Regoverning Markets

Agrifood Sector Studies

Production, marketing and impacts of market chain changes on farmers in China: The case of cucumber and tomato in Shandong province (B)

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Micro study report of Component 1 (China)
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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.

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 describe 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.

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

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Contents

1 Introduction

There have been growing concerns on the impacts of rapid changes in downstream of food market chains on small farmers in developing countries. Modern retails, particular supermarkets, have been emerging in many developing countries since early 1990 (Reardon et al. 2005; Balsevich et al. 2006). Rapid marketing chain changes have also occurred in food processing, wholesaling and procurements (Reardon and Timmer 2007). Previous studies believe that there could have serious distributional impacts of the rise of supermarkets in downstream of the market chain. For example, there are case studies in Latin America, Central and Eastern Europe, Mexico, Brazil and Kenya that suggest that it is the rich, large farmers that benefit from the rise in demand for fruit and vegetables and the emergence of supermarkets (Reardon and Timmer 2007; Berdegué et al. 2005; Dries et al 2004; Neven and Reardon 2004; Schwentesius et al 2002).

Because of the high transaction costs involved with purchasing from millions of small farmers and difficulties in monitoring quality and food safety, it is often assumed that supermarkets and their agents (for example, specialized wholesalers; preferred suppliers) will turn to large and better-off farmers. As a consequence, the rise of demand for horticultural and other high-valued commodities in the consumer consumption basket and the concomitant rise in supermarkets, have created concerns among the international community about the possible adverse consequences on small, poor farmers (Reardon and Timmer 2007).

The findings from China on the impacts of the rising supermarket and other marketing chain changes in production and marketing at the farm level, however, are mixed. Several recent studies have shown that both downstream and midstream segments of the marketing chain in China have also evolved dramatically since the early 1990s (Bi et al. 2004; Hu et al. 2004; Goldman and Vanhonacker 2006). The midstream wholesale sector is also evolving in some fundamental ways, though less rapidly than the retail sector (Huang et al. 2006). Studies based on supermarket or industrial surveys show that the emerging supermarket and special supplier could be engines of food product market expansion and may have significant impacts on small farmers (e.g. Zuo and Zhang 2003; Hu. et al 2004; Hu et al. 2006).

Supermarkets have provided input services for farmers through provisions of better seeds, appropriate use of pesticides and fertilizers, and other technologies (Hu et al. 2004). However, several micro level studies conducted in the Greater Beijing have showed a somewhat different story (Wang et al. 2006; Dong et. al. 2006; Wu et al. 2007). These studies found that while there have been significant changes in downstream of marketing chains, they questioned whether the changes in downstream have been penetrated into upstream due to high transaction costs

between modern retails and small farmers in China.

The overall goal of Component 1 of the Regoverning Markets programme in China is to prepare more evidence-based policy advice concerning the implications and opportunities for vegetable producers during a period of a boom in horticulture demand and a restructuring of upstream markets. Hence, the research in Component 1 concentrates on identifying the determinants and consequences of the restructuring of the horticultural sector in China. The analysis is conducted on three levels: national meso (the policy issues and the national business environment, Module 1), local meso (the different chain segments and villages, Module 2) and micro (household level, Module 3).

Our meso level study of this Regovening Market project has showed a somewhat different story (Huang et. al. 2006 and 2007). We found that in nearly all the villages over the samples, production is equally small scale and marketing is dominated by the sales of farmers to small traders and small wholesalers, in horticulture in general and vegetable in particular (Huang et al. 2007). The meso study also provides evidence of no formal contracting in the vegetable production and marketing. Buyers play no role in providing technology, technical advice or credit in vegetable production in Shandong (Huang et al. 2007).

Given the mixture of findings from previous studies and our meso study in this project, the overall goal of this micro study (Module 3) is to look for more empirical evidence of market restructurings and to quantify their impacts on farmers based on an intensive farm primary survey of two major vegetables (cucumber and tomato) in China's largest vegetable production area; Shandong province. Specifically, this study is aimed to examine the following four sets of research questions and test the hypotheses related to each set of these questions:

i) Who are producing vegetables as the market expands? What are the major determinants of vegetable production? The major hypotheses to be tested are: poor and small farmers are excluded from vegetable production; off farm employment has significantly affected vegetable production.

ii) What are the observed market restructurings in general? What are the observed marketing choices (e.g. restructured and traditional marketing channels) by farmers? The major hypothesis to be tested is: the changes in downstream of market chain have significantly penetrated into upstream, or farmer's marketing choices have experienced significant changes over time.

iii) What are the major determinants of farmers' marketing choices? Key hypotheses to be tested include: small and poor farmers are often excluded from the modern market chains; incentive, and marketing infrastructure have

3

significant effects on farmers' marketing choices; institutions such as farmers' association facilitate farmers' participation in the modern marketing chains.

iv) What are the impacts of market restructurings or farmers' marketing choices on farmers' income, production, and technology choices? The major hypotheses to be tested include: there are significant impacts of farmers' marketing choices on their income (e.g. net income, return to family labour, return to capital), input use (e.g. labour and capital), and technology (e.g. ratio of capital and labour inputs).

The report is organized as follows. The next section synthesizes the major findings from our meso study. Section 3 discusses sampling method and data used in this study. Section 4 analyses crop production patterns and farmers' marketing choices with a specific focus on the selected two vegetables (cucumber and tomato). Section 5 explains methodologies, including the econometric models and estimation procedure. Section 6 discusses results of econometric estimation and hypotheses testing. The last section concludes the study.

2 Key context points from the village and PRA surveys

In module 1 key policy issues, broad vegetable supply chain issues and key stakeholders are identified. This part is intended to set the stage for the analysis done under Modules 2 and 3. The goal of Module 1 is to analyse the evolution of China's restructured supply chain at a national level over a period of the past 10 or more years. With this background, the objective of Module 2 is to study in more depth the restructuring changes that are occurring inside China's rural communities and within the markets. Module 2 researches also provides context for this micro-level study in Module 3 (this report). In particular, in the research based on Module 2 we primarily study how marketing supply chains are operating and evolving within villages; inside wholesale markets and inside supermarkets.

The main questions answered in Module 1 and 2 in the meso study of China's vegetable industry 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. Do we see changes in the composition of markets in the downstream segment of supply chains?
4. What is happening to middle segments of supply chains - the wholesale markets?
5. Is there evidence of changes in wholesale markets?
6. Are most changes between traders in the wholesale markets and downstream actors or between traders in the wholesale markets and upstream actors?
7. Do we see any traces of innovative institutions in China's downstream supply channels?
8. What are the drivers of these changes or forces that are keeping traditional institutions in place?
9. What are the trends of farmers in their efforts to enter the production of the horticultural market and what constraints do they face?
10. Are their marketing constraints that are keeping farmers out of the horticultural markets?
11. What are the technological, managerial, and organizational practices/behaviour related to market channel choices of the farmers?
12. What are the interactions between the market and production practice behaviour of producers and local food industry segments, labour, land and other inputs and financial services markets?

The main findings in the meso study are:

- Upstream segments of the marketing chain have evolved dramatically in the past 20 years. China has moved from a country with a food system based on rationing in the cities to one that was based on wet markets and small shops, to one in

5

which the supermarket and restaurant sectors are growing faster than anywhere else in the world. Exports of horticultural commodities have also risen. It should be noted, however, that the retail sector is very competitive.

- The midstream wholesale sector also is evolving in some fundamental ways, though less rapidly than the retail sector. While the number of wholesale markets has not risen very fast, their size is increasing, especially for key players. In other words, consolidation is occurring. In addition, there is evidence of specialization and the emergence of markets that are focused on providing more high quality products. The nature of the actors is also changing. From a market that is made up of mostly small traders to one with an emerging set of more permanent small and large wholesalers. Some of the large wholesalers have formal and informal ties with supermarket chains. However, it should be noted that even large wholesalers are relatively small and there are literally thousands of actors and markets are very competitive. On the buying side there has been much less change and most of the buying is still done directly with farmers by employees of the small trading firms and wholesalers, by their agents or from farmers that bring their commodities to the markets.

- The main fundamental drivers of this evolution of downsteam and midstream are rising incomes, urbanization, domestic market liberalization and international trade liberalization. Indeed, China's markets are being driven by rapidly rising demand in an unregulated environment that allows for easy entry at all levels of the marketing chain.

- In response to the rise in supermarkets, restaurants and other forces (e.g., increased agricultural exports out of Shandong Province), the village and RRA surveys showed that the composition of marketing channels are changing. The sales of traders in wholesale markets have risen by an average (in both tomato and cucumber markets in Shandong) of five to six percentage points. Likewise, with the exception of cucumber markets in Shandong, the share of tomato and cucumber sales from wholesale markets to modern channels have increased, although the changes have been very moderate. The shares of tomatoes and cucumbers that are being sold into the export market have risen sharply. Taken together (supermarkets, restaurants and exports), sales to these new downstream channels have risen by more than ten to 15 per cent.

- While the downstream markets are shifting, the nature of markets shielded farmers from the shifts. Wholesalers of cucumber and tomatoes, purchase more than 85 per cent of their goods direct from farmers. Clearly, the small trading firms that make up China's wholesale markets are small enough, that they are able and find it profitable to either send an agent to procure from China's small

tomato and cucumber farmers or go themselves or purchase from farmers that come to the wholesale markets.

- At the village level we find that the production of vegetables reflects national trends. They rose rapidly in the 1990s and grew moderately in recent years. However, the meso level data has allowed us to identify the mechanism of rising production: most of the net increase in the production of our case study commodities, tomatoes and cucumbers, has come from the entry of new producers, not much from the expansion of farm size of existing ones.

- Tomato and cucumber farmers have adopted a number of new varieties recently. All village farmers purchased their new seeds from small private horticulture seed peddlers. They did not access any of their new varieties from buyers.

- For the crop yield increase, most of the perceived production constraints are a lack of improved technology, quality of input, and the occurrence of natural disasters. For constraints limiting entry into horticulture production, the most common two responses were that, off farm work was more lucrative and that the family would have been short of labour had they tried to produce tomatoes and cucumbers. Generally, the constraints were similar for richer and poorer farmers. There are few regulatory or institution or physical constraints.

- Marketing is dominated by the sales of farmers to small traders and small wholesalers. Consistent with the national meso study, there is almost no penetration of the new retailing institutions. Buyers play no role in providing technology, inputs, technical advice or credit. There is no formal contracting.

- There are few constraints outside, of poor information and high transaction costs that are, in a large part associated with the small size of China's farms. Interestingly, price variation and government regulation were not considered as major constraints.

- In such an environment, small farmers dominate; we see that there is no real difference in the nature of constraints faced by the poor or remote in either production or market. In previous work in the Greater Beijing, poor farmers benefit and horticultural crops contribute positively to the income of the poor.

- Our meso study concludes that although markets at all levels are competitive and food is being provided to the cities in an efficient and inexpensive way, and small farmers are participating, there will be great challenges for China to meet its increasing demand for food safety in the coming years. From the production side, the policy makers may need to consider appropriate policy instruments that can foster cooperatives and focus on producing safer pesticides. Regulation on the

production and import side of the pesticide industry may be the best way to clean up vegetable production. Policy makers need to address the most critical aspects of the marketing constraints: how to get better information to farmers. This is not going to be easy. There should be more programmes on cable television and radio, which seek to provide up to date, extremely detailed and unbiased price data. Forecasting supply and making recommendations is going to be difficult if not impossible. In fact, farmers did not complain about having horticultural crops become unprofitable due to over supply. However, more information, the total area planted and year to year changes would be welcome and might help academics begin an annual update of the state of the economy for major commodities. Cooperatives will help in some cases in overcoming high transaction costs. Continued monitoring of markets for fairness of access is crucial.

3 Data sources and sampling measures

3.1 Sampling framework

The data for this study comes from a stratified random sampling survey in the Shandong province. This survey is a representative sample of tomato and cucumber growing villages in the province. The first step in conducting the survey involved creating two sampling frames of county level tomato production and county level cucumber production. With knowledge of the total production environment in Shandong for each crop, we ranked all 140 counties in Shandong by the level of the crop (tomato or cucumber) area per farm population. Based on the ranking from high to low per farm production of each crop (tomato or cucumber) for all farms, we kept the top 74 counties for each of the tomato and cucumber sampling population, which accounted for about 90 per cent of the total tomato or cucumber production in Shandong.

We then divided these 74 counties into the following five groups (or five regions): two high production county regions, two medium and one low production county regions. Each of the production regions, ranking from high to low productions, accounted for about ten per cent, 15 per cent, 20 per cent, 25 per cent and 30 per cent of the rural farm population within the sampling population (74 counties). Then, one county was randomly selected from each of the above five groups. In total, we have five sample counties for each crop. The farm population in each set of countries provided data for our weighting system, which is used to create point estimates for provincial averages (that is, major or 90 per cent of the production villages) of each of our variables.

Second, after the sample counties were chosen, a relatively similar stratified random process was used to select townships. The number of towns, however, differed by the type of county. Specifically, in each of the two high production counties, five townships were selected (two high production townships; two medium ones; and one small one). In each of the two medium production counties, three townships were selected (one high production township; one medium and one low). In the low production county, only two townships were selected (one high production township; the other low production township). In total for each crop, the survey teams visited 18 townships.

