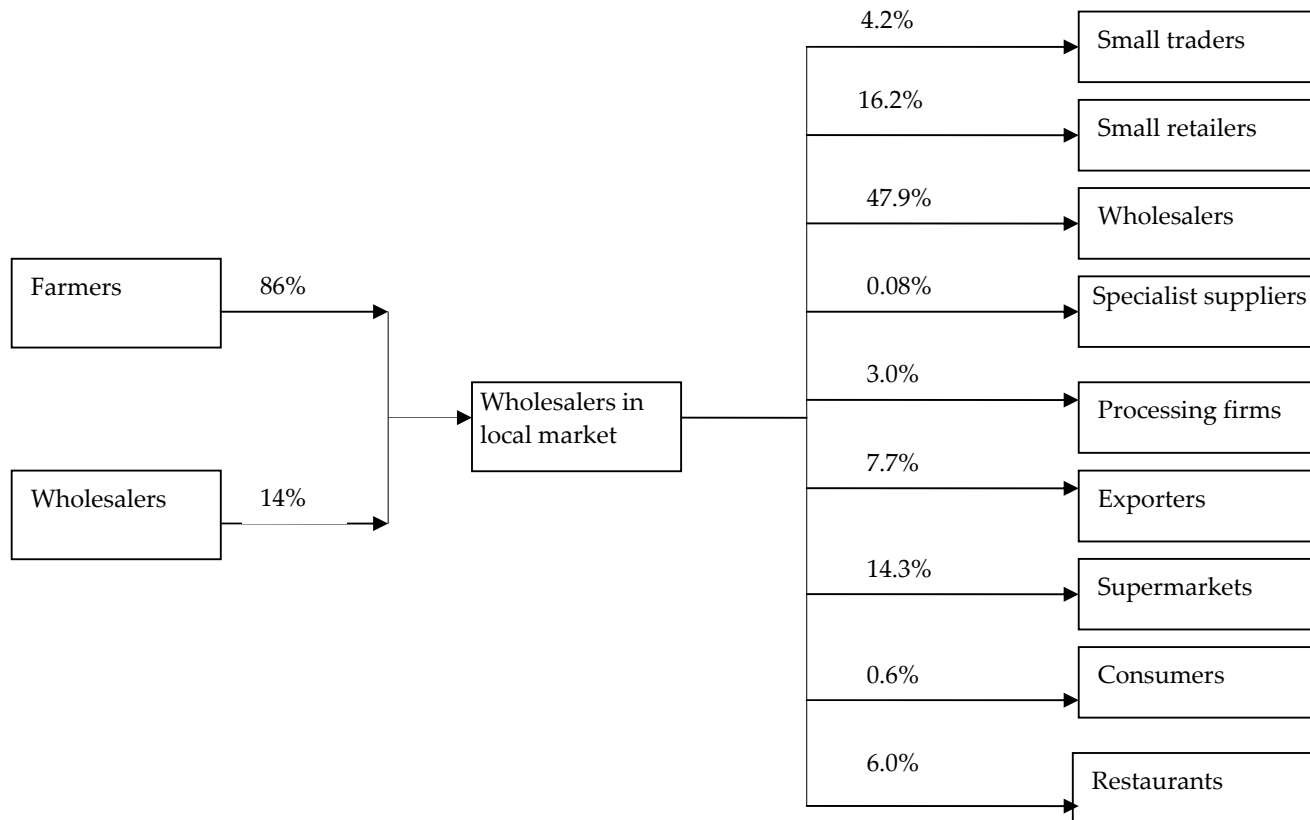
Data source: community-level survey by authors

