

# Marketing Channel and Technology Adoption; Chinese Villages in the Local Horticulture Market

L. WANG  
S. ROZELLE  
J. HUANG  
T. REARDON  
X. DONG

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## **Marketing Channel and Technology Adoption: Chinese Villages in the Local Horticulture Market**

### **1. Introduction**

In the 1950s and 1960s, China was known for its focus on grains self-sufficiency – the “iron rice bowl.” At the dawn of economic liberalization, China began a policy focus on agricultural diversification to add horticulture products to the grain foundation, and began the “vegetable basket” program. But it has not been until the 1990s and into the 2000s the domestic horticultural products economy, just like the produce export economy, has really taken off. The horticulture sector has grown with the kind of stunning speed and vitality that reflects these characteristics of Chinese rapid overall development in the past two decades.

There has been, however, relatively little field research aimed at understanding how the domestic horticulture market is changing at the village level, who is sharing in the development, how it is related to technology adoption and modernization of the millions of small farms, and how the market itself might be restructuring. The fact that produce wholesale markets developed from a small base extremely quickly in the late 1980s and 1990s (Ahmadi-Esfahani and Locke 1998) and urban retail markets so quickly restructured in the late 1990s and 2000s (Hu et al. 2004) suggest that domestic horticultural markets in the rural and peri-urban areas might also be restructuring.

This paper focuses on that restructuring, and uses a random sample of 200 villages in the Beijing area to inform the debate. The rural area surrounding (to a 140 km radius) Beijing was chosen as the whole area, including Beijing, contains 15 million permanent residents (6.65 million rural and 8.35 million urban) and 5 million migrants/temporary, with incomes growing rapidly and with the economy in a state of ferment and flux and development, a perfect context in which to study this change. The paper starts with an examination of the data, then the patterns in the data with respect to village participation in the horticulture product markets, and finally an econometric exploration of the relations among subsector choice, market channel choice, and technology choice, to understand the mutual influences of agricultural diversification, market restructuring, and technological modernization.

## **2. Village Data**

The data comprise observations on village characteristics as well as average behavior (as described by village leader respondents) in production and marketing of crops. Two recalls were made, from 2000 and 2004. The sample is 201 villages selected at random from concentric circles (“rings”) drawn, with the center at the steps of the Forbidden City in Beijing, at 40 km, 60, 80, 100, and 140 kms from Beijing. These rings comprise the peri-urban flatlands up through km 100, and then some 20-30 km of hilly and mountainous

area, and then a further 20 -30 kms of flatland into Hebei province. The villages are thus representative of this area . The survey took place in June/July of 2005.

### **3. The Characteristics of the Villages and their Horticulture Market Participation**

Table 1 shows sample village characteristics. There is a clear correlation, as one moves from the inner ring nearest Beijing, to the furthest ring, that there is a modest increase in land per capita (though all still tiny farms), a near tripling of average income, a tripling of the poverty incidence from a quarter/ third to nearly 90% in the hinterland rings, a decline in average education as one moves away from Beijing, but a relative homogeneity given the ring (measured by the income/capita Gini coefficients measured over villages in a ring). Thus within this mere 140 km swath, one finds among the richest and among the poorest rural people in China.

Table 2 shows crop composition across the rings in the two years. In general, there was a remarkable increase in the share of fruits, vegetables, and nuts (FVN) between 2000 and 2004, and a sharp decrease in grain share – showing very rapid agricultural diversification into non -staples. This is predictable from Bennett's Law, where the share of staples in the diet and the economy decreases with increases in incomes, the latter happening quickly over this period, along with improvements in infrastructure and production. Moreover, as von Thunen would predict, there is a rough, but very rough, correlation between fruits and vegetables in the

three inner rings, that are nearer the city markets and mostly flat land, and more nuts in the mountain area, and grains as one goes to the outer rings.

Table 3 shows the distribution of vegetable production across the rings. In just four years, the area jumped an incredible 50%, with fastest growth in the inner three rings. While about a quarter of the villages in each ring have some vegetable production, it is really quite concentrated, with a few villages having the lion's share. The diversity of vegetable crops increased over the mere four years recalled, and is highest as one nears Beijing, explicable by incomes and perishability.