Third, after the sample townships were selected, a similar stratified random process was used to select villages. In the high production county and high production township, three villages were selected (one a high production village; one a medium one and one a low one). In the high production county medium township and the medium production county high and medium production townships and the low

production county high production township, we chose two sample villages (one high and one low). In the low production township of all counties, we only chose one village per township. Therefore in total for each crop (for the five counties and 18 townships), we interviewed farmers in 35 villages (22 in high production counties; ten in the medium production counties; and three in the low production counties).

Finally, Households were selected from the sample villages. Here we used cucumber crop as an example to show how the households were sampled. In each of the 35 cucumber villages, first we divided all households into two groups: households with and without cucumber production. Then we randomly selected seven cucumber households and three non-cucumber households in each village. However, there are exceptions. These are for the villages where a total number of cucumber producers is less than seven.

In this case, we selected all the cucumber households and randomly selected three non-cucumber households if the number of cucumber households is five or six, and two to three non-cucumber households if the number of cucumber households is less than five. In the end, we interviewed 335 households with 327 households used in the final analysis because there were eight households with incomplete information. For tomatoes, we interviewed 330 households with only one household that had incomplete records. Below summarizes the distributions of the final samples for cucumber and tomatoes in Shandong province.

Crop	County	Township	Village	Household	w/ the crop	w/o the crop
Cucumber	5	18	35	327	228 (70%)	99 (30%)
Tomato	5	18	35	329	229 (70%)	100 (30%)
Total	10	36	70	656	457	199

3.2 Survey instruments and data

After choosing the villages and households, the enumeration team then visited each village and ran two data collection activities. One enumerator conducted a two hour, sit-down survey with the village leader and accountant. In this survey, information on the village's farming, general economic characteristics, transportation and market infrastructure, and local institutions were enumerated. The respondents also provided information on the village's horticulture producing history as well as recounted previous policy and other government initiated efforts to extend vegetables (and tomato and cucumbers) in the village.

A profile of local markets and neighbouring marketing venues were also part of the survey. In general, the main task of the village leader survey was to create a set of

policy and instrumental variables for econometric analysis on the impacts of marketing channel choices on farmers.

In each sample household, we conducted two round surveys. We did these two round surveys because we wanted to have more accurate information from farmers' records on the second buyers when they sell their products. In the first round, we distributed a recording sheet to all farmers, reminded them to ask the first buyers on the second buyers' information, and trained them how to appropriate ask this information. In the second round survey, we conducted about two hour, sit-down surveys in each household. In this survey, information and data on the following areas were enumerated.

- Household characteristics in 2001 and 2006
- Family member employment in 2001 and 2006
- Cropping structure and cultivate land in 2001-2006
- Areas and outputs of all plots with cucumber or tomato in 2001 and 2006
- Crop production and commercialization in 2001 and 2006
- Marketing channels of cucumber or tomato in 2001 and 2006
- Monthly average prices of cucumber or tomato sold in 2006
- Technology and varieties adopted in 2001 and 2006
- Marketing information
- Crop income and other income in 2006 and total income in 2001
- Household durable assets in 2001 and 2006
- Household level instrumental variables and others variables

A full set of questionnaires in English is attached to this report as an Annex.

3.3   Create weights for analysis

Since we collected the crop area and farm population data on all villages, townships and counties, we are able to construct farm population-based weights to create point estimates of our variables that are provincial representative. In this micro study, analysis of the first set of research questions (who are producing vegetable as its market expands? What are major determinants of vegetable production?) Should we use whole samples that include both cucumber (or tomato) households and non-cucumber (or non-tomato) households, while the analysis for the rest of the fou4 sets of research questions only deals with the households with cucumber (or tomato) productions. Therefore we developed two weight systems corresponding to their respective sample population.

1). Weights for whole samples: these are weights used to estimate a representative of all farmers in Shandong province.

The weight for h^{th} households from k^{th} village of jth township of ith county, P_{ijkh}, is defined as:

$$P_{ijkqh} = W_i \cdot W_{ij} \cdot W_{ijk} \cdot W_{ijkq} \cdot W_{ijkqh}$$

where,

W_i: weight for i^{th} category counties with values of 0.1, 0.15, 0.2, 0.25 and 0.3 for each of the five counties ranging from the highest to the lowest per farm production for the crop studied. The value of 0.1 here represents the farmers in the highest production county accounts for ten per cent of all farmers in 74 counties of Shandong province studied in this project. The sum of W_i over i equals one.

W_{ij}: weight for j^{th} township in i^{th} county, its values are corresponding to the shares of farm populations belonged to j^{th} category of townships within i^{th} county. The sum W_{ij} over j equals one.

W_{ijk}: weight for k^{th} village in j^{th} township of ith county, its values are corresponding to the shares of farm populations belonged to k^{th} category village in j^{th} township of ith county. The sum of W_{ijk} over k equals one.

W_{ijkq}: shares of farmers who plant or not plant the crop (cucumber or tomato) in k^{th} village in j^{th} township of ith county. q indexes two groups of farmers (plant or not plant the crop), $W_{ijk1} + W_{ijk2} = 1$.

W_{ijkqh}: reciprocal of h type sample numbers in k^{th} village in j^{th} township of ith county. h indexes two groups of farmers (plant or not plant the crop). For example, in a village with ten samples, there are seven households planted tomato and three households without produce tomato, the W_{ijkqh} for each household with the crop is 1/7 and the value is 1/3 for non-tomato household.

The sum of P_{ijkh} over i, j, k, q and h equals one.

2). Weights for the samples that have tomato or cucumber productions: these are weights used to estimate a representative of all farmers who participated in the crop production and marketing in Shandong province.

The weight for h^{th} household with cucumber (or tomato) production from k^{th} village of jth township of ith county, Y_{ijkh}, is defined as:

$$P_{ijkh} = Z_i \cdot Z_{ij} \cdot Z_{ijk} \cdot Z_{ijkh}$$

where,

Z_i: weight for i^{th} category counties, its values are corresponding to the shares of cucumber (or tomato) farmers from the ith category counties in all cucumber (or tomato) farmers in 74 counties studied. The number of cucumber (or tomato) farmers in each category county is estimated as the follow. First, we estimate the share of cucumber (or tomato) sown area from the ith category counties in the 74 counties. Second, we divide the crop area shares by an adjustment factor that

considers the variations of average cucumber (or tomato) area per household across different category counties. The adjustment factors are 1.2, 1.1 and 1 for high, medium and low cucumber production counties, and 1.5, 1.3 and 1 for tomato. These parameters come from the average production scale observed in difference category countries. Finally, we scale the weights so that the sum of Z over i equal one

Z_{ij}: weight for j^{th} township in i^{th} county, its values are corresponding to the shares of cucumber (or tomato) farmers from the jth category townships in all cucumber (or tomato) farmers in the ith county. The procedure to generate the shares is the same as those discussed for Z_i's.

Z_{ijk}: weight for k^{th} village of jth township in i^{th} county, its values are corresponding to the shares of cucumber (or tomato) farmers from the kth category village in all cucumber (or tomato) farmers in j^{th} township of the ith county.

Z_{ijkh}: reciprocal of sample cucumber (or tomato) household numbers in k^{th} village in j^{th} township of ith county.

4 Production and marketing

4.1 Vegetable production

Crop production is dominated by small farms. All households have land contracted from their villages with 30 years of rights use. On average, the household farm size was only 5.2mu (0.35 hectare) in cucumber villages and 7.1mu (0.47 hectare) in tomato villages (row 3, Table 1). Among all households surveyed, the largest farm size was only 23mu (1.53 hectare) in cucumber villages and 18mu (1.2 hectare) in tomato villages (Appendix Table 1). There are also a few households that rented out their all contract lands to other farmers; therefore their farm size was recorded as zero in Appendix Table 1.

Despite small farm sizes, farmers in Shandong normally grow several crops. Major crops are maize, wheat, cotton, peanuts and vegetables. In cucumber villages, the vegetable area accounted for 29 per cent (2.7/9.2) of total crop area (row 3, Table 2). For households engaged in cucumber production, per household vegetable areas increased from 3.7mu in 2001 to 5.2mu in 2006 (column 3). It is interesting to note that the increase in cucumber production is much less than the overall vegetable growth. This is because of diversification of vegetable production occurred overtime. Beside cucumber, farmers also simultaneously plant several other vegetables in both greenhouse and open field, including Chinese cabbage, peppers, eggplant, string beans and others. A similar growing trend of vegetable production has also been occurring in tomato villages.

Similar to the findings from the meso study (Huang et al. 2007), the household survey shows that the number of farmers engaged in vegetable production increased over 2001-2006. In cucumber villages, among 327 households surveyed, 200 households planted cucumber in 2001, the number raised to 228 in 2006 (rows 1 and 2, Table 1), an increase of 14 per cent within five years. More significant increase of farmers' participation in vegetable production is presented in tomato villages where the number of tomato households raised by 23 per cent from 186 in 2001 to 229 in 2006.

Comparison between households engaged and not engaged in cucumber (or tomato) production reveals several interesting findings. First, although all farms are very small, the size of the farm in terms of cultivated land area is positively associated with the vegetable production. Average cucumber farm had 6.1mu land (0.41 hectare) in 2006, which was about 27 per cent higher than that of non-cucumber farm (4.8mu, row 3, Table 1). The similar finding is also observed in tomato samples. Our tests show that these differences are statistically significant. Because participation in

vegetable production is affected by many other factors, we will further examine whether or not farm size has a significant effect on vegetable production in section 6.

Second, the significant difference is observed in off farm employment between cucumber (or tomato) households and non-cucumber (or non-tomato) households. For example, in cucumber villages, there were 29.5 per cent of labour who had off farm job for households engaged in cucumber production in 2006, while the corresponding number for non-cucumber households was as high as 43.4 per cent, nearly 14 per cent points higher than that of cucumber producers (row 9, Table 1).

Although off farm employment is less in tomato villages (27.8 per cent) than cucumber villages (39.2), labour engaged in off farm employment in non-tomato production households also reached 31.4 per cent, which is about 70 per cent (31.4/18.5) higher than that of tomato households (18.5 per cent). Higher off farm employment in cucumber villages than tomato villages may be explained by the different in their farming size (row 3, Table 1). The finding of lower off farm employment associated with vegetable production should not be surprising because vegetable production is more labour-intensive than grain production, the later accounted more than 70 per cent of crop area in our study areas.

Third, there is nearly no difference in farmers' wealth between the households engaged and not engaged cucumber/tomato productions. For example, per capita durable consumption asset was 7439 yuan for cucumber producers in 2006, which is almost the same as that of non-cucumber producers (7395 yuan, row 10, Table 1). While on the average, tomato producers have a slight lower per capita asset (8484 yuan) than non-tomato producers (8731 yuan), the difference is not statistically different. Given this background, our hypothesis is that the poor might not be excluded from the emergence of new market expansion.

Fourth, the significant differences between households engaged and not engaged in the vegetable production are observed on their village characteristics (the last 3 rows, Table 1). To ensure stable supply of vegetable to urban consumers, China developed a 'Vegetable Base' programme in many rural areas near cities. In the villages where farmers engaged in tomato production, more than one third (35.2 per cent) of these villages have 'Vegetable Base' programme (the third last row). This is what we should expect, because 'Vegetable Base' villages normally received supports from government through irrigation investment and other infrastructural development.

However, this difference is not evidenced in cucumber villages. So far, we have no explanation for this indifference. There is also evidence of the role of the rural market infrastructure development on vegetable production expansion, particular in cucumber samples. In the villages where cucumber household samples located, on average, their distance from the nearest wholesale market was 4.6km in 2005, much

shorter than that of the villages where the non-cucumber household samples located (6.2km, the second last row).

Last but not least, there is no statistically significant difference between these two groups of farmers in terms of population, household head age and education (rows 4-6, Table 1). Regardless whether or not engaged in cucumber or tomato production, average family has about three to four persons, the household head has an average of about 46 with seven to eight years of education. These are the typical rural farm family in Shandong as well as in the whole of China.

4.2 Vegetable marketing

Above all, the results of the micro household study on cucumber and tomato marketing channels in our 70 villages support the findings of the analysis that was based on village meso study in Shandong (Huang et al. 2007) and our early study in the Greater Beijing (Wang et al. 2006; Dong et al. 2007). In general, our study shows that most cucumbers and tomatoes are moving through traditional supply channels (Table 3 and Figure 1a-2b). The following summary shows the major nature of vegetable marketing channels in Shandong.

First, farmers' marketing channels are dominated by small wholesaler and brokers. The results of household survey confirm with our meso level marketing and village survey, which also show that farmers' selling vegetables are dominated by hundreds of small traders, particular the small wholesalers. In cucumber and tomato villages, farmers sold nearly 80 per cent of their vegetables to wholesalers (column 3, Table 3). Vegetables sold to small brokers nearly made up the rest of all vegetable marketed by farmers. The local individual brokers purchased about 20 per cent of farmers' cucumber and tomato (column 2 and Figures 1a-2b). Clearly, the small trading firms and individuals that make up China's wholesale markets are small enough that they are able and find it profitable to either send an agent to procure from China's small cucumber and tomato farmers or go themselves or purchase from farmers that come to the wholesale markets.

Second, despite significant horticulture market restructuring occurred in retails, wholesales and processing, these downstream changes have not penetrated into farm procurements. Modern channels, which include special suppliers, processing companies, farmers' associations, supermarkets, restaurants and export companies, all together accounted for only 1.5 per cent for cucumber and 0.2 per cent for tomato in 2001-2006 in Shandong (column 4, Table 3).

