Supermarket Supply Chains with Chinese Characteristics:

The Case of Walmart's Direct Farms

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1. Introduction: The Rise of Supermarkets in China

China's supermarket sector has grown rapidly in the past twenty years, driven by increased incomes, increased urbanization, state investment in food retail, and increased openness to foreign direct investment (FDI). Reardon et al. (2004) describe recent trends: having achieved only minimal presence by the early 1990s, by the mid-2000s supermarkets commanded 30% of the urban food retail market with sales growth of 30 to 40 percent per year. Modern retail growth has been similar to what has been observed in other emerging markets (Reardon et al. 2003; Weatherspoon and Reardon 2003), though the growth in China has been considerably faster. The supermarket sector remains highly fragmented in China, however; the top four companies in sales, Walmart, Carrefour, RT-MART, and China Resources Enterprise together accounted for only 35.9% of total supermarket retail revenue in the Chinese market in 2012 (PRWEB 2012).

As supermarkets have increased their presence in China, their demand for stable supplies of fresh fruits and vegetables meeting private quality and food safety standards has also grown. A challenge for supermarkets has been where and how to source these fresh fruits and vegetables, particularly given retailer concerns about food safety in traditional procurement channels. While the majority of fresh fruits and vegetables are still procured through the wholesale market system (Reardon et al. 2004), supermarkets and other retailers prioritizing product traceability and cost reduction are beginning to establish supply chains designed to circumvent the wholesale market and source closer to the farmgate.

Direct procurement from farmers, though still rare in emerging markets, can offer attractive benefits to companies, farmers, and governments. Companies can secure a

steady, safe supply of food to urban areas. For governments, such programs can boost investment, incomes and employment in the farm sector. For farmers, direct farm programs can offer a high value, market option with characteristics, such as quantity and price stability and the provision of key services such as credit, technical assistance and management skills generally unavailable in spot markets (Kirsten and Sartorius 2002; Michelson et al. 2012), though these relationships likely introduce new production and marketing risks (Naryayanan 2012).

China's agrarian structure, however, presents special challenges to buyers seeking to source directly from farmers. China's scale and recent agrarian history present unique opportunities and challenges for supply chain structuring and consequently small farmer participation in quality-differentiated food markets. The geography and magnitude of potential demand and sourcing is immense while average landholdings in the country remain extraordinarily small and fragmented. The smallholder sector in China is made up of more than 200 million farmers cultivating plots averaging only 0.6 hectares in 2008 (NSBC; Deng et al 2010) and farms have relatively low productive asset stocks, on average close to 700 USD according to Rozelle et al. (2006). With farming dominated by so many small-holder households, the transactions costs of sourcing at the farm-gate are likely to be very high without an intermediate actor or institution such as a lead farmer or farmer cooperative to aggregate and coordinate production and facilitate the transaction. In other countries, Non-Governmental Organizations and farmers' cooperatives have served this purpose. Little is known about the structure of intermediation that is emerging to connect small-holders to supermarkets in China.

The institutional and organizational structure that emerge as retailers seek to establish more direct procurement relationships with farming communities will have important implications for the quality and price of fresh produce available to Chinese consumers as well as the level and stability of income for farm households participating in these emerging value chains. This paper uses recently collected data from 35 "production bases" participating in Walmart's Direct Farm program to describe the Direct Farm procurement chain. We highlight the critical role played by a relatively new set of private market actors in the Chinese rural landscape that we term "supply companies". These supply companies play important roles as providers of logistical services such as transportation and cold-chain storage and, in many cases, are directly responsible for organizing and coordinating farm production. While our analysis is mainly descriptive, it provides, as far as we are aware, a first systematic look at the role of supply companies in the organization of production and land tenure relationships in farming communities participating in retail value chains.

2. Chinese Government Policies Related to Agricultural Value Chains

The Chinese agrarian sector has undergone a period of significant reform in the past three decades. Starting in the late 1970s, the government replaced the centrally-planned commune system with the "Household Responsibility System" (HRS), allocating what had been collectively owned land to households through grants of 15 year land-use rights. The transition from communes to the HRS has been associated with significant increases in agricultural productivity and decreases in rural poverty (Lin 1992).