Table 4.1 shows marketing channels across rings. They include: the “**traditional**” or (1) producers directly sell products to consumers ; (2) producers sell products to small brokers in village, then small brokers sell products to other small brokers; (3) producers sell products to brokers out of village (could be periodic markets in the town, or wet markets in cities), then small brokers sell products to other small brokers ; and (7) small brokers buy products from producers, then sell to consumers - and the “**modern**”, (4) small brokers buy products from producers , then sell to wholesalers or professional suppliers or specialized wholesalers; (5) wholesalers or professional suppliers (specialized wholesalers) buy products from producers, then sell to other wholesalers or professional suppliers; (6) any other channel connected to supermarkets.

One can see that the hotbed of modernization of the market channels is concentrated in rings 2 and 3, hence not closest to Beijing (where it is easy for small brokers to access farmers than traditional wholesale markets), with some out in the outer rings. The most common market channel is still the traditional (with some 70% of marketing) but there is a tendency, even in this brief recall span, for market modernization to occur. Moreover, one can posit that a decade or so ago the share of the modern channels was next to nothing, so the restructuring is occurring quickly indeed.

Table 4.2 shows that the market modernization is most advanced, and happening fastest, in fruit and nuts. Vegetables are lagging, but the rough share, 8% of modern channels in total for vegetables, is close to the roughly 10% share of supermarkets in urban retail of vegetables estimated by Hu et al. (2004), so the incipient pattern presents itself. A number of factors will determine how fast any of the FVN categories' market channels are modernized, including the demands for differentiated products and quality, the cost of using the traditional channels, and the speed of restructuring of the urban wholesale and retail sectors. This will be a phenomenon to track over the next decade.

#### **4. Regressions explaining Market Channel Participation and Technology Adoption in the Horticulture Sector**

Table 5 shows the regression models explaining participation in an FVN category (does the village produce fruits? Vegetables? Nuts?), and the determinants of technology innovation/adoption (measured by use of new technologies in production of one of those), and the determinants of market channel. The hypothesis is that modern market channels and technology modernization are correlated.

Table 6 shows the determinants of crop composition across villages. Note that more arable/flat land, more labor (because of labor intensity), more education, and closeness to the urban market drive vegetable production. By contrast, as fruit is grown in hilly areas, there is a negative sign on flat land.

Table 7 shows the results for each crop category of the determinants of use of modern technology and use of modern market channels. Space constraints limit the discussion to several striking points. For vegetables (and also for fruit), the results show strongly that the modern market channel determines the use of modern technology, as hypothesized, because farmers have to employ new techniques to meet the product and transaction requirements of the modern channel. Less land means more technology innovation, as Hayami and Ruttan would predict. Innovation is less further from Beijing, perhaps due to cost of inputs. The results are less clear for the determinants of market channel.

## **5. Conclusions**

There has been a remarkably rapid diversification of agriculture in only a half decade in the Beijing region toward fruits, nuts, and vegetables. At the same time there has been nearly as quick modernization of market channels and production technology. The traditional market channels still dominate, but there has been a substantial increase and spread of modern channels. While the characteristics of this market transformation and boom differ widely across regions or space, there is substantial sharing in the boom by very poor villagers in the hinterland as well as better off villagers in the peri urban areas.

## **References**

- Ahmadi-Esfahani, F.Z. and C.G. Locke. 1998. "Wholesale food markets with 'Chinese characteristics'", *Food Policy*, 23(1): 89-103.
- Hu, D., T. Reardon, S. Rozelle, P. Timmer, H. Wang. 2004. "The Emergence of Supermarkets with Chinese Characteristics: Challenges and Opportunities for China's Agricultural Development," *Development Policy Review*, vol. 22, no. 4, Sept.: 557-86.



**Table 1. Summary statistics for sample villages**

Socioeconomic variables	year	40KM	60KM	80Km	100Km	140Km
Average population	2004	753	885	831	1,596	1,068
	2000	759	893	853	1,573	1,048
Cultivated land per capita(mu) (1 hectare=15mu)	2004	1	1.11	1.06	1.13	1.22
	2000	1.13	1.22	1.19	1.30	1.64
Farmer's annual net income per capita(US \$)	2004	515	441	244	269	199
	2000	385	323	210	191	153
Average ratio of farmers who have high school education in the village	2004	12.6%	8.6%	7.4%	7.3%	7.2%
	2000	9.7%	6.8%	6.7%	5.7%	6.3%
Daily cost for hiring a man to do farming in the village(US \$)	2004	2.8	3.0	2.6	2.9	3.0
	2000	2.0	2.4	1.8	2.2	2.2
Gini coefficient	2004	0.23	0.27	0.34	0.26	0.27
	2000	0.25	0.27	0.29	0.31	0.3
Share of poor villages <sup>1</sup>	2004	38%	55%	83%	76%	98%
	2000	60%	72%	100%	92%	100%
Share of villager in which villager's income level less than national average level <sup>2</sup>	2004	23%	48%	75%	71%	93%
	2000	32%	45%	85%	70%	90%
Average Distance from the village to the nearest county road(KM)	2004	3	5	6	11	6
	2000	3	5	6	12	6