Third, while the locations of vegetable procurements are mostly in wholesale markets, they differ slightly between cucumbers and tomatoes. Farmers sold most of

their cucumbers in local wholesale markets. Farmers brought 67 per cent cucumbers to wholesale market for selling in 2001, which rose slightly to 70 per cent in 2007 (row 2, Table 4). For tomato, the procurement occurred in wholesale market accounted for only 55 per cent in 2001 and 50 per cent in 2006 (row 6). Indeed, even for individual brokers, they also purchase more than one third of cucumbers from farmers in wholesale markets. While modern channels account for only 2 per cent of farmers' cucumbers, about 80 per cent is also occurred in wholesale market (row 2).

Although the upstream segments of the marketing channel are dominated by brokers and wholesalers, there are changes occurring when the entire procurement process is followed, especially in the tomato market (Table 4, rows 5 to 8). When we track not only to whom farmers sell their crop to, but also at what location, it can be seen in the case of tomatoes that there is a type of vertical integration occurring. Specifically, in 2001 wholesalers purchased only 38 per cent of their total volume from farmers in the field (or at the side of the road near the village); they purchased 58 per cent in the wholesale market (that is, from farmers that delivered them to the market column 3).

By 2006, nearly half (49 per cent) of all of the tomatoes purchased by wholesalers were purchased in the field of farmers (column 7); farmers delivered less than half (also 49 per cent) to the wholesale market. In other words, according to our data, tomato wholesalers, which make up the dominant part of the market were increasingly moving out of the wholesale market and purchasing the crop in the field and in this way were capturing more of any value added in the marketing chain. Because of this practice, between 2001 and 2006 an increasing percentage of tomatoes were being procured inside China's village directly from the fields of farmers.

Unfortunately, we do not know why this vertical integration was occurring. There are several explanations. One is that consistent with the observations from the meso study, there is more differentiation within some wholesale markets between lower quality and higher quality fruits and vegetables. It also could be that wholesalers are forced to go out to villages if they want to provide higher quality horticultural crops. There is evidence that prices are higher when wholesalers buy crops in the field and when brokers do (rows 1, 5 and 9, Appendix Table 2). Alternatively, as increasingly more horticultural producers enter the market, it could be that wholesalers are acting more aggressively as a way to capture another link in the marketing chain and added value (profits however small) that are associated with it.

Curiously, no such change was occurring in the cucumber market. If anything, there was a slight rise in the per cent of cucumber sales that were transacted in the wholesale market (Table 4, rows 1 to 4, columns 1 and 5).

There is more change over time in markets when we examine the first and second segments of the supply chain at the same time. To see how diverse and numerous supply chains become, we created four diagrams of the marketing flows those for cucumbers in 2001 (Appendix Figure 1); those for cucumbers in 2006 (Appendix Figure 2); those for tomatoes in 2001 (Appendix Figure 3) and those for tomatoes in 2006 (Appendix Figure 4). In total, the distinct number of paths range from 13 (for tomatoes in 2001) to 16 (for cucumbers in both 2001 and 2006; and for tomatoes in 2006). The diagrams also allow for the creation of three groups of channels: two traditional or non-modern ones that a.) go from brokers to either brokers or wholesalers or consumer; or that b.) go from wholesalers to either wholesalers or brokers or consumer; and another set of marketing paths that at some point in the first two links of the supply chain pass through the hands of at least one modern suppliers (i.e., supermarket; restaurant; specialized supplier; processing company and/or export company). When looking at marketing chains in this way, we say that these are marketing flows that are 'based on both first and second buyers.'

While there is little change between 2001 and 2006 in supply chains when looking at both first and second buyers in the case of cucumbers (from 3.9 to 4.2 per cent Appendix Figures 1 and 2), there is much more change in the case of tomatoes (from 29.4 to 37.4 Appendix Figures 3 and 4). Because of this, we focus the rest of our analysis on the case of tomatoes and analyse this trend using information from the two appendix figures which, for convenience, is summarized in Table 5 rows 1 to 3.

In fact, according to our data, the rise of modern channels for tomatoes with looking at both first and second buyers is quite widespread across our sample. The most significant rise in percentage terms occurs in Shouguang county, one of the most well known horticultural sites in China. Between 2001 and 2006, the share of tomatoes that pass through modern suppliers in the first two links of the supply chain rose from 45.9 to 58.7 per cent (rows 4 and 5, Table 5). The share of tomatoes passing through such supply chains also rose in three of the other four counties in the sample; Laixi rows 10-12; Boxing rows 13-15; and Muping rows 16 to 18). The share passing through modern supply chains only fell in one county (Pingyuan rows 7 to 9). Although modern buyers have not penetrated to the farm household level (or into China's rural villages), in the case of tomatoes in Shandong province, they are increasingly present in the supply chain at least at the second link.

4.3   Who is selling to whom: a descriptive sketch of the determinants of supply channel choice.

The most poignant finding of the cross tabular analysis which examines which types of farmers are involved in which marketing channels is that there are no remarkable differences among the subgroups (Table 6). For example, in the case of cucumbers,

when farm sizes vary from less than 3.9 mu (lower tercile) to more than 5.8 mu (upper tercile), the share of farmers from each of the farm sizes that sell to wholesalers varies from 78.1 to 78.2 (and the relationship is non-linear, meaning when moving from the smallest farms to largest farmers, the share selling to wholesalers falls then rises—rows 1 to 3). The share of farmers selling to brokers from different size farms varies only slightly (from 21.4 to 21.9 and 21.4 per cent). Similar trends (or more precisely lack of remarkable trends) appear when sorting the households by distance to nearest wholesale market (rows 10 to 12); and in villages with and without farmer associations (rows 13 and 14). The same absence of sharp trends occurs in the case of tomatoes (rows 15 to 28).

The only trends that shift more than 10 per cent points in a linear way are the cases of per capita assets and distance to nearest county road (local highways). In both the case of cucumbers (Table 6, rows 4 to 6) and tomatoes (rows 18 to 20) as farmers accumulate more and more assets, the share of their crop that is sold to brokers rose. At the same time, the share sold to wholesalers fell. This is a bit unexpected (it might be thought that farmers with more assets should want to take their cucumbers and tomatoes to the wholesale market and earn the return to transport). It is interesting to note that the results of the cross tabs for distance to the local highway is also not as expects. The data show as farmers are further away from a local county highway, they are more likely to sell their cucumbers to a wholesaler and are less likely to sell to a broker. But the opposite direction is found in tomato cases (Table 6). So far we do not have good explanations for these observed facts, an issue that needs further investigation in the future.

When looking at who is selling to the modern marketing chains based on both the first and second buyers, the results are mixed (Table 7). In 2001, when grouping households by farm size and per capita assets the shift of the percentage of farmers selling to modern channels either rises and falls or falls and rises (column 4). The same is true for 2006 (column 9), there is almost no detectable trend or emergence of a trend. However, on distance to nearest county road, the far from the road, the more likely sell to modern channels and less likely to wholesalers (rows 6-9). Table 7 also shows that a larger and rising (between 2001 and 2006) share of tomatoes is going to households that live nearer to wholesale markets than those that live further away (columns 4 and 9; rows 10 to 12). It should be remembered, however, that although there are some (albeit not many) trends that shift systematically across groups and over time, it is unclear if these results will hold up in the multivariate analysis.

4.4 Descriptive evidence of impact of emergence of marketing chain on horticulture production

Because there is so little penetration of modern supply channels in 2006 (there were only two cucumber households that sold to modern buyers; and one tomato household that sold to modern suppliers), there is really no way to assess impact (Table 8). With so few observations, there is really no way to understand differences in input intensity, capital/labour ratios and returns between those producing horticultural commodities that are directly sold to modern supply channels (rows 3 and 6).

There are differences between those that sell to brokers and those that sell to wholesalers. For example, those that sell to wholesalers use higher levels of pesticides, and capital, but lower levels of labour (Table 8, rows 1, 2 and 5 and 6). This means that the capital to labour ratios of those that sell to wholesalers is higher than those that sell to brokers. Statistical tests of differences between the means, however, are not significant.

A more meaningful picture of the effects of participating in modern supply channels can be examined by looking at tomato farmers who sell into supply chains in which either the first or second buyer is a modern buyer (e.g., supermarket, specialized supplier, restaurant, processor or exporter Table 8, rows 7 to 9). While the differences between those that sell to the either of the two no-modern chains and those that sell to the modern chain are relatively small, the point estimates are systematically different.

Farmers that sell to the modern chains tend to use more capital (about 10 per cent more than those that sell to wholesalers; and more than 30 per cent more than those that sell to brokers). In contrast, farmers that sell to modern chains also use less labour than those the sell to wholesaler markets (122 days/mu versus 140 days/mu); although they use slightly more than farmers that sell to brokers (125 days/mu versus 115 days/mu). Because of these capital and labour us trends, overall capital to labour ratios for those farmers that sell to modern chains (23 yuan/day) are somewhat higher than those that sell to brokers (15 yuan/day) or wholesalers (22 yuang/day).

The biggest differences between those that sell into modern chains and those that sell into non-modern chains are in terms of net income and other measures of return (Table 8, rows 7 to 9; columns 8 to 10). The point estimate of net income per mu of farmers selling into modern chains are fully more than double those selling into either of the other two non-modern chains. Farmers selling to modern chains have

similarly high returns to capital (less so) and returns to family labour (equally so) as those that sell into non-modern chains.

Given the higher levels of capital used by farmers selling to modern chains, the higher returns, at least on average, must be due to higher prices received by those farmers. Indeed, this is real case we observed in our survey. For example, when we tabulate procurement prices of cucumber and tomato based on marketing chains and locations, we find that the prices of selling to modern chains averaged at 2.38 yuan/kg in 2001-2006, which was 54 per cent higher than that of "wholesaler to non-modern" chain and 63 per cent higher than that of "broker to non-modern" chain (last row, Appendix Table 2).

5 Econometric models and estimation

5.1 Model's specifications

This section discusses the models used to examine three of four sets of research questions listed in the introduction section. These three sets of research questions are: i) Who are producing vegetable as its market expands and what are major determinants of vegetable production? Are the poor and small farmers excluded from the vegetable market expansion? ii) What are major determinants of farmers' marketing choices? Have the small and poor farmers been excluded from the modern market chains? And iii) What are impacts of farmers' marketing choices on farmers?

For the first set of research questions, based on a descriptive analysis presented in the previous section, we specify farmers' cucumber (or tomato) sown area, A, model as:

(1) $A_{ijt} = f$ (Incentive$_{it}$, FarmSize$_{it-n}$, Asset$_{it-n}$, Household$_{it}$, Shifters$_j$)

Where, i, j and t index household, village and year. Definition of each variable is defined below:

A: the sown area (mu) of cucumber (or tomato) with the following 2 specification: i) a dummy variable (A=1 if A>0 and 0 if A=0); ii) actual sown area (mu).

Incentives: because the regression is mainly using cross-section household data, we use the following two variables to reflect incentives of farmers engaged in vegetable production. The first variable is the household distance from county road (km). The second is off farm labour share (percentage) in 2001 (base year), which measures farmers' forgone income or opportunity cost for vegetable production.

FarmSize: household cultivated land (mu) in the base year (2001).

Asset: per capita consumption assets (yuan), including houses, furniture, and other durable family assets.

Household: the characteristics of households, including household head age (years) and education (years).

Shifters: these are village and policy shifters include the following 3 variables: i) Vegetable Base Village: a dummy variable equals 1 if the village was a specialized villages supported by government in the past 5 years, otherwise it equals zero; ii) average household cucumber area (mu) in the village in 6 years ago; iii) farmer association: a dummy variable equals 1 if the village has farmer's association, otherwise it equals zero.

For the second and third sets of research questions (the determinants of farmers'

marketing choices, M_{ki}, and their impacts on farmers, Y_{ij}), we have the following specifications:

(2) $M_{ijt} = f$ (Incentive$_{it}$, FarmSize$_{it-n}$, Asset$_{it-n}$, Household$_{it}$, Shifters$_j$, *IVs*)

(3) $Y_{ijt} = f$ (Incentive$_{it}$, FarmSize$_{it-n}$, Asset$_{it-n}$, Household$_{it}$, Shifters$_j$, M_{ijt})

Where all variables in (2) and (3) are the same as those in (1) except for the following variables:

M_{ijt} is a vector of the marketing choices of ith farmer from j[th] village in year t. In this study, we divide farmer's marketing choices into 3 channels (small broker, wholesaler and modern channels, detail definitions were discussed in section 4).

Y_{ijt} is a set of variables that are hypothesized to be affected by the farmer' marketing choices (M_{ijt}). In the study, we identify the following impact variables: i) Pesticide input use per mu (yuan/mu); ii) total capital inputs per mu (yuan/mu); iii) total labour working days per mu (day/mu), total labour inputs including family labour and hired labour inputs; iv) capital input per labour day, or capital input to total labour input ratio (yuan/day); v) capital input per family labour day, or capital to family labour input ratio (yuan/day); vi) net income (total output value minutes total capital inputs and hired labour costs) per mu (yuan/mu); vii) return to capital input, that is, net income divided by total capital inputs; viii) return to family labour (net income divided by total family labour inputs, yuan/day).