Since 2000, the central government has initiated a second generation of reform policies designed to promote agricultural development and strengthen agricultural production and marketing among small farmers, at least three of which are relevant to our research: the Dragon-Head Company Program, the Farmer Cooperative program, and the Direct Farm Program.

In 2002, the government began a lending program to promote agricultural industrialization and contracting between large agribusiness and small farmers, the Dragon-Head Companies Program. Under this program, the government granted special status to companies meeting criteria related to size, technology, and potential to improve farm incomes. (Gale and Callender, 2005). Dragon Head companies are granted special tax status as well as access to loans with favorable terms through China's Agricultural Development Bank. Designated Dragon Head firms agree to develop systems that improve farmers' market access, credit access, and technology use (Guo et al. 2007). The Dragon Head program now exists at the provincial and municipal levels and includes more than 60,000 firms (Zhang 2013).

Since the late 1990s, the government has played an active role in forming and strengthening farmer cooperatives through Ministry of Agriculture programs providing services including financial and credit support, tax exempt status, marketing information, cash grants and subsidies, and technical training (Deng 2010). A 2006 law granted formal legal status to registered cooperatives (Sonntag et al, 2005); with formal legal status, cooperatives could sign contracts and act as businesses. According to the Ministry of Agriculture, the number of rural cooperatives reached 180 thousand in 2008 and nearly ten percent of farmers belonged to at least one agricultural cooperative. The period of

most rapid growth has been since 2000 (Deng, 2010). Xia (2011) describes the use of contracts among cooperatives and the relationships between cooperatives and agro-industrial firms.

Finally, at the end of 2008, the Chinese Ministries of Commerce and Agriculture jointly issued an "Announcement to Initiate Direct Farm Pilot Programs" to promote the modernization of the agricultural product supply chain and to facilitate linkages between small farmers and agribusiness. The program announced by the Ministries articulated four primary goals:

- Overcome the challenges of selling fresh agricultural produce;
- Increase farmers' income;
- Reduce transactions costs by eliminating intermediaries between farmers and retailers
- Increase the traceability of fresh produce to better guarantee food safety and quality.

To accomplish these goals, the government program was designed to encourage supermarkets, agricultural wholesalers and agricultural cooperatives to engage in "Direct Farm Program" relationships. For example, supermarkets would purchase fresh agricultural product directly from farmers on farm bases[1], build and use cold chain storage, invest in food safety testing equipment and build distribution centers located in the county or city where the farm base is located.

[1] A farm base or agricultural production base connotes a scale of land with specialization of production, uniformly managed in terms of production and input use spraying. Farm bases usually work with enterprises or cooperatives in vertically integrated production and sourcing relationships.

At the end of 2008, the Ministries of Agriculture and Commerce included nine supermarkets as pioneer enterprises in the pilot Direct Farm program. The government provided support through organizing trade forums and conferences to facilitate communication between supermarkets and farmer cooperatives, motivating local government to finance cold chain storage and distribution centers to increase supermarkets' ability to supply product and providing training classes for supermarket and cooperatives.

In 2009, the Chinese government expanded the Direct Farm pilot by announcing a certification and financial incentive program for Direct Farm programs in 13 provinces and two cities. Individual direct farm programs consisting of a supermarket and agricultural product circulation companies/cooperatives that satisfy specific registered capital, financial investment and partnership requirements could apply for an official "direct farm" certification. Once certified, the program is in theory eligible for a financial incentive of 2 million yuan; 1.5 million yuan for cold chain storage or distribution centers, 300,000 yuan for food safety testing equipment systems, and 200,000 yuan for farm base product brand building program.

An increasing number of supermarkets in China have started direct farm programs, including local supermarkets, national level domestic large supermarkets such as Vanguard, and multinational supermarkets such as Carrefour and Metro. Walmart provides an excellent case study to examine the organizational structure and the contractual arrangements between the supply companies and participating farmers as Walmart was one of nine supermarkets involved in the first round pilot program and uses a model similar to other supermarkets. Currently, products marketed under Walmart's

Direct Farm program include fresh vegetables, fruits, meats, grains and seafood. In the stores (Walmart Stores and Sam's Club) these products are labeled with a Walmart direct farm logo and sold in a special section. As of the end of 2011, Walmart's direct farm program was sourcing products from 81 farm bases in 23 provinces.