Note1: the criterion of poor is world bank's 1 dollar a day.

Note 2: in 2004, the national farmer's net income per capita was 2,265 RMB. In 2000, the number was 2,252RMB.

**Table 2. C crops composition across rings**

	Total		40Km		60Km		80Km		100Km		140Km	
	2004	2000	2004	2000	2004	2000	2004	2000	2004	2000	2004	2000
Grains	58%	69%	55%	65%	52%	66%	54%	56%	73%	79%	52%	70%
cash crops	12%	7%	13%	9%	8%	5%	6%	5%	10%	6%	23%	11%
Vegetables	5%	3%	8%	7%	10%	5%	4%	3%	4%	2%	3%	2%
Fruits	14%	13%	20%	17%	9%	7%	19%	20%	11%	10%	19%	14%
farm nuts	6%	4%	3%	2%	18%	13%	5%	4%	1%	1%	3%	1%
gathered nuts	4%	4%	0%	0%	2%	2%	11%	12%	2%	2%	1%	2%
Others	1%	1%	0%	0%	1%	2%	0%	0%	0%	1%	0%	0%
total area (10,000mu)	38.6	41.1	5.0	5.3	8.2	7.6	6.4	7.2	10.9	11.9	8.2	9.1

Note: 1 hect are=15mu

**Table 3: Distribution of vegetable production across rings**

	All rings		40KM		60Km		80Km		100Km		140Km	
	2004	2000	2004	2000	2004	2000	2004	2000	2004	2000	2004	2000
Percentage of villages in which farmers grow vegetables	26%	25%	28%	33%	35%	33%	25%	25%	23%	23%	20%	15%
percentage of the biggest three villages to total village in the ring	76%	76%	56%	57%	80%	80%	63%	69%	93%	89%	88%	85%
Total vegetables area(1,000mu)	21	14	4.0	3.5	8.0	3.5	2.8	2.3	3.9	2.9	2.2	1.7
Concentration index	0.23	0.26	0.14	0.15	0.21	0.32	0.17	0.21	0.38	0.32	0.26	0.28
Simpson's diversity index	0.45	0.37	0.65	0.48	0.12	0.13	0.44	0.37	0.58	0.48	0.45	0.39

Note: Simpson's diversity index is calculate d by this way:  $D = \frac{\sum[n(n-1)]}{[N(N-1)]}$

n is the area of a particular vegetable in a village, N is total area of all vegetables in the village.

Simpson's index=1 -D

**table 4-1: different marketing channels across rings**

	channel Type1	channel Type2	Channel Type3	channel Type4	channel Type5	channel Type6	channel Type7	channel Type8	Total number of channels
40Km	19%	18%	22%	10%	0%	2%	26%	4%	112
60Km	25%	17%	8%	18%	5%	5%	10%	13%	103
80Km	9%	45%	4%	22%	0%	0%	18%	2%	108
100Km	11%	26%	12%	19%	6%	2%	20%	4%	100
140KM	21%	18%	18%	21%	3%	1%	15%	3%	72

**Table 4-2: Different marketing channels to different products**

	channel Type1	channel Type2	Channel Type3	channel Type4	channel Type5	channel Type6	channel Type7	channel Type8	Total number of channels
Vegetables	13%	35%	16%	2%	3%	3%	21%	7%	110
Fruits	22%	18%	15%	16%	2%	1%	22%	4%	284
Farm nuts	10%	34%	1%	32%	4%	4%	5%	10%	73
gathered nuts	0%	32%	4%	61%	4%	0%	0%	0%	28
Total	17%	25%	13%	18%	3%	2%	18%	5%	495

Note: Channel type1: producers directly sell products to consumers.