IVs are instrumental variables used in the farmers' marketing channel choices. They include: household's distance from nearest wet market (km); distance from the nearest wholesale market (km); years from the nearest wholesale market established (years); sale tax in local periodic market (a dummy variables which equal 1 if there is tax, otherwise it equals zero; and local government regulations on vegetable marketing, a dummy variable equals 1 if there is any local government regulations on location of farmers' vegetable marketing in the past 5 years, otherwise it equals 0. We use the above variables as instrumental variables in farmers' marketing channel choices because we believe that these variables do not have direct impacts on farmers' vegetable production inputs and outputs, but they may have indirect impacts on farmers' vegetable production inputs and outputs through their impacts on farmers' marketing channel choices.

5.2 Model's estimations

Equation (1) can be estimated by Ordinary Least Squares (OLS) if it is assumed the error term of the equation follows a normal distribution. Unfortunately, of the sample's 654 (658) households in cucumber (tomato) study, which are used in the regression, in 216 cucumber (243 tomato) samples did not produce cucumber (tomato). Statistically, this can be accounted for by using a Probit (A is defined as yes

or no) or Tobit estimator to estimate the parameters in equation (1). Therefore, we estimated equation (1) in 2 alternatives. For Probit, we apply weight regression methods. The weights were discussed in section 3. We are not able to run Tobit with weights because there is no software available to do so. In all regressions, we use whole samples, with and without cucumber (or tomato) production households. The results of estimations are presented in Table 9a for cucumber and Table 9b for tomato.

For determinants of farmers' marketing channels, equation (2) is estimated by three alternatives. First, we use OLS and Tobit for estimations. The results of OLS estimation are also report because it can use weight regression. While Tobit regression is better than OLS as there are many zero values of independent variables, we cannot estimate Tobit with our weight regression. Then we also try a household fixed effect model because we have 2 years panel data for all variables in equation (2). When we estimate equation (2) using the household fixed effect, all non-time variant household variables disappear, including the farm size (in base year) and per capita fixed asset (in base year). As we are more interested in testing whether or not small farms and poor farmers are excluded (or included) in emerging marketing, these two variables in 2001 and 2006 are used in the regression.

One more note is about estimation of equations (2). As we discussed earlier, if the marketing channels are based on the first buyers, then the shares of modern marketing channels were only 1.5 per cent for cucumber and 0.8 per cent for tomato in 2001-2006. Indeed, there are only a couple of households who sold their vegetables directly to modern channels. But if we define marketing chains based on both first buyers and second buyers, the shares of modern marketing chains are significant for tomato (still nearly zero for cucumber, Table 5 and section 4).

Therefore, when we run the equation (2), we only estimate the wholesale market channel versus the brokers' marketing channel. But when we run equation (2) for tomato with marketing chains based on both the first and second buyers, we estimate both wholesale and modern chains. The comparison one is broker channel. The results of estimations are presented in Tables 10a and 10b for cucumber and tomato marketing channel choices based one the first buyers, and Table 11 for tomato based on both the first and second buyers.

Equation (3), the impact model, should be estimated simultaneously with equation (2). If the equation (2) is estimated by OLS, then we apply 2 Stage Least Square (2SLS) method. When equation (2) is estimated using Tobit, we use the estimated values of farmers' marketing channels in equation (3). Because we also concerns whether or not our instrument variables for marketing choices are strong enough to deal with endogenous problems in the impact model (equation 3), we try the third alternative estimation of impact model (equation 3). That is, we use lagged five years marketing

choices as explanation variable in impact equation. Because we have only 2 years data, therefore in this specification, the sample reduces to those households that had cucumber (or tomato) production in both 2001 and 2006. The results of impact model estimations are presented in Tables 12-15.

The last note about the estimation is the samples used in equation (1) and equations (2) and (3). To estimate equations (2) and (3), we are limited to a sub-set of samples used in equation (1). That is, we are dealing with only those households that have cucumber (or tomato) production because zero production implies zero value for all marketing channels. It should be note that the weights used in estimations of equations (2) and (3) differ from the weights used in equation (1) as we discussed in the sampling and data section.

6 Results of the econometric estimation

In this section we examine the results of the multivariate analysis. There are three different empirical exercises: the determinants of production; the determinants of marketing and impact analysis. In the determinants of marketing chains analysis and in the impact analyses that examine the role of marketing chains, we must use two definitions of modern chains the sales of farmers to the first buyer only; and the sales of the farmers to the first and second buyers.

6.1 Determinants of cucumber and tomato production

The multivariate analysis examining the determinants of participation in cucumber and tomato production in our Shandong sample shows that farm size is an important determinant of vegetable production (Table 9, columns 1 and 3) or area (column 2 and 4). In cucumber production, the parameter of farm size is positive in participation though not statistically significant (column 1), it is highly significant in sown area (column 2). In tomato production, the parameters of both participation and sown area are positive and statistically significant (columns 3 and 4). In other words, households that have access to large amounts of land have higher probability of participating in vegetable production. For tomato, marginal impact of farm size on the participation probability is 2 per cent (0.02, Table 9).

In contrast, the wealth of farmers seems have less or no impact on vegetable production (Tables 9). Although there is some propensity for farmers with more assets to participate relatively more in cucumber production, the result disappears when examining the area devoted to cucumber production. In the case of tomatoes, the wealth of a household is uncorrelated with neither participation nor the sown area decision. Hence, these findings indicate that the poor is not excluded from vegetable production, the results reinforce our early findings in the Greater Beijing (Wang et al 2006; Dong et al 2007). Wealth in terms of assets has little, if any, effect on the decision to produce cucumber or tomatoes. China's horticulture markets, according to these results, allow poor equal access to these emerging production activities.

The variable that is strongly associated with production decision is the availability of household labour. Because there is little hired labour in horticulture production, farmers depend on family labour. Hence, if there were relatively more family members that were working in the off farm labour market in 2001, we find that in 2006, such households were less likely to produce and devote less area to both cucumbers and tomatoes (Tables 9, row 3). Other variables such as village characteristics and policy variables also appear to have an effect on horticultural production, particular in sown areas (lower part of Table 9).

6.2   Determinants of marketing channel choice

In this section we examine the determinants of the marketing decision of the cucumber and tomato farmers.   In the first part of the section, since there are almost no direct sales to modern supply channels, we examine why some cucumber (tomato) farmers sell to wholesalers and others sell to brokers (the dependent variable is defined to be the amount of the output of the farmer that this sold to the wholesaler. In the second part of the section, we focus on the sales of tomato producers to modern channels, when the first and second links in the marketing chain are considered.

The most important finding of the multivariate analysis in the determinants of marketing channel choice is that small farms and poor farmers are not excluded from emerging of wholesale markets. In the case of cucumbers, there is no evidence that the size of the farm or the wealth of the farm households matters in the farmer's decision to sell to wholesale market or broker (Table 10a).   In fact, the sign on the per capita asset variable is negative and significant in the OLS version of the equation, implying that poorer farmers actually participate in wholesale marketing channels more than rich ones (which was what our descriptive statistics pointed to column 1). However, when accounting for the limited nature of the dependent variable (column 2) or including fixed effects in our model (to account for all non-time varying unobservables column 3), the measured relationship between per capita assets and the marketing channel choice is insignificant.

The same results are true for tomato producers (Table 10b). The t-ratio associated with both of the coefficients of the farm size and per capita asset variables in the determinants of tomato marketing channel choice is low.   None of farm size and wealth parameters is statistically significant. In other words, both small and large farmers and rich and poor ones have equal opportunity to participate in wholesale marketing channels.

Tables 10a and 10b also show that there are some other coefficients (particular those variables to be used as instrumental variables in the impact analysis), that are significant. For example, the distance of the household from the wholesale market has significantly negative impacts on selling cucumber to wholesaler (Table 10b). As expected the sign on this variable is negative, meaning as farmers live further from wholesale markets, they tend to sell to brokers – who in their search for opportunities to purchase crops from farmers for resale onto second buyers – are apparently willing to go further away from wholesale markets (than farmers are willing to haul their goods). However, the distance from the wholesale market has significant positive impact on selling tomato to wholesalers (Table 10b). This is may

be explained by the fact that there has been increasing trend of wholesaler purchasing tomato in farm field. By 2006, the share of wholesalers purchasing tomato from farmers in farm field (instead of in wholesale market) already accounted for about 50 per cent of their total procurement (Table 4). The multivariate regression also shows that more sale tax in local market is associated with less transaction in wholesale market. This is what we may expect because transaction between farmers and small brokers nerve paid for sale tax.

Several village level policies also have significant impacts on tomato producers marketing choices. The three village level policy variables are all significant in fixed effect model. Villages with historical legacies of cultivating tomatoes; those that have been designated "Vegetable Baskets" and those with farmer associations are more willing to sell their crops to wholesale markets.

Even when looking at the first and second buyers of the sales of tomato producers, the same general results hold (Table 11, rows 3 and 4). Small and large farmers have equal access to modern supply chains (column 3, 6 and 9). Likewise, there is no evidence that relatively rich farmers (or those with more per capita assets) have any greater propensity to participate in any type of marketing channel, including extended modern marketing channels. In fact, in the extended modern marketing channel equations (columns 3, 6, and 9), the sign on the coefficient of the per capita asset variable is negative and significant (not positive, which would be the sign if richer farmers were more likely to be able to involved in modern marketing channels).

Also like the results in Table 10a and 10b, there is no strong systematic relationship that is in evidence between the other variables and the marketing channel regardless of the type of estimator that is used (Table 11, rows 1 and 2; 5 to 13). While we do not know precisely how to explain the results, such findings are consistent with an explanation that rests on the observation that China's horticulture markets are extremely competitive. When 50 million horticulture farmers are buying from 10 million small traders who are operating as brokers, wholesalers and as agents of modern buyers, competition blurs the distinction among marketing channels. Farmers sell to (traders buy from) any number of different buyers (farmers) because markets offer more or less the same price for similar commodities. In other words, competitive markets make all farmers large and small and rich and small indifferent between selling to brokers, wholesalers, consumers or modern buyer.

6.3 Impacts of marketing channels on input use, technology and income

Perhaps unsurprisingly, given the results of the determinants analysis, when looking

at the effect on income of whether or not tomato (or cucumber) producers sell to brokers or wholesalers, there is no significant impact on income (Table 12, row 1). Holding incentives, farm and asset size and farmer and village characteristics constant, the coefficient on the marketing channel variable is statistically insignificant from zero. This is true if we use a.) two stage least squares estimators (or OLS with a fitted value of the marketing channel variable—column 1); b.) fixed effect / IV estimator (column 2); or c.) a lagged value of the marketing channel variable (column 3). Such a finding is consistent with the observations that China's horticultural markets are extremely competitive. Excess profits in any segment of the market are quickly competed down to zero.

We repeat the same analysis for all possible impacts on farmers as those presented in Table 12, the results are summarized in Table 13. Because we are most interested in the impacts of farmers' marketing channel choices on farmers, in Table 13, we report only the parameters, standard errors and significance of the parameters of wholesale market channel variable on a set of variables that measure the crop inputs, technology and income. The parameters of all other variables as those reported in Table 12 are estimated but not reported.

Table 13 shows that, in the case of cucumbers, it is also difficult to find a significant effect of the choice of cucumber marketing channel on input use, the capital/labour ratio choice or returns to capital inputs and labour inputs (Table 13, rows 1 to 3). In fact, 21 of 24 coefficients on the cucumber marketing channel choice variable are statistically insignificant from zero. Even in the cases that they are significant (capital input OLS with fitted value estimator; net income fixed effects and lagged value of the marketing channel variable), the magnitudes of the coefficients are extremely small.

Specifically, if the measured levels of inputs of capital and income were actually true, compared to the current capital inputs (from 2092 yuan/mu to 2334 yuan/mu, Table 8) and income (from 4130 yuan/mu to 5408 yuan/mu, Table 8) levels the higher use of capital (14.3 yuan/mu, column 2, Table 12) and higher levels of income (about 14 yuan/mu, column 6, Table 12)) would represent a gain of less than 1 per cent. In other words, even if the results were statistically valid, the real message is that there is no meaningful different in input use, technology or returns between those cucumber farmers that sell to brokers or wholesalers.

The same interpretation can be made in the case of tomatoes (Table 13, rows 4 to 6). While in the case of tomatoes there were twice as many measured coefficients that were statistically different than zero (6 of 24 instead of 3 of 24 as in the case of cucumbers), the economic significance of the coefficients are all nearly zero. The difference in the level of use of total capital, the capital/total labour use ratio and capital/family ratio between tomato farmers that sell to wholesale markets and those

that sell to small brokers is less than one per cent.

When examining the impacts of the sales decision in both the first and second links of the marketing chain for tomato producers, the general findings is the same although the results suggest that there are more consistent measured (albeit small) impacts on income of those that sell into modern supply chains. In looking the most basic results of the effect of the choice of marketing channels on income in Table 14, it can be seen that, as before there is no measurable difference between the decision to sell to brokers or wholesalers (row 1).

However, using all three estimators the positive sign on the coefficient of the modern marketing channel variable suggests that the income of those that sell into modern marketing channel is higher (and significantly so row 2). More specifically, depending on the estimation approach, in per capita income of those selling into modern supply chains is between 56.70 yuan and 147.34 yuan higher than those selling to brokers (or wholesalers). Such a finding is consistent with the descriptive statistics.

However, these findings also must be kept in perspective. Given the net income per mu is about 4130-5408 yuan (column 8, Table 8), this means that per mu incomes of those that sell into modern supply chains are higher by a factor of 1 to 3 per cent.

When looking at the full set of impacts (Table 15), it can be seen that in addition to differences in income between those that sell into modern marketing channels and those that do not (column 6 which are the same as the coefficients reported in Table 14), there also are differences in the level of capital used and the level of the capital/labour ratio. The measured differences also are fairly robust. However, like differences in income, the magnitudes of the differences are extremely small—less than one per cent.