3. Data Collection

As part of a broader study on the impacts of Direct Farm programs on rural development, in October through December, 2012, researchers from the Center for Chinese Agricultural Policy (CCAP), the University of California, Davis, and Columbia University conducted interviews with farm leaders, supply company management and local government officials in the locales of 38 out of 44 of the fruit and vegetable production bases participating in Walmart's Direct Farm program in China. These production bases are located in the following 15 provinces: Shandong (6), Liaoning (5), Beijing (4), Guangdong (4), Xinjiang (4)I, Sichuan (3), Yunnan (2), Fujian (2), Jiangxi (2), Shanghai (2), Hunan (1), Hubei (1), Hebei (1), and Jiangsu (1).[2] The interviews were carried out two research teams consisting of one senior research fellow and several graduate students from CCAP.

In each survey PB location, we interviewed a range of people to complete three separate surveys. First, the production base survey was completed by interviewing the manager of the supply company and the production base manager, who was typically the

[2] The number in parentheses is the number of Walmart production bases in the province. Six fruit and vegetable production bases were excluded for because of local coordination issues. The excluded production bases were in Hainan (1), Shanxi (2), Zhejiang (1) and Hubei (1).

head of the local cooperative.[3] The production base survey collects information on the organizational structure of the production base, including land tenure and labor relations, as well as information on cropping portfolios, farming practices, marketing, and contract terms between the supply company and individual farmers. The remaining two surveys were conducted with government officials at the township and county levels. These surveys collected basic socio-economic information about the township and county in which the production base was located as well as information on specific government policies and involvement in Direct Farm programs. To complete these survey forms, we interviewed officials from the local Bureau of Agriculture and, in some cases, also from other administrative offices, such as the Bureau of Commerce, Bureau of Transportation, and Bureau of Livestock.

Completing the interviews typically required 2 full days on-site. County-level government officials were interviewed on the first morning. In order to avoid potential biases related to officials' relationships with specific retailers, no specific mention was made about Wal-mart's Direct Farm program; instead we justified the survey as an effort to understand the dynamics of agricultural product markets. Following the completion of the county-level survey, the research team visited the Walmart production base to interview the production base manager and the manager from the supply company who is responsible for managing production relationships and contracts with the production base. Completion of the production base survey form required, on average, 4 hours. After completing the production base survey, the research team then administered the

[3] In some cases, the supply company manager and the production base manager were the same individual. This occurred when the supply company rented in land and directly controlled production through a wage labor or sub-leasing arrangement.

township-level survey with either the head or deputy head of the township, who is in charge of agricultural development issues in the township.

While conducting the fieldwork, it became immediately apparent that relationships between the supply company and the farmers participating in the production base were heterogeneous and, often-times, complex. As we will discuss in later sections, this complexity and heterogeneity is interesting as it suggests both that the supply companies are playing multiple, complex roles and that these roles are different depending on crop, region and other factors. For now, however, we also note that this complexity created challenges to data collection. As mentioned above, for the production base survey, we often interviewed two people. The first was the leader/representative of the production base. When the production base was comprised of owner-operated farms, this was typically the leader of the village cooperative. When the land had instead been consolidated by the supply company, this was typically a farm manager who had been hired by the supply company to manage and coordinate production. The second person was a manager or representative from the supply company that received the purchase orders from Walmart. Given that some of the supply companies are quite large operations, this individual was often based at the supply company's headquarters. For example, two of the largest supply companies are Golden Mao and Xingyeyuan, which are based in Shenzhen and Dalian respectively.

Determining the true relationship between the supply company and the production base was often difficult as conflicting answers were often initially given by the production base manager and the supply company representative. The complexity of understanding this relationship hinged on two factors. First, the greater is the degree of control of production by the supply company (for example when the supply company

rents in village land and sets up a wage –labor based farm), the less complex was data collection. This is because the supply companies typically maintained centralized and relatively good records that permitted easy responses to questions about production and contracts. In contrast, when the production base is controlled by a large number of owner-operated family farms, the production base leader (cooperative head) typically was less able to provide high quality information about the many different farms. Second, the greater was the number of supply companies to whom the production base supplied fresh produce, the more challenging was the data collection. Once again, since production bases dominated by owner-operated small farms typically engaged in supply relationships for a number of crops and with a number of different supply companies, data collection was most challenging with them.