Figure 9b. Tomato marketing chain in Shandong in 2000



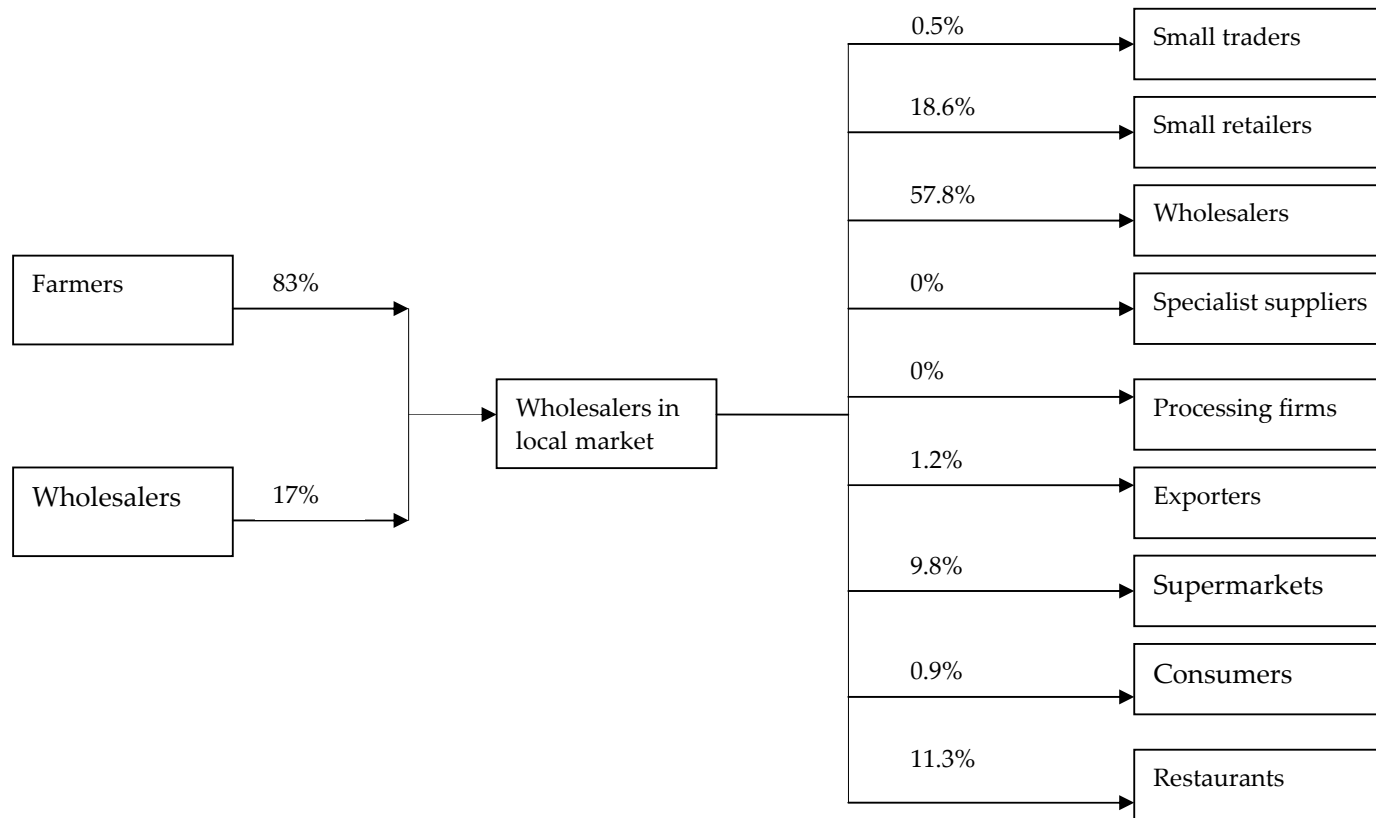
Data source: community-level survey by authors