So what accounts for the differences in income between those that sell into modern channels and those that do not. Based on our interviews and empirical findings there are explanations. First, the prices of those selling to the modern supply chains are much higher (Appendix Table 2). Second, farmers are using slightly more capital. Because the higher price in the save villages and in the same time, given the competitive of markets, is mainly due to higher quality, it might be that the willingness to invest more capital into the production process is the key to producing higher quality tomatoes which allows farmers into the marketing channel that pays a quality premium for the tomatoes that flow through the channel.

7 Conclusions

This micro study, Module 3 of Component 1, is to look for more empirically evidence of market restructurings and analyse their impacts on farmers based on intensive farm household survey of the selected products, cucumber and tomato in Shandong province, a largest vegetable production area in China. Major findings related to four sets of research questions in this study have been examined. Major findings for each of these 4 sets of research questions are summarized below.

1) Determinants of farmers' participation in emerging vegetable production activities

    i)   Vegetable markets have been expanding. More farmers have been participating in vegetable production. The growth of vegetable production is mainly from new entry of farmers. Although increase in vegetable area per household also contributes to its production growth, its impact is much less than the impact of new households participated in the production.

    ii)   While there is evidence of large farmers be more likely to be included in vegetable production, all farms are small (averaged 0.4 hectare). The largest farm size is only about 1.5 hectare in cucumber households and 1.2 hectare in tomato ones.

    iii)   There is no evidence of poor being excluded from vegetable production. Wealth has little effect on the decision to produce cucumber or tomatoes. China's markets allow poor equal access to the emerging horticulture activities.

    iv)   Family labour availability or off farm employment is found to be important determinants of vegetable production. This should not be surprising because horticulture is more labour intensive crops than other major crops such as wheat and maize in Shandong. Other factors such as government supporting policies at village level (e.g., 'Vegetable Base"'programme) are also found to have significant impacts of farmers' participation in vegetable production.

2) Nature of market restructurings

    i)   There have been emerging wholesale markets. Farmers sell nearly 80% of their vegetables to wholesalers and wholesalers' market channel share is still keeping growing. The small brokers purchase about 20 per cent of farmers' vegetables.

    ii)   Consistent with the findings of local meso study, the rapid restructurings of downstream retail market and midstream food processing industry have not penetrated into farm procurement. Overall, farmers selling their vegetables directly to modern channel are nearly none exist.

iii) However, in the case of tomato, there is some evidence of penetration of downstream changes, mainly export market expansion, into wholesale market. But, this emerging change, again, has not penetrated into farm procurement. The penetration has stopped at wholesale level. An indication of a very competitive wholesale market, efficient small wholesalers in linking downstream and upstream, and high transaction costs of modern retails and exporters with millions of small producers.

iv) Although the upstream segments of the marketing channel are dominated by wholesalers and small brokers, there is a type of vertical integration occurring in tomato (but not in cucumber). In the case of tomato, wholesalers have increasingly purchased their tomato from farmers in the field.

3) Determinants of farmers' marketing choices

i) Small farms and poor are not excluded from the emerging wholesale markets. There is no evidence of the size of the farm or the wealth of the farm households affecting the farmer's choices of selling their products to wholesalers or brokers. Both small and large farmers and rich and poor ones have equal opportunity to participate in wholesale marketing channels.

ii) Even when looking at a longer marketing chain (linking both the first and second buyers) of tomato producers, small farmers still have equal access to modern supply chains. There is also no evidence that relatively rich farmers have any greater propensity to participate in any type of marketing channel, including extended modern marketing channels.

iii) Marketing infrastructure, local sale tax, and several other village level policies are found to have significant effects on farmers' marketing choices.

4) Impacts of marketing restructurings on farmers

i) There is no significant impact of marketing choices between wholesalers and brokers on farmers' crop inputs, technology use and income. The results are holding for nearly all measurements of impacts in both cucumber and tomato samples. This finding is consistent with the competitive of China's horticultural markets.

ii) Although there is evidence of impacts of the sales decision in both the first and second links of the marketing chain for tomato producers, the magnitudes of the impacts are small, about 1 per cent to 3 per cent of the crop income.

There are several lessons that may rise from this study. First, land tenure, particular equitable distribution of land among farmers is critical important for all farmers benefiting from marketing expansion and avoiding some of them left behind (or be

excluded) when market restructurings occurred. Second, a competitive market benefits farmers, including small and poor farmers. However, when a competitive market is dominated by small traders, there is also great challenge in meeting consumer's demand for food safety. Third, rural transportation and market infrastructure are essential for small farmers to effectively participate in markets. Fourth, as government supporting policies in production and infrastructure (e.g. 'Vegetable Base' programme in China) can play important roles in farmers' participating in vegetable production and marketing, future efforts may need to emphasize more in the poor and remote villages than the current 'Vegetable Base' villages that are located mostly in sub-urban areas. Last but not least, while we do not find significant impacts of farmer association on both farmers' vegetable production and marketing channel choices, this may also imply that, as the previous studies have shown (Shen et al. 2005), most existing farmer associations are not well functioned. There is need to develop more functional associations or cooperatives that can really provide farmers useful inputs and marketing services.

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9 Tables and figures

Table 1.Characteristics of Sample Households and Villages in Shandong Province

	Cucumber villages			Tomato villages		
	Average	Cucumber households	Non-cucumber households	Average	Tomato households	Non-tomato households
Number of observations						
2001	327	200	127	329	186	143
2006	327	228	99	329	229	100
Households in 2006 [a]						
Household cultivated land (mu)	5.2	6.1	4.8	7.1	8.5	6.5
Population (number)	3.8	4.1	3.7	3.5	3.8	3.4
Head age (years)	46.6	46.0	46.8	46.2	44.8	46.8
Head education (years)	7.3	7.7	7.1	7.7	7.6	7.8
Labour (number)	2.9	3.0	2.8	2.5	2.7	2.4
Labour/population (%)	76.9	75.3	77.6	74.0	73.8	74.1
Off farm labour share (%)	39.2	29.5	43.4	27.8	18.5	31.4
Per capita asset (yuan)	7408	7439	7395	8662	8485	8731
Villages characteristics [a]						
"Vegetable Base" in past 5 years (%)	26.8	26.8	26.8	22.5	35.2	17.5
Cucumber or tomato area in 2000 (mu) [b]	0.6	0.9	0.5	0.5	0.7	0.4
Distance from wholesale market in 2005 (km)	5.7	4.6	6.2	12.2	11.3	12.5

Note: a: All numbers are weighted averages.

b: The numbers under cucumber columns are cucumber areas and those under tomato columns are tomato areas. 15 mu = 1 hectare.

Table 2. Household Crop Sown Area in Shandong in 2001 and 2006

	Sample Number	Crop sown area (mu)			
		Total	Vegetable	Cucumber /tomato	Other
Cucumber villages					
Whole sample					
2001	327	9.3	2.4	0.6	6.9
2006	327	9.1	2.9	0.5	6.2
Average		9.2	2.7	0.6	6.6
Cucumber households only					
2001	200	9.7	3.7	1.6	6.0
2006	228	11.2	5.2	1.8	6.0
		10.4	4.4	1.7	6.0
Tomato villages					
Whole sample					
2001	329	11.3	1.4	0.6	9.9
2006	329	11.2	1.9	0.6	9.3
Average		11.3	1.7	0.6	9.6
Cucumber households only					
2001	186	14.0	3.5	2.3	10.6
2006	229	14.0	3.9	2.3	10.1
Average		14.0	3.7	2.3	10.3

Note: All numbers are weighted averages.

Table 3. Farmers' Cucumber and Tomato Marketing Channels in Shandong in 2001 and 2006

	Sample Number	Shares by marketing channels (%)			
		Brokers [a]	Wholesalers	Modern channels [b]	Total
Cucumber villages					
2001	200	25.7	73.4	1.0	100
2006	228	18.3	79.8	2.0	100
Average		21.6	76.9	1.5	100
Tomato villages					
2001	186	21.6	78.3	0.03	100
2006	229	19.7	79.9	0.4	100
Average		20.6	79.2	0.2	100
All villages					
2001	386	23.5	76.0	0.5	100
2006	457	19.0	79.8	1.2	100
Average		21.1	78.1	0.8	100

Note: a: the numbers under broker category also include farmers directly sold vegetables to consumers in local periodic and wet markets, which are about 2% for cucumber and 1% for tomato (see Figures 1a-2b).

b: Modern channels include special suppliers, processing companies, farmers' associations, supermarkets, restaurants and export companies. They accounted for 0.6%, 1.0%, 0.1%, 0.02%, 0.1% and 0.1%, respectively in 2006 in cucumber villages, and 0, 0, 0, 0.3%, 0.03% and 0, respectively in 2006 in tomato villages.

Table 4. Farmers' Cucumber and Tomato Marketing by Channels and Location in Shandong in 2001 and 2006

Locations	Shares by marketing channels (%)							
	2001				2006			
	Total	Broker	Whole-saler	Modern channel	Total	Broker	Whole-saler	Modern channel
Cucumber								
Field	26	38	21	15	23	41	19	6
Wholesale market	67	36	79	50	73	37	81	85
Wet market	7	26	0	35	4	22	0	9
Total	100	100	100	100	100	100	100	100
Tomato								
Field	37	35	38	0	45	30	49	0
Wholesale market	55	42	58	100	50	53	49	100
Wet market	8	23	4	0	5	17	2	0
Total	100	100	100	100	100	100	100	100

Table 5. Tomato Marketing Chains based on both first and second buyers in Shandong in 2001 and 2006

	Sample number	Shares by marketing channels (%)			
		Brokers→ non-modern	Wholesalers → Non-modern	Modern Channels	Total
Average					
2001	186	21.5	49.1	29.4	100
2006	229	18.3	44.3	37.4	100
Average		19.8	46.5	33.7	100
Shouguang county					
2001	65	12.5	41.6	45.9	100
2006	75	9.8	31.5	58.7	100
Average		11.0	35.9	53.1	100
Pingyuan county					
2001	58	34.0	57.8	8.2	100
2006	65	50.4	44.9	4.7	100
Average		41.8	51.6	6.6	100
Laixi county					
2001	23	32.4	66.9	0.7	100
2006	39	17.1	78.8	4.1	100
Average		24.5	73.0	2.5	100
Boxing county					
2001	35	14.3	31.7	54.0	100
2006	34	10.1	30.6	59.3	100
Average		12.0	31.1	56.9	100
Muping county					
2001	12	23.6	75.6	0.8	100
2006	16	32.8	61.8	5.4	100
Average		28.5	68.3	3.2	100

Note: Modern channels include: i) brokers → modern; ii) wholesalers → modern; and iii) directly sold to modern channels.

Table 6. Selected Farms' Characteristics and Marketing Channels in 2001 and 2006

	Sample number	Shares by marketing channels (%)			
		Brokers	Wholesalers	Modern Channels	Total
Cucumber villages					
Household cultivated land in 2001					
<=3.9 mu	143	21.4	78.1	0.5	100
3.9-5.8 mu	150	21.9	74.9	3.2	100
>5.8 mu	135	21.4	78.2	0.4	100
Per capita asset in 2001					
<=2350 yuan	144	15.1	84.6	0.3	100
2350-5800 yuan	143	21.7	76.3	2.0	100
>5800 yuan	141	27.8	69.8	2.2	100
Distance to nearest county road					
<0.5 km	146	26.2	70.5	3.3	100
0.5-2 km	171	22.1	77.2	0.7	100
>2 km	111	14.3	85.7	0.0	100
Distance to nearest wholesale market					
<=0.5 km	137	26.1	69.5	4.4	100
0.5-3 km	160	15.4	84.3	0.3	100
>3 km	131	24.6	75.3	0.1	100
With farm association					
0=no	353	22.4	76.7	0.9	100
1=yes	75	18.3	77.5	4.2	100
Tomato villages					
Household cultivated land in 2001					
<=5.5 mu	144	20.4	79.5	0.1	100
5.5-8.5 mu	134	15.3	84.2	0.5	100
>8.5 mu	137	24.1	75.8	0.1	100
Per capita asset in 2001					
<=2100 yuan	140	16.0	83.3	0.7	100
2100-5120 yuan	137	19.5	80.5	0.0	100
>5120 yuan	138	26.0	73.9	0.1	100
Distance to nearest county road					
<0.5 km	137	14.1	85.8	0.1	100
0.5-3 km	141	24.8	75.2	0.0	100
>3 km	137	22.4	77.1	0.5	100
Distance to nearest wholesale market					
<=3 km	146	14.9	85.0	0.1	100
3-7.5 km	147	28.6	70.9	0.5	100
>7.5 km	122	19.8	80.1	0.1	100
With farm association					
0=no	339	20.3	79.4	0.3	100
1=yes	76	21.9	78.1	0.0	100

Table 7. Selected Farms' Characteristics and Marketing Chains Based on the First and Second Buyers in 2001 and 2006

| | 2001 | | | | | 2006 | | | | |
| | | Shares by marketing channels (%) | | | | | Shares by marketing channels (%) | | | |
	Sample Number	Brokers→ non-modern	Wholesalers → Non-modern	Modern Channels [a]	Total	Sample Number	Brokers→ non-modern	Wholesalers → Non-modern	Modern Channels [a]	Total
Household cultivated land in 2001										
<=5.5 mu	62	26.2	57.3	16.5	100	82	14.1	57.8	28.1	100
5.5-8.5 mu	61	12.9	51.8	35.3	100	73	13.3	41.5	45.2	100
>8.5 mu	63	24.1	42.8	33.1	100	74	23.9	38.6	37.5	100
Per capita asset in 2001										
<=2100 yuan	62	14.1	57.9	28.0	100	78	18.0	45.2	36.8	100
2100-5120 yuan	66	22.2	41.6	36.2	100	71	13.6	40.1	46.3	100
>5120 yuan	58	27.9	50.0	22.1	100	80	24.3	48.6	27.1	100
Distance to nearest county road										
<0.5 km	65	12.6	68.0	19.4	100	72	14.6	51.6	33.8	100
0.5-3 km	54	29.9	49.2	20.9	100	87	20.5	49.8	29.7	100
>3 km	67	22.2	35.2	42.6	100	70	19.4	34.6	46.0	100
Distance to wholesale market										
<=3 km	65	18.0	41.8	40.2	100	81	11.5	33.2	55.3	100
3-7.5 km	64	25.3	52.0	22.7	100	83	31.4	37.0	31.6	100
>7.5 km	57	21.7	53.3	25.0	100	65	14.8	61.0	24.2	100
With farm association										
0=no	164	22.2	47.3	30.5	100	175	16.2	34.7	49.1	100
1=yes	22	15.4	63.4	21.2	100	54	24.1	70.8	5.1	100

Note: Modern channels include: i) brokers → modern; ii) wholesalers → modern; and iii) directly sold to modern channels.