4. Description of Direct Farms

We begin with a description of the prevalence of Direct Farms (associated with Walmart or any other retailer) in the 34 counties from our survey. Table 1 shows that Direct Farms in the surveyed counties experienced rapid growth since 2007, when a supportive policy to encourage its development was launched jointly by Ministry of Agriculture and Ministry of Commerce of China. In the 34 counties we visited there are 463 townships in total. Of these, 24% had a Direct Farm in 2012, whereas only 4% had a Direct Farm in the initial year of the government's policy. In early years of the program, the prevalence of Direct Farms selling to foreign supermarkets was slightly higher than that of Direct Farms selling primarily to their domestic counterparts. By 2008, however, this changed as domestic supermarkets became relatively more important in sourcing from Direct Farms. By 2012, about 17% of the 463 townships had at least one Direct

Farm selling to domestic supermarkets, which nearly doubles the prevalence of foreign supermarkets procuring from Direct Farms. Interestingly, our survey shows that some Direct Farms were already operating before the policy launched in 2007, suggesting that some supermarkets had already begun sourcing more directly from farming communities before the government introduced their promotional policies.

[TABLE 1 ABOUT HERE]

Table 2 presents the same information as Table 1 for the subset of townships with a Direct Farm selling to Walmart. As these farms are the object of our study, 100% of these townships had a Direct Farm in 2012 (the year of the survey). Not surprisingly, the prevalence of Direct Farms in the surveyed townships is significantly higher than in the full population of townships in the surveyed counties. Also not surprisingly, the prevalence of Direct Farms selling to domestic supermarkets is consistently lower than those selling to foreign supermarkets and that gap increases over time.

[TABLE 2 ABOUT HERE]

Table 3 provides basic information of the size of surveyed Direct Farms. The average area of Direct Farms is about 2,800 mu (or about 187 ha.), but differs between vegetable and fruit farms, with Direct Farms specializing in fruit about thirty percent larger than those specializing in vegetables. Table 3 shows that 16 out of the 20 fruit bases range between 1000 and 3000 mu, while 13 of the 18 vegetable bases are under 2,000 mu.

Table 3 also indicates that, on average, 85% (2386/2809) of total area of the Direct Farms is contracting with the supply company that is contracting with Walmart. This is

not surprising given the Direct Farms were selected because of the existence of Walmart supply company. However, it is interesting to note that, in most of the Direct Farms, the contractual relationship is not exclusive; the Direct Farms typically sell to a range of intermediaries including the Walmart supply company and other supply companies. As we will see shortly, in most cases the Walmart supply company only accounts for a small proportion of the total value of fresh produce purchased from the Direct Farm.

[TABLE 3 ABOUT HERE]

Given China's land tenure system, coordination from village or higher-level government leadership is likely to be important for the establishment of a Direct Farm. As such, we anticipated that it would be quite difficult to establish multi-village Direct Farms. It was somewhat surprising, therefore, to learn that in fact, this is quite common and there is no remarkable difference between fruit and vegetable Direct Farms.

Table 4 presents information about the number and types of crops grown by the surveyed Direct Farms. The most important distinction is that vegetable Direct Farms grow a significantly larger number of crops, just over 16 on average, than fruit-based Direct Farms, which typically specialize in a single fruit.

[TABLE 4 ABOUT HERE]

For production bases which were not own-operated by farmers, we also asked how the SC acquired the land and how farmers participated in the land use[4]. Table 5 shows

[4] As we mentioned earlier, in many cases it is difficult to distinguish farmers cooperatives from WM supply company. According to the Ministry of Agriculture

that among 20 Direct Farms there is only one was rented directly by the SC from individual farmers, while all of the rest of the Direct Farms had to rent in through village leaders or farmers cooperatives[5]. This is not surprising given the fact that land area owned by Chinese individual farmers is usually small, being less than one mu per person in the nation. Directly negotiating and contracting with individual farmers for SC in most cases is practically impossible. Table 5 also indicates that farmer's land had been somehow consolidated prior to WM SC renting it in for establishing the production base. The average area rented by SC is 2,457 mu (or about 164 ha) for wage-labor PB, and 2,195 mu (or about 146 ha). For Direct Farms with a mixed operational model, the land size is quite small, being only 1,324 mu (or 88 ha).