Figure 10a. Cucumber marketing chain in Shandong in 2005

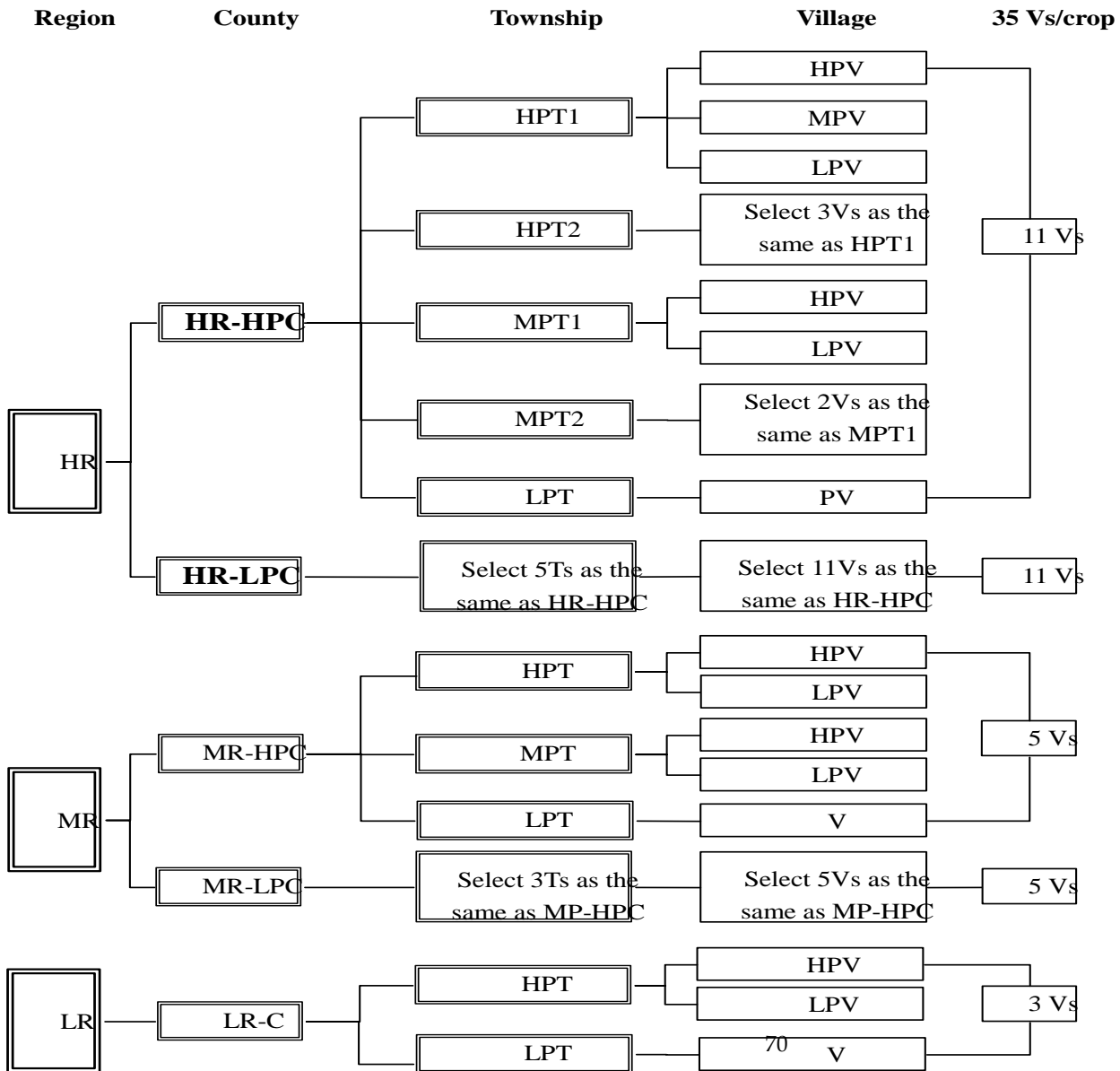


Data source: community-level survey by authors

Figure 10b. Cucumber marketing chain in Shandong in 2000

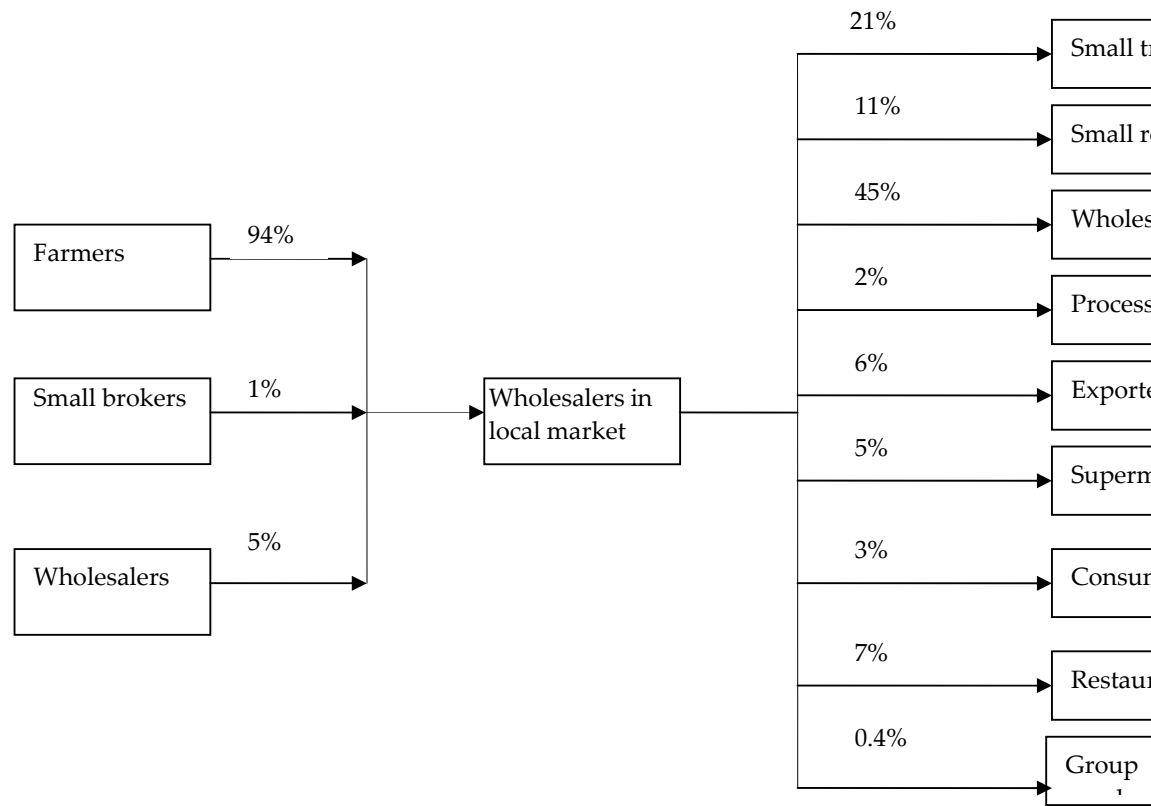


Data source: community-level survey by authors



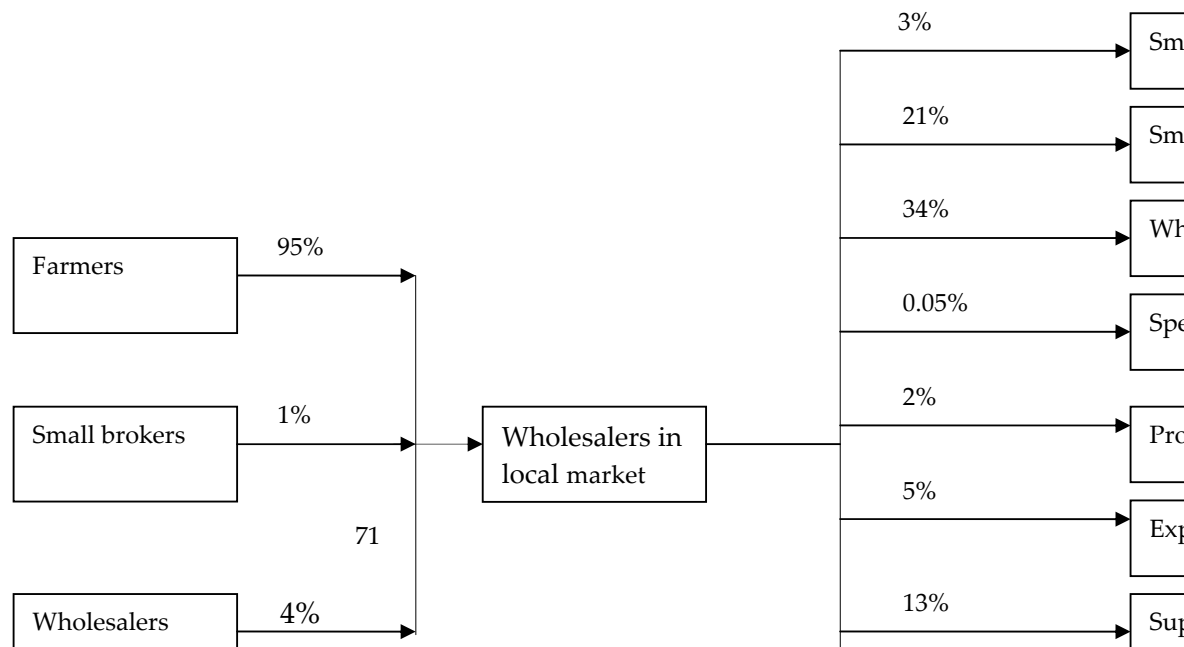
Note: L=Low, M=Medium, H=High
P=Production per average farm or rural population.
R=Region, C=County, T=Town, V=Village

Appendix Figure 2. Tomato marketing chain in Shandong in 2005



Data source: wholesale market survey by authors

Appendix Figure 3. Cucumber marketing chain in Shandong in 2005



Data source: wholesale market survey by authors

Appendix Table 1. Composition of the wholesale market sample

	Consumer marketplace (Beijing)				Production marketplace (Shandong)		
	Total	Xinfadi	Baliqiao	Dongjiao	Total	Shouguang	Nunan