Table 8. Marketing Channels, Inputs and Outputs of Crop Production in Shandong Provinces in 2006.

	Sample number	Pesticide use (yuan/mu)	Capital input (yuan/mu)	Family hired labour (day/mu)	+Family labour (day/mu)	Capital labour (yuan/day)	/Capital / family labour (yuan/day)	Net income (yuan/mu)	Return to capital (ratio)	Return to family labour (yuan/day)
Cucumber villages (based on the first channel of the buyers) [a]:										
Brokers	37	334	2092	153	153	18	18	4130	2.9	40
Wholesalers	189	359	2334	148	148	20	20	5408	2.7	47
Modern channels	2	116	1353	170	170	16	16	3693	2.8	23
Tomato villages (based on the first channel of the buyers) [a]:										
Brokers	52	183	1572	120	120	15	15	4922	4.9	61
Wholesalers	176	238	2132	137	132	23	24	7253	4.1	81
Modern Channels	1	71	2429	357	357	7	7	12071	5.0	34
Tomato villages (based on largest chain that links the first and second buyers)										
Brokers→non-modern	45	184	1497	115	115	15	15	4585	5.1	61
Wholesalers→non-modern	129	261	2020	146	140	22	22	5123	3.1	53
Modern chains [b]	55	190	2270	125	122	23	24	10588	5.6	123

Note: a: the first buyer's first channel account for 93.5% and 93.3% of cucumber and tomato sold by farmers.

b: Modern chains include: i) brokers → modern; ii) wholesalers → modern; and iii) directly sold to modern channels.

Table 9. Determinants of Household's Cucumber and Tomato Sown Area (*A*) in Shandong, 2001-2006

	Cucumber		Tomato	
	Probit:	Tobit:	Probit:	Tobit:
	A=1 or 0	A=mu	A=1 or 0	A=mu
	(w/ weight)	(w/o weight)	(w/ weight)	(w/o weight)
Incentives:				
Distance from county road (km)	-0.04	-0.02	0.01	0.02
	(0.02)*	(0.04)	(0.01)	(0.04)
Off farm labour share in 2001 (%)	-0.003	-0.012	-0.005	-0.029
	(0.001)*	(0.003)***	(0.001)***	(0.005)***
Farm Size and assets in 2001:				
Cultivated land (mu)	0.01	0.11	0.02	0.09
	(0.01)	(0.03)***	(0.01)**	(0.03)***
Per capita asset (10,000 yuan)	0.14	0.09	0.02	0.08
	(0.04)***	(0.13)	(0.05)	(0.23)
Farm household head:				
Age (years)	-0.002	-0.02	0.0005	-0.05
	(0.005)	(0.01)*	(0.0028)	(0.01)***
Education (years)	0.01	0.05	0.01	-0.13
	(0.01)	(0.03)**	(0.01)	(0.05)***
Village and policy shifters:				
Village per household cucumber area $_{t-6}$ (mu)	0.06	0.49	0.09	0.57
	(0.08)	(0.12)***	(0.03)***	(0.08)***
"Vegetable Base" in past 5 years (yes=1; no=0)	0.03	0.04	0.09	0.04
	(0.11)	(0.19)	(0.07)	(0.27)
Farmer association (yes=1; no=0)	-0.07	0.39	-0.03	-0.23
	(0.10)	(0.21)*	(0.07)	(0.31)
Constant		0.40		3.52
		(0.47)		(0.77)***
Observations	652	652	658	658

Note: the parameters under Probit model have been standardized as the marginal impacts; all numbers in parentheses are robust standard errors. ***, ** and * represent statistically significant at 1%, 5% and 10%, respectively.

Table 10a. Determinants of Cucumber Wholesaler Marketing Channel Based on First Buyers in Shandong, 2001-2006

	OLS (w/ weight) (1)	Tobit (w/o weight) (2)	FE (w/ weight) (3)
Incentives:			
Distance from county road (km)	3.25	1.64	2.76
	(1.14)*** [a]	(1.37)	(3.37)
Off farm labour share [b] (%)	-0.10	-0.08	0.02
	(0.10)	(0.08)	(0.12)
Farm Size and assets:			
Cultivated land [b] (mu)	0.29	0.10	-1.38
	(0.83)	(0.91)	(1.05)
Per capita asset [b] (10,000 yuan)	-7.07	-0.04	1.25
	(3.76)*	(3.60)	(2.25)
Farm household head:			
Age (years)	0.16	-0.30	-0.33
	(0.27)	(0.26)	(0.59)
Edu (years)	-0.33	-0.40	
	(0.82)	(0.78)	
Village and policy shifters:			
Village per household cucumber area $_{t-6}$ (mu)	-3.48	1.64	4.88
	(3.33)	(3.50)	(3.18)
"Vegetable Base" in past 5 years (yes=1; no=0)	6.93	-5.06	2.32
	(5.53)	(5.64)	(3.27)
Farmer association (yes=1; no=0)	6.28	8.32	9.06
	(6.13)	(6.13)	(6.06)
IV's:			
Distance from wet market (km)	-0.12	-0.44	-3.98
	(1.13)	(1.22)	(1.95)**
Distance from wholesale market (km)	-1.12	-1.03	2.01
	(0.52)**	(0.52)**	(2.08)
Years from wholesale market established	0.001	0.23	0.24
	(0.189)	(0.22)	(0.43)
Sale tax in periodic market (yes=1; no=0)	-14.85	-16.09	-1.49
	(4.72)***	(5.07)***	(1.38)
Regulation on marketing (yes=1; no=0)	6.53	7.27	-1.19
	(5.04)	(5.06)	(3.84)
Constant	80.24	97.29	101.35
	(15.27)***	(14.78)***	(16.80)***
Observations	427	427	380
R-squared	0.11		0.93

a: All numbers in parentheses are robust standard errors except for those under OLS regression, which are standard errors. ***, ** and * represent statistically significant at 1%, 5% and 10%, respectively.

b: In the OLS (w/ weight) and Tobit (w/o weight) we use the base year (2001) data of off farm labour shares, cultivated land and per capita asset in regression, while in the FE (w/ weight) model we use data from both years (2001 and 2006) of these 3 variables in regressions.

Table 10b. Determinants of Tomato Wholesaler Marketing Channel Based on First Buyers in Shandong, 2001-2006

	OLS (w/ weight) (1)	Tobit (w/o weight) (2)	FE (w/ weight) (3)
Incentives:			
Distance from county road (km)	-1.53	-2.85	0.26
	(1.28)	(1.10)** a	(2.00)
Off farm labour share b (%)	0.22	0.28	-0.02
	(0.12)*	(0.12)**	(0.06)
Farm Size and assets:			
Cultivated land b (mu)	1.07	0.55	1.20
	(0.88)	(0.78)	(0.92)
Per capita asset b (10,000 yuan)	-2.35	-6.49	-1.76
	(5.98)	(5.39)	(3.18)
Farm household head:			
Age (years)	-0.19	-0.41	-0.47
	(0.31)	(0.29)	(1.39)
Edu (years)	0.84	-0.20	
	(1.31)	(1.13)	
Village and policy shifters:			
Village per household tomato area $_{t-6}$	1.92	0.91	6.37
(mu)	(1.55)	(1.82)	(2.85)**
"Vegetable Base" in past 5 years	15.30	9.15	67.21
(yes=1; no=0)	(7.15)**	(6.19)	(21.32)***
Farmer association (yes=1; no=0)	5.15	7.28	16.85
	(6.89)	(7.19)	(8.08)**
IV's:			
Distance from wet market (km)	-1.01	-0.41	-0.29
	(0.85)	(0.70)	(0.24)
Distance from wholesale market (km)	0.79	0.85	
	(0.33)**	(0.31)***	
Years from wholesale market established	-0.63	-0.61	-0.53
	(0.25)**	(0.27)**	(0.86)
Sale tax in periodic market (yes=1; no=0)	-13.07	-13.06	19.13
	(6.27)**	(5.63)**	(10.37)*
Regulation on marketing (yes=1; no=0)	6.85	17.38	
	(11.46)	(10.32)*	
Constant	75.45	98.87	16.34
	(19.66)***	(17.96)***	(37.60)
Observations	415	415	344
R-squared	0.11		0.91

a: All numbers in parentheses are robust standard errors except for those under OLS, later are standard errors. ***, ** and * represent statistically significant at 1%, 5% and 10%, respectively.
b: In the OLS (w/ weight) and Tobit (w/o weight) we use the base year (2001) data of off farm labour shares, cultivated land and per capita asset in regression, while in the FE (w/ weight) we use data from both years (2001 and 2006) of these 3 variables in regressions.

Table 11. Determinants of Tomato Marketing Chains Based on both the First and Second Buyers in Shandong, 2001-2006

	OLS (w/ weight)			Tobit (w/o weight)			FE (w/ weight)		
	Chain 1[b]	Chain 2[b]	Chain 3[b]	Chain 1[b]	Chain 2[b]	Chain 3[b]	Chain 1[b]	Chain 2[b]	Chain 3[b]
Incentives:									
Distance from county road	1.7	-1.1	-0.6	7.8	-4.4	1.0	-0.9	4.3	-3.4
(km)	(1.3)	(1.3)	(0.8)	(2.1)***	(1.7)***	(2.4)	(2.0)	(5.3)	(5.9)
Off farm labour share [c] (%)	-0.2	0.3	-0.03	-0.6	0.4	-0.1	0.02	0.1	-0.1
	(0.1)**	(0.1)*	(0.11)	(0.2)**	(0.2)**	(0.2)	(0.06)	(0.1)	(0.1)
Farm size and assets:									
Cultivated land [c] (mu)	-0.8	-0.9	1.7	0.5	-0.7	1.9	-1.1	0.7	0.4
	(0.9)	(0.9)	(0.7)**	(1.5)	(1.2)	(1.6)	(0.8)	(0.8)	(0.9)
Per capita asset [c]	3.3	9.9	-13.2	17.9	9.3	-32.5	3.7	0.1	-3.8
(10,000 yuan)	(6.1)	(6.3)	(5.7)**	(10.3)*	(8.1)	(12.2)***	(2.5)	(2.6)	(2.3)*
Farm household head:									
Age (years)	-0.1	-0.6	0.7	0.2	-0.3	-0.2	-0.6	-1.7	2.3
	(0.3)	(0.3)**	(0.3)***	(0.6)	(0.4)	(0.6)	(1.0)	(2.1)	(2.1)
Education (years)	-0.4	-0.5	0.9	-1.0	1.2	-3.2			
	(1.2)	(1.3)	(1.1)	(2.2)	(1.7)	(2.3)			
Village and policy shifters									
Village per household	-1.6	-2.5	4.1	2.0	-6.3	9.2	-5.6	-2.1	7.7
tomato area $_{t-6}$ (mu)	(1.5)	(1.5)*	(1.5)***	(3.5)	(3.0)**	(3.5)***	(2.7)**	(3.5)	(3.9)*
"Vegetable Base" in past 5	-14.0	16.1	-2.1	-21.3	14.0	3.2	-68.8	68.7	0.1
years (yes=1; no=0)	(7.1)**	(7.5)**	(5.9)	(12.7)*	(9.3)	(12.9)	(22.5)***	(22.2)***	(2.3)
Farmer association (yes=1;	-3.0	21.6	-18.6	-4.9	33.7	-35.6	-14.2	11.1	3.1
no=0)	(6.6)	(7.6)***	(6.8)***	(14.3)	(10.8)***	(15.3)**	(7.2)**	(7.7)	(3.6)
IV									
Distance from wet market	1.2	-1.2	-0.1	-0.2	0.5	-1.8	0.1	0.8	-0.9
(km)	(0.9)	(0.9)	(0.7)	(1.3)	(1.1)	(1.5)	(0.2)	(1.1)	(1.1)
Distance from wholesale	-0.8	1.2	-0.5	-2.0	1.6	0.1			
market (km)	(0.3)**	(0.3)***	(0.2)**	(0.6)***	(0.5)***	(0.6)			
Years from wholesale	0.6	-0.7	0.1	1.2	-1.2	0.2	0.9	0.9	-1.8
market established	(0.2)**	(0.3)***	(0.2)	(0.5)**	(0.4)***	(0.6)	(0.8)	(2.0)	(2.0)