[TABLE 5 ABOUT HERE]

Farmer's participation in Direct Farms differs by operational model. For Direct Farms which are operated in sublease model, that is, the SC rented in land, made some investment (such as greenhouse, irrigation system), and then rented back to individual farmers. It is unnecessary that the farmers to whom the land subleased to have to be those who rented out their land directly or indirectly to the SC. In fact, the SC land often is leased to farmers from outside of the villages where the Direct Farm is located. In Table 6, we see that there are about 15% of households who rented the well-invested land from

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and Ministry of Commerce of China, to establish direct farm, retailers have to directly procure

[5] Land ownership in rural China, according to the HRS, is largely belong to village collective, while individual farmers in the village hold the right of occupancy. So, when we say that SC rents land from village leaders or farmers cooperative, it actually means village leaders or farmer cooperative are coordinating the land acquisition and signing leasing contract with SC on farmers' behavior. This is because in most cases it's often impossible or economically nonsense for SC to directly negotiate and contract with individual farmers for land acquisition.

SC were from other villages in the county, and near 30% are from outside of the county. For wage-labor PBs, even more farmers hired by the PBs were from outside of the county, and near half of them were actually from other provinces.

Three things in Table 6 should be highlighted. First, the number of households for PBs operated by sublease receivers (136 households) and land owners (420 households) indicates the low bound of individual farmers involved. This is because the SC often works with household for business activities (such as contracting, procurement etc) for these two models rather than with individual farmers. So, in many cases it is difficult for the representative of SC or the head of PB to tell the numbers of labors involved in the production[6]. Second, the number of owner-operated households who participated in the WM "DF" is a kind of loosing concept. During the survey, we learned that the SC or their collaborators (such as long-time relationship vender) often procure products from outside of the PB area. This could be either because the products from their PB cannot meet order demand, in both quality and quantity dimensions, or because the SC wants to procure and store more for anti-seasonal benefits, or other reasons. As their management system to separate PB products from outside products is often not as good as their claimed, it is actually difficult or sometime impossible for them to exactly tell the number of owner-operated households. The number (420) reported in table 6 hereby mainly reflects the number of owner-operated farmers who the SC has a relatively stable relationship. It is not surprising for SC to procure products from outside of the PB. Finally, in the survey, we did not ask where owner-operated farmers are from because we presumed 100% are

[6] According to our research agenda, we will have phase two survey in which we will survey individual households in the selected PBs to gain information of individual labor participation. By doing so, we will be able to empirically measure the effects of "DF" on rural labor participation and the welfare achievements to them due to the "DF".

local villagers considering land ownership. However, we did find that many owner-operated lands were indeed not operated by the land owners who hold right of occupancy under the HRS land tenure system. In many cases, these lands were operated by the owner's relatives or the villagers in their village, but there were also some cases in which the land was rented to migrants from outside of the area or some agricultural extension persons by various types of agreements. Major differences from the sublease and wage-labor models are that these lands are still operated by individual family and the land tends to be smaller. This kind of model (we still called it owner-operated) can often be seen in PBs of products which have ordinary value, but it is very uncommon for high value products such as in two grape PBs in Bingchuan, Yuannan, and in the honey-dew or cantaloupe PB in Hamin, Xinjiang.

[TABLE 6 ABOUT HERE]

We now turn to investment and infrastructure across the Direct Farms. There are various infrastructures in the Direct Farms, but investments differ between vegetable and fruit production bases. For all types of infrastructures listed in Table 7, vegetable PBs are more likely to have than fruit PBs do, particularly for greenhouse and worker's dormitory. For example, near 80% of surveyed vegetables bases have greenhouse, which versus 26.3% for fruit bases. Also, the percentage of PBs providing worker housing is also significantly higher for vegetable PBs than for fruit PBs. However, the average investment on cold chain and warehouse is much greater for fruit PBs than vegetables. Relatively shorter harvesting season for fruit than vegetable is probably the primary reason for fruit PBs to invest more on warehouse and cold chain than vegetable PBs.