Total	40	20	10	10	25	10	15
Cucumber wholesalers	20	10	5	5	20	5	15
Tomato wholesalers	20	10	5	5	5	5	0

Regoverning Markets

Regoverning Markets is a multi-partner collaborative research programme analysing the growing concentration in the processing and retail sectors of national and regional agrifood systems and its impacts on rural livelihoods and communities in middle- and low-income countries. The aim of the programme is to provide strategic advice and guidance to the public sector, agrifood chain actors, civil society organizations and development agencies on approaches that can anticipate and manage the impacts of the dynamic changes in local and regional markets. The programme is funded by the UK Department for International Development (DFID), the International Development Research Centre (IDRC), ICCO, Cordaid, the Canadian International Development Agency (CIDA), and the US Agency for International Development (USAID).

Agrifood Sector Studies

These studies look at specific agrifood sectors within a country or region. Research studies have been carried out in China, India, Indonesia, Mexico, South Africa, Turkey, Poland and Zambia covering the horticulture, dairy and meat sectors. Part A describes the observed market restructuring along the chains. Part B explores the determinants of small-scale farmer inclusion in emerging modern markets. Using quantitative survey techniques, they explore the impacts on marketing choices of farmers, and implications for rural development.

The studies were coordinated by:

Jikun Huang, Centre for Chinese Agricultural Policy (CCAP), China
(contact jkhuang.ccap@igsnr.ac.cn)

Thomas Reardon, Michigan State University (MSU), USA
(contact: reardon@msu.edu)