Table 11. Determinants of Tomato Marketing Chains Based on both the First and Second Buyers in Shandong, 2001-2006 (continued)

	OLS (w/ weight)			Tobit (w/o weight)			FE (w/ weight)		
	Chain1[b]	Chain 2 [b]	Chain 3 [b]	Chain1 [b]	Chain 2 [b]	Chain 3 [b]	Chain1 [b]	Chain 2 [b]	Chain 3 [b]
Sale tax in periodic market	12.2	-0.5	-11.7	30.4	-7.5	-16.4	-18.4	4.3	14.1
(yes=1; no=0)	(6.1)**	(6.5)	(5.4)**	(11.2)***	(8.6)	(11.5)	(10.2)*	(5.2)	(11.3)
Regulation on marketing	-19.0	-19.5	38.5	-50.4	-10.5	49.7			
(yes=1; no=0)	(7.3)***	(11.1)*	(9.8)***	(21.8)**	(15.8)	(20.1)**			
Constant	27.5	79.5	-7.0	-58.8	51.3	8.6	101.7	-2.5	0.8
	(19.7)	(19.7)***	(16.2)	(34.9)*	(27.3)*	(37.1)	(34.8)***	(48.1)	(44.5)
Observations	415	415	415	415	415	415	344	344	344
R-squared	0.11	0.16	0.22				0.93	0.93	0.93

a: All numbers in parentheses are robust standard errors except for those under OLS regression, which are standard errors. ***, ** and * represent statistically significant at 1%, 5% and 10%, respectively.

b: Chain 1 is "brokers→non-modern", Chain 2 is "wholesalers→non-modern", Chain 3 includes i) brokers → modern; ii) wholesalers → modern; and iii) directly sold to modern channels.

c: In the OLS (w/ weight) and Tobit (w/o weight) models we use the base year (2001) data of off farm labour shares, per capita cultivated land and per capita asset in regression, while in the FE (w/ weight) model we use data from both years (2001 and 2006) of these 3 variables in regressions.

Table 12. Impacts of Tomato Wholesale Market Channel Choice on Net Income in Shandong, 2006 (based on first buyers)

	Net income (yuan/mu)		
	2SLS (1)	Use estimated M in FE in Table 10a (2)	Use lag M (Mt in 2001 (3)
Marketing channels (M)			
Wholesale market shares (%)	-2.36	15.90	14.98
	(56.03)	(14.92)	(14.63)
Incentives:			
Distance from county road (km)	-43.68	50.80	47.37
	(144.66)	(224.70)	(221.45)
Off farm labour share [b] (%)	16.66	18.83	20.63
	(25.07)	(25.88)	(25.66)
Farm size and assets:			
Cultivated land [b] (mu)	589.58	574.10	576.89
	(115.91)*** [a]	(141.54)***	(143.43)***
Per capita asset [b]	2,217.92	2,887.53	2,972.73
(10,000 yuan)	(1,799.74)	(2,238.88)	(2,287.75)
Farm household head:			
Age (years)	-89.08	-78.78	-81.92
	(57.31)	(66.78)	(65.27)
Education (years)	-394.55	-304.75	-294.73
	(235.12)*	(280.03)	(283.26)
Village and policy shifters:			
Village per household	345.43	237.52	271.35
tomato area $_{t-6}$ (mu)	(297.42)	(220.63)	(214.90)
"Vegetable Base" in past 5 years	2,127.65	1,732.65	1,814.29
(yes=1; no=0)	(1,673.18)	(1,398.67)	(1,392.40)
Farmer association	-2,226.39	-2,034.75	-2,039.75
(yes=1; no=0)	(983.28)**	(1,127.81)*	(1,141.00)*
Constant	7,757.40	5,603.71	5,601.37
	(6,542.22)	(4,734.18)	(4,768.52)
Observations	229	172	172
R-squared	0.18	0.17	0.17

a: ***, ** and * represent statistically significant at 1%, 5% and 10%, respectively.

b: In the OLS (w/ weight) and Tobit (w/o weight) models we use the base year (2001) data of off farm labour shares, per capita cultivated land and per capita asset in regression, while in the FE (w/ weight) model we use data from both years (2001 and 2006) of these 3 variables in regressions.

Table 13. Impact of Wholesale Marketing Channel Choice Based on First Buyers in Shandong, 2006

	Pesticide (yuan/mu) (1)	Capital (yuan/mu) (2)	Labour (day/mu) (3)	Capital/total labour (yuan/ day) (4)	Capital/family labour (yuan/ day) (5)	Net income (yuan/mu) (6)	Return to capital (7)	Return to family labour (yuan/day) (8)
Cucumber								
1. Fitted value of wholesalers, OLS	1.1	14.3	0.5	0.1	0.1	18.8	-0.01	0.1
	(1.5)	(6.1)**	(0.5)	(0.1)	(0.1)	(23.5)	(0.02)	(0.2)
2. Fitted value of wholesalers, FE	0.1	2.6	-0.1	0.03	0.03	14.4	-0.002	0.1
	(0.7)	(2.9)	(0.2)	(0.03)	(0.03)	(7.2)**	(0.008)	(0.1)
3. Wholesaler, lagged	0.3	2.6	-0.1	0.04	0.04	13.9	-0.003	0.1
	(0.6)	(2.6)	(0.2)	(0.02)	(0.02)	(6.4)**	(0.007)	(0.1)
Tomato								
4. Fitted value of wholesalers, OLS	0.1	-9.9	0.1	-0.5	-0.4	-2.4	0.1	0.7
	(1.4)	(12.9)	(0.8)	(0.4)	(0.4)	(56.0)	(0.1)	(1.1)
5. Fitted value of wholesalers, FE	0.3	5.9	0.3	0.04	0.06	15.9	-0.02	0.1
	(0.4)	(2.9)**	(0.2)	(0.02)*	(0.03)**	(14.9)	(0.02)	(0.3)
6. Wholesaler, lagged	0.2	5.1	0.1	0.06	0.07	15.0	-0.02	0.2
	(0.4)	(2.5)**	(0.2)	(0.02)***	(0.02)***	(14.6)	(0.02)	(0.3)

Note: All numbers in parentheses are robust standard errors except for those under OLS regression, which are standard errors. ***, ** and * represent statistically significant at 1%, 5% and 10%, respectively.

Table 14. Impacts of Tomato Market Channels on Net Income in Shandong, 2006 (based on both the first and second buyers)

	Net income (yuan/mu)		
	Use estimated M in OLS in Table 11	Use estimated M in FE in Table 11	Use lag M (M_t in 2001
Marketing channels (M)			
Wholesale market shares (%)	16.89	4.43	0.51
	(42.47)	(11.34)	(12.48)
Modern channel shares (%)	147.34	69.93	56.70
	(48.16)*** [a]	(23.52)***	(22.72)**
Incentives:			
Distance from county road (km)	87.60	21.15	-2.78
	(156.71)	(201.06)	(210.77)
Off farm labour share [b] (%)	15.21	31.24	40.71
	(20.33)	(22.44)	(24.32)*
Farm size and assets:			
Cultivated land [b] (mu)	470.23	503.46	495.47
	(122.16)***	(119.12)***	(127.04)***
Per capita asset [b] (10,000 yuan)	3,651.20	3,515.55	3,433.54
	(1,202.84)***	(1,939.93)*	(2,043.81)*
Farm household head:			
Age (years)	-125.40	-126.58	-143.71
	(59.82)**	(59.97)**	(62.23)**
Education (years)	-235.45	-343.29	-368.29
	(217.23)	(236.99)	(248.84)
Village and policy shifters:			
Village per household	-721.78	-226.33	-42.36
tomato area $_{t-6}$ (mu)	(423.81)*	(303.65)	(264.68)
"Vegetable Base" in past 5 years	-1,155.08	910.15	1,344.93
(yes=1; no=0)	(1,407.97)	(1,390.64)	(1,468.68)
Farmer association	2,302.87	-111.73	-686.00
(yes=1; no=0)	(1,664.59)	(975.45)	(1,066.82)
Constant	4,008.65	7,329.31	9,019.87
	(4,635.22)	(4,185.56)*	(4,275.55)**
Observations	229	172	172
R-squared	0.14	0.32	0.28

a: ***, ** and * represent statistically significant at 1%, 5% and 10%, respectively.

b: In the OLS (w/ weight) and Tobit (w/o weight) models we use the base year (2001) data of off farm labour shares, per capita cultivated land and per capita asset in regression, while in the FE (w/ weight) model we use data from both years (2001 and 2006) of these 3 variables in regressions.

Table 15. Impact of Tomato Marketing Channels Based on Both the First and Second Buyers in Shandong, 2006

	Pesticide (yuan/mu) (1)	Capital (yuan/mu) (2)	Labour (day/mu) (3)	Capital/total labour day) (4)	Capital/family labour (yuan/ day) (5)	Net income (yuan/mu) (6)	Return capital (7)	to Revenue to family labour (yuan/day) (8)
1a. Fitted value of wholesalers, OLS	-0.7 (1.6)	-8.7 (13.5)	-0.02 (0.90)	-0.5 (0.3)	-0.4 (0.3)	16.9 (42.5)	0.05 (0.04)	0.8 (1.0)
1b. Fitted value of modern channels, OLS	-1.2 (2.1)	18.7 (18.0)	0.4 (1.1)	-0.1 (0.3)	-0.1 (0.2)	147.3 (48.2)***	0.05 (0.04)	1.3 (0.7)**
2a. Fitted value of wholesalers, FE	0.5 (0.4)	4.6 (2.8)	0.3 (0.2)	0.04 (0.03)	0.06 (0.03)**	4.4 (11.3)	-0.02 (0.02)	-0.03 (0.19)
2b. Fitted value of modern channels, FE	-0.6 (0.4)	7.3 (3.5)**	0.1 (0.2)	0.06 (0.03)*	0.08 (0.04)**	69.9 (23.5)***	-0.001 (0.025)	0.8 (0.6)
3a. Wholesaler, lagged	0.5 (0.4)	4.1 (2.5)	0.2 (0.2)	0.06 (0.02)**	0.07 (0.02)***	0.5 (12.5)	-0.03 (0.02)	0.05 (0.20)
3b. Modern, lagged	-0.4 (0.4)	8.4 (3.9)**	0.1 (0.3)	0.06 (0.03)**	0.09 (0.04)**	56.7 (22.7)**	-0.01 (0.02)	0.7 (0.5)

Note: All numbers in parentheses are robust standard errors except for those under OLS regression, which are standard errors. ***, ** and * represent statistically significant at 1%, 5% and 10%, respectively.

Appendix Table 1. Farmers' Cucumber and Tomato Marketing Channels by Counties in Shandong, 2001 and 2006

	Sample number	Shares by marketing channels (%)			
		Brokers	Wholesalers	Modern channels	Total
Cucumber villages					
Cangshan county					
2001	54	10.7	89.2	0.1	100
2006	70	8.6	91.2	0.2	100
Average		9.5	90.4	0.1	100
Yinan county					
2001	65	11.7	88.3	0.0	100
2006	76	9.5	90.4	0.1	100
Average		10.4	89.5	0.1	100
Laixi county					
2001	29	30.3	67.7	2.0	100
2006	33	12.0	79.2	8.8	100
Average		21.1	73.5	5.4	100
Daiyue county					
2001	31	60.7	35.3	4.0	100
2006	31	48.5	48.6	2.9	100
Average		54.5	42.1	3.4	100
Wenshang county					
2001	21	40.3	59.7	0.0	100
2006	18	48.7	51.3	0.0	100
Average		44.4	55.6	0.0	100
Tomato villages					
Shouguang county					
2001	65	12.5	87.5	0.0	100
2006	75	9.8	89.2	1.0	100
Average		11.0	88.4	0.6	100
Pingyuan county					
2001	56	34.9	65.1	0.0	100
2006	65	51.4	48.6	0.0	100
Average		42.8	57.2	0.0	100
Laixi county					
2001	22	32.4	67.6	0.0	100
2006	39	17.2	82.8	0.0	100
Average		24.5	75.5	0.0	100
Boxing county					
2001	33	14.3	85.7	0.0	100
2006	34	14.4	85.6	0.0	100
Average		14.4	85.6	0.0	100
Muping county					
2001	10	23.6	75.9	0.5	100
2006	16	32.8	66.2	1.0	100
Average		28.4	70.8	0.8	100

Appendix Table 2. Procurement prices by location and marketing channels, yuan/kg

	Marketing channels based on the first buyers		
	Broker	Wholesaler	Modern
Cucumber			
Farm field	1.20	1.42	
Wholesale market	1.02	1.27	
Wet market	1.05	1.71	
Average	1.11	1.34	No enough observations to generate meaningful prices
Tomato			
Farm field	1.36	1.83	
Wholesale market	1.64	1.96	
Wet market	1.39	1.49	
Average	1.51	1.87	

	Marketing chains based on the first and second buyers		
	Broker→ non-modern	Wholesaler→ non-modern	Broker → modern; Wholesalers → modern; Direct to modern
Tomato			
Farm field	1.40	1.55	2.38
Wholesale market	1.47	1.61	2.38
Wet market	1.49	1.23	2.15
Average	1.46	1.55	2.38

Appendix Table 3. Description of Major Variables Used in Determinants of Cucumber and Tomato Sown Area Models in 2001 and 2006

	Cucumber			Tomato		
	Mean.	Min.	Max.	Mean.	Min.	Max.
A: with cucumber or tomato production (1=yes 0=no)	0.35	0	1	0.26	0	1
A: Cucumber or tomato area (mu)	0.61	0	9	0.74	0	15.2
Incentives:						
Distance from county road (km)	2.0	0	7.5	2.7	0	10
Off farm labour share in 2001 (%)	22.2	0	100	23.1	0	100
Farm size and assets:						
Cultivated land in 2001 (mu)	5.2	0	23	7.0	0	18
Per capita asset in 2001 (10,000 yuan)	0.5	0.004	5.1	0.5	0.01	3.0
Farm household head:						
Age (years)	44.1	19	78	43.7	18	72
Education (years)	7.3	0	12	7.7	0	14
Village and policy shifters:						
Village per household cucumber or tomato area $_{t-6}$ (mu)	0.5	0	3.7	0.4	0	7.7
"Vegetable Base" in past 5 years (yes=1; no=0)	0.37	0	1	0.23	0	1
Farmer association (yes=1; no=0)	0.15	0	1	0.27	0	1

Note: all figures were in 2001 and 2006 except for those with year specified.