[TABLE 7 ABOUT HERE]

The infrastructure investment sources vary by crop and infrastructure type. Table 8 compares the identities of who made certain types of investments by fruit versus vegetable based Direct Farms. For greenhouse, over 80% of vegetable PBs received government investment, which doubles the number for fruit PBs. Also, there are 50% of vegetable PBs and 40% of fruit PBs received investment for greenhouse from supply companies. For warehouse, cold chain, and worker accommodation were largely invested by supply companies. This is the same for both vegetable and fruit PBs. Investments on irrigation system on vegetable PBs were mostly from SC or local government, while farmers were still the primary investors for irrigation for fruit PBs.

Table 9 shows the frequencies of various levels of certifications acquired by the Direct Farms. In addition to infrastructures, applying for and holding food safety-related certificates is another key investment as it may determine the price farmers receive and it may be required to participate in various types of markets. For vegetable PBs we visited, there were 41%, 18% and 35% and 60% of them holding green food, organic, and other private certificates, respectively. Table 9 also shows that the cost to get these certificates was mainly covered by the SC who directly or indirectly (but closely) works with the PB. This is especially true for vegetable PBs. This is not surprising as we saw earlier that most of vegetable PB lands were controlled by SC. Apparently, holding occupancy rights of land gives the SC more incentives to apply these certificates. Considering the same reason, we were expecting a very small proportion of fruit PB holding these kinds of

certificates as fruit PBs were mostly owner-operated. Surprisingly, these numbers are even higher in fruit PBs, approximately by 20% for every certificate than vegetable PBs.

5. Discussion

The way by which the value chains for fresh fruit and vegetables develop in China can have important implications for both the price and quality of food available to Chinese consumers but also, and the focus of this paper, for the development of rural communities in China. In particular, the institutional structures that emerge will play an important role in determining whether or not and how small-holder households participate in these value chains and the flow of benefits to these households.

Our initial exploration of Walmart's Direct Farm program provides some initial insights into these questions. We find that, while the Direct Farms program provides a means for produce to arrive on retail shelves without having passed through the traditional wholesale market, the program is far from "direct". Instead, a newly emerging sector of private intermediaries, which we call Supply Companies, plays a critical role in organizing and coordinating production. The degree to which benefits of selling into these value chains ultimately pass through to small-holders is a question that remains open and will be explored in future research.

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Appendix A. Tables

Table 1. Growth of Direct Farms in All Townships in Surveyed Counties: 2006-2012

	Percentage of Counties in Surveyed Townships that Had at Least One Direct Farm in…						
	2006	2007	2008	2009	2010	2011	2012
Any DF	3	4	9	13	19	24	24
DF of Foreign supermarket	2	3	6	6	9	11	11
DF of Domestic supermarket	2	3	6	10	14	17	17

Table 2. Growth of Direct Farms in Townships with Walmart Direct Farm: 2006-2012

	Percentage of Counties in Surveyed Townships that Had at Least One Direct Farm in…						
	2006	2007	2008	2009	2010	2011	2012
Any DF	22	31	47	56	86	100	100
DF of Foreign supermarket	22	31	47	56	86	100	100
DF of Domestic supermarket	11	17	22	25	33	39	39

Table 3. Indicators of Walmart Direct Farm Size

	Vegetable (n=18)	Fruit (n=20)	Total (n=38)
Total Area (mu)	2392	3185	2809
Number of DF in size categories :			
300 -- 1000 mu (#)	7	0	7
1000 –2000 mu (#)	6	8	14
2000 –3000 mu (#)	1	8	9
3000 --5000 mu (#)	2	3	5
5000 -- max mu (#)	2	1	3
Area contracting with WMSC (mu)	2202	2569	2386
Total value sold to supply company			
Mean (million yuan)	66	29	48
Number of DF in value categories:			
0-10 million yuan (#)	7	4	11
10-30 million yuan (#)	3	8	11
30-80 million yuan (#)	5	6	11
80-400 million yuan (#)	3	0	3
Number of Villages per DF:			
1 village (#)	9	8	17
2 villages (#)	3	2	5
3 villages (#)	1	6	7
>3 villages (#)	5	2	7

1) There are two missing values for size contracted with WMSC, total value, and number of village.
2) For PBs that fill in the township but not villages, we assumed that the # of village is equal to the # of township.

Table 4: Direct Farm Crop Portfolios

	Amount
# of Crops per vegetable DF (n=18)	16.6
% of DF with Leafy Green (Short Cycle)	94.4%
% of DF with Leafy Green (Long Cycle)	94.4%
% of DF with Root	50%
% of DF with Legume	50%
% of DF with Nightshade	66.7%
% of DF with Squash	72.2%
# of Crops per fruit DF (n=20)	1.2
% of DF with Tree Fruits	80%
% of DF with Vine/Bush fruits	30%

Table 5. Terms of Land Acquisition by Supply Company

	Wage	Sublease	Both
# of PB	13	2	5
% of PB rent in their land			
From individual hhs	0% (0)	0% (0)	20% (1)
from village leaders	69.2% (9)	100% (2)	20% (1)
from cooperative	23.1% (3)	0% (0)	60% (3)
state owned land	7.7% (1)	0%(0)	0% (0)
% of PB have the following situation prior to renting in land:			
Farmed by families	38.5% (5)	50% (1)	60% (3)
Consolidated land and farmed by another company	38.5% (5)	50% (1)	20% (1)
collective owned land and not farmed	23.1% (3)	0% (0)	0% (0)
private owned land and not farmed	0% (0)	0% (0)	20% (1)
Mean area rented by SC (mu)	2457	2195	1324
Years since first rental			
Min-5	5	1	2
6-10	7	1	2
11-max	1	0	1
Length of land contract (years)			
Min-5	2	1	0
6-10	4	0	0
11-20	3	1	4
20-max	3	0	0

1) There are two missing values for Length of land contract.

Table 6: Terms of Participation of Households on SC Land

	Model Type		
	Sublease (n=23)	Wage (n=7)	Owner (n=18)
Number of households or wage worker	136	106	420
Mean of percentage of households are from the following place: (%)			
the same village as the land	57.1	37.5	≤100
other villages in this county	14.3	30.2	0
other counties in this province	7.1	1.3	0
other provinces	21.4	31	0
Mean area operated by each household (mu)	39.5	12.7	10

1) The number of households for wage worker model is not very accurate. Since number of workers is reported for wage worker model, instead of number of households
2) For mean area operated by each household, 2 missing values for wage labor model and 4 missing values for owner operator model.

Table 7: Capital Investments on Direct Farms

	Vegetables		**Fruit**	
	%DF with the Invest.	Mean Invest. (Thousand Yuan)	%DF with the Invest.	Mean Invest. (Thousand Yuan)
Greenhouse	76.5	8,861	26.3	8,316
Warehouse	55.6	500	45	10,441
Cold Chain	66.7	1,247	52.6	10,083
Worker Housing	44.4	1,760	27.8	1,166
Irrigation	83.3	511	72.2	556
TOTAL INVESTMENT per DF	NA	1,616	NA	11,188

Table 8: Identity of Investor on Direct Farms

	Vegetables			Fruit		
	% DF's in which investments were made by…			% DF's in which investments were made by…		
	Farmers	SC	Gov.	Farmers	SC	Gov.
Greenhouse	40	50	83.3	60	40	40
Warehouse	0	100	20	0	100	20
Cold Chain	0	100	14.3	0	50	0
Worker Housing	16.7	66.7	33.3	0	100	0
Irrigation	18.2	54.5	54.5	66.7	33.3	44.4

Table 9: Investment in Certification by Direct Farms

	Vegetables			Fruit		
	% DF have	Years cert.	% SC paid cert. fee	% DF have	Years cert.	% SC paid cert. fee
Green food	41.2	5.3	83.3	63.2	4.9	55.6
Organic	17.6	1.5	50	31.6	3.7	50
Other Private	35.3	2	100	55.6	3.2	55.6