Appendix Table 4. Description of Major Variables Used in the Models of Determinants of Farmers' Cucumber and Tomato Marketing Channel Choices and Their Impacts on Farmers in 2001 and 2006.

	Cucumber			Tomato		
	Mean.	Min.	Max.	Mean.	Min.	Max.
Brokers (%)	27.0	0	100	26.8	0	100
Wholesalers (%)	71.5	0	100	72.9	0	100
Modern channel (%)	1.5	0	100	0.2	0	90
Net income in 2006 (yuan/mu)	5102	-670	19080	6696	-50	28480
Incentives:						
Distance from county road (km)	1.7	0	7.5	2.6	0	10
Off farm labour share in 2001 (%)	20.8	0	100	11.9	0	100
Farm size and assets:						
Cultivated land in 2001 (mu)	5.3	1	23	7.5	1	18
Per capita asset in 2001 (10,000 yuan)	0.55	0.004	5.10	0.45	0.03	2.66
Farm household head:						
Age (years)	43.0	19	73	42.4	18	69
Education (years)	7.4	0	12	7.3	0	12
Village and policy shifters:						
Village per household cucumber or tomato area $t-6$ (mu)	0.8	0	3.7	0.8	0	7.7
"Vegetable Base" in past 5 years (yes=1; no=0)	0.26	0	1	0.30	0	1
Farmer association (yes=1; no=0)	0.17	0	1	0.18	0	1
IVs:						
Distance from wet market (km)	2.0	0	18	3.8	0	20
Distance from wholesale market (km)	3.6	0	45	9.4	0	50
Years from wholesale market established	12.1	0	56	13.7	0	56
Sale tax in periodic market in past 5 years (yes=1; no=0)	0.70	0	1	0.66	0	1
Regulation on marketing in past 5 years (yes=1; no=0)	0.19	0	1	0.07	0	1

Note: all figures were in 2001 and 2006 except for those with year specified.

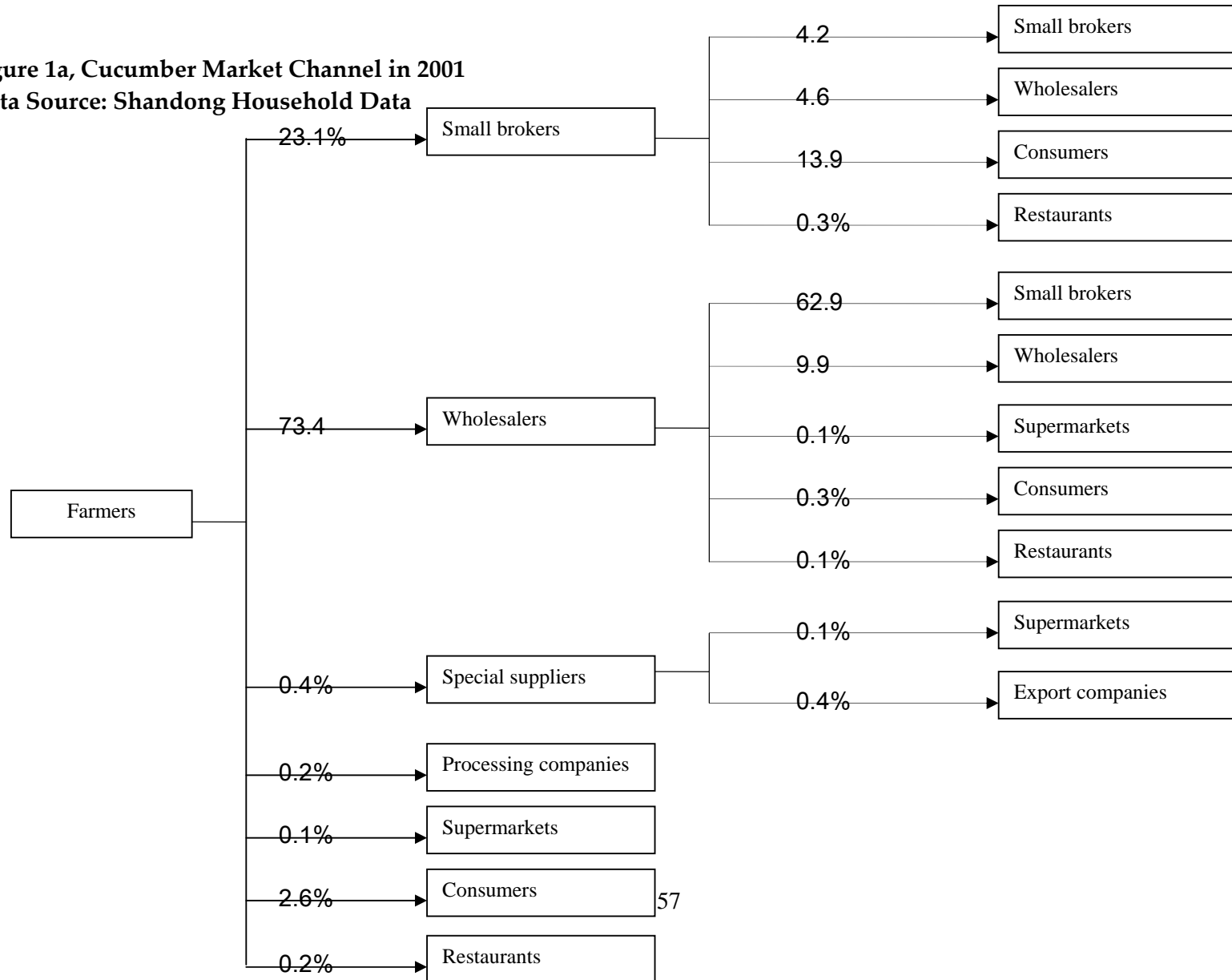**Figure 1a, Cucumber Market Channel in 2001**
Data Source: Shandong Household Data

```
                                                         4.2  ──────►  Small brokers
                                                         4.6  ──────►  Wholesalers
                         23.1% ──►  Small brokers
                                                        13.9  ──────►  Consumers
                                                         0.3% ──────►  Restaurants


                                                        62.9  ──────►  Small brokers
                                                         9.9  ──────►  Wholesalers
                         73.4  ──►  Wholesalers         0.1% ──────►  Supermarkets
                                                         0.3% ──────►  Consumers
    Farmers                                              0.1% ──────►  Restaurants


                                                         0.1% ──────►  Supermarkets
                         0.4%  ──►  Special suppliers
                                                         0.4% ──────►  Export companies

                         0.2%  ──►  Processing companies

                         0.1%  ──►  Supermarkets

                         2.6%  ──►  Consumers          57

                         0.2%  ──►  Restaurants
```

Figure 1b. Cucumber Market Channel in 2006
Data Source: Shandong Household Data

Farmers

- 16.4% → Small brokers
  - 2.2 → Small brokers
  - 5.9 → Wholesalers
  - 0.007% → Processing companies
  - 0.4% → Supermarkets
  - 7.4% → Consumers
  - 0.5% → Restaurants
- 1.0% → Processing companies
- 0.02% → Supermarkets
- 1.8 → Consumers
- 0.1% → Restaurants
- 79.8 → Wholesalers
  - 65.8% → Small brokers
  - 11.9% → Wholesalers
  - 0.004% → Processing companies
  - 1.2% → Supermarkets
  - 0.7% → Consumers
  - 0.2% → Restaurants
- 0.1% → Export companies
- 0.6 → Special suppliers
  - 0.2% → Supermarkets
  - 0.4% → Export companies
- 0.1% → Farmers' associations | 58
  - 0.1% → Supermarkets
  - 0.03% → Export companies

Figure 2a. Tomato Market Channel in 2001
Data Source: Shandong Household Data

Figure 2b. Tomato Market Channel in 2006
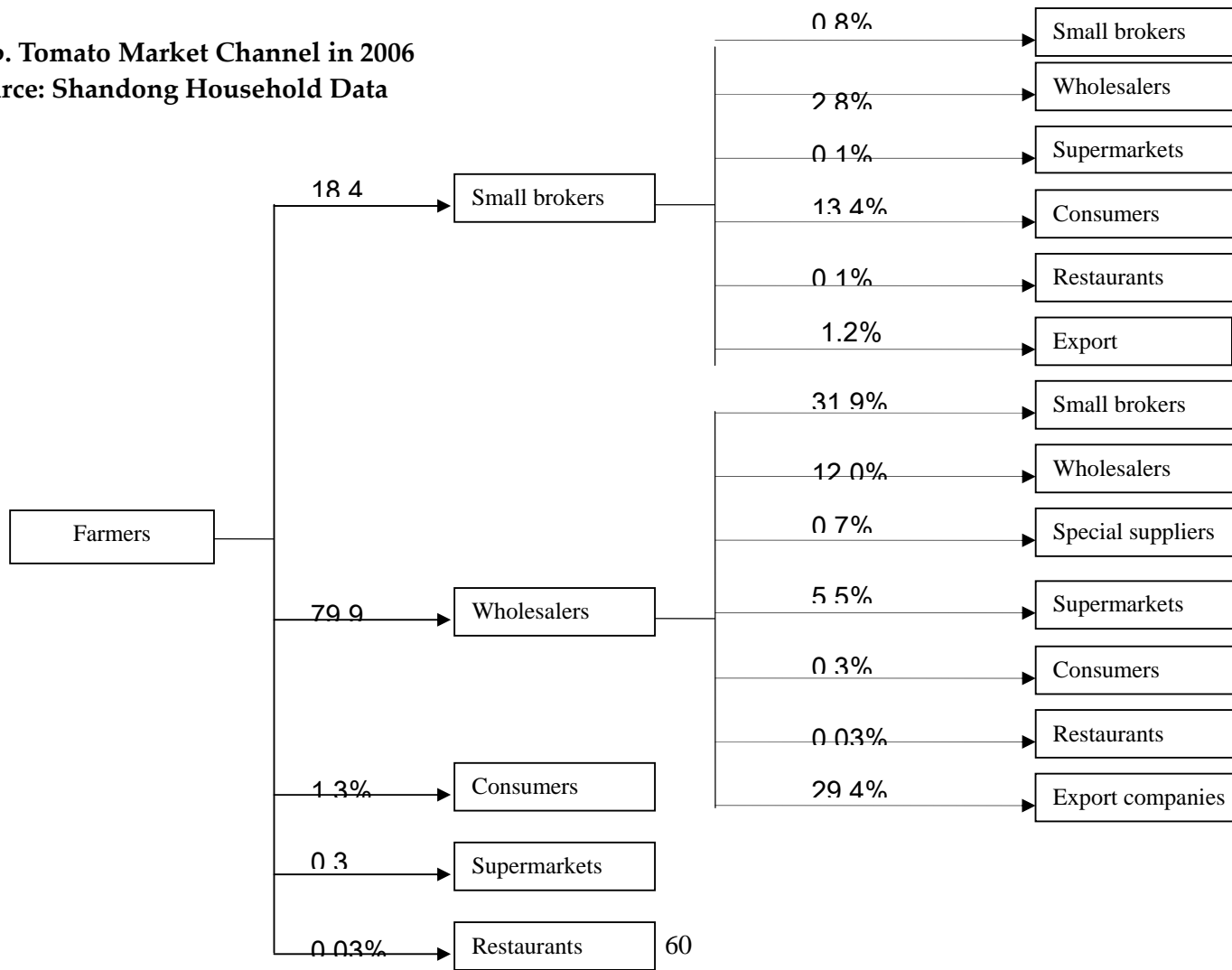**Data Source: Shandong Household Data**

Farmers

- 18.4 → Small brokers
  - 0.8% → Small brokers
  - 2.8% → Wholesalers
  - 0.1% → Supermarkets
  - 13.4% → Consumers
  - 0.1% → Restaurants
  - 1.2% → Export
- 79.9 → Wholesalers
  - 31.9% → Small brokers
  - 12.0% → Wholesalers
  - 0.7% → Special suppliers
  - 5.5% → Supermarkets
  - 0.3% → Consumers
  - 0.03% → Restaurants
  - 29.4% → Export companies
- 1.3% → Consumers
- 0.3 → Supermarkets
- 0.03% → Restaurants

60

Regoverning 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 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.

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