Channel type2: producers sell products to small brokers in village, then small brokers sell products to other small brokers.

Channel type3: producers sell products to brokers out of village (could be periodic markets in the town, or wet markets in cities), then small brokers sell products to other small brokers.

Channel type4: small brokers buy products from producers, then sell to wholesalers or professional suppliers.

Channel type5: wholesalers or professional suppliers buy products from producers, then sell to other wholesalers or professional suppliers.

Channel type6: any channel connected to supermarkets.

Channel type7: small brokers buy products from producers, then sell to consumers.

Channel type8: other channels

**Table 5**

Description of explanatory variables in both regression models

Variables	Measurement	Description
Per capita cultivated land	Mu/person (mu=1/15 ha)	Area of per capita cultivated land in the village
Labors	Persons	Number of total labors (the person aged between 16-60) in the village
Percent of educated labors	%	Percent of labors with high-school or higher education levels in the village
No. of off-farm labors	Persons	Number of labors who do off-farm jobs outside the village for at least three months per year
Percent of off-farm labors	%	Percent of labors who do off-farm jobs outside the village for at least three months per year
Labor price	RMB/day	Daily wage of hiring a labor in the village
Distance to Beijing	Kilometers	40, 60, 80, 100, or 140 kilometers
Distance to county	Kilometers	Distance from the village administration office to the county government location
Distance to all-year road	Kilometers	Distance from the village administration office to the county-level standard road
Rural periodic market	Dummy (0 or 1)	Whether majority of villagers go to rural periodic market: 1 is yes, 0 is no
Well depth	Meters	Average depth of wells in the village (depth from the ground to the water surface)
No. of agricultural brokers	Persons	Number of agricultural brokers in the village
No. of private businesses	Households	Number of households that own small private business with less than 7 employees (such as taxi driver, or small shops in the village, not including agricultural brokers)
New processing factory	Factories	Number of newly established agricultural processing factories in the past five years in the village
New county road project	Dummy (0 or 1)	Whether the new county-level road was built in the village in the past five years: 1 is yes, 0 is no.
New irrigation project	Dummy (0 or 1)	Whether the new irrigation project (with more than 10,000 RMB investment) was implemented in the village in the past five years: 1 is yes, 0 is no.
Number of Vehicles	Vehicles	Number of transportation vehicles (including trucks, tractors and agricultural pickups) in the village
Number of Managers	Dummy (0 or 1)	Whether someone the people of the village does management jobs in agricultural processing factories, supermarket or export-oriented factories: 1 is yes, 0 is no.
Cell phone signal availability	Dummy (0 or 1)	Whether cell phone signal is available in the village

Note: data is 2004 data if no specific denotations.

**Table 6**  
**Crop composition determinants**

	Dependent variable : ratio of crops			
	Vegetable	Fruits	Farm nuts	Grain
Per capita cultivated land	0.382 (0.14)***	-0.088 (0.12)*	-0.485 (0.25)**	0.489 (0.29)*
Number of laborers	0.005 (0.003)*	-0.00002 (0.0002)	-0.002 (0.001)**	0.0002 (0.0004)
The average depth of wells	-0.002 (0.003)	0.002 (0.002)	-0.016 (0.01)*	0.007 (0.003)***
Percent of educated labors	2.945 (1.81)*	-0.745 (1.53)	0.939 (1.62)	-6.325 (2.15)***
Distant to Beijing	-0.007 (0.004)*	-0.004 (0.003)	-0.001 (0.004)	0.0004 (0.004)
Distant to the town	-0.0004 (0.002)	-0.003 (0.002)	0.001 (0.002)	0.001 (0.001)
Cell phone signal availability	-0.072 (0.60)	-0.231 (0.48)	-0.279 (0.43)	0.544 (0.61)
New county road project	-0.303 (0.33)	-0.024 (0.27)	0.223 (0.29)	0.606 (0.48)
Rural periodic market	0.584 (0.35)*	-0.575 (0.31)*	-0.351 (0.31)	0.451 (0.38)
New irrigation project	-0.146 (0.26)	-0.465 (0.24)*	-0.015 (0.29)	0.774 (0.31)**
No. of off-farm labors	0.0004 (0.0005)	-0.001 (0.01)	0.001 (0.002)	0.003 (0.002)
No. of agricultural brokers	-0.008 (0.004)*	-0.001 (0.002)	0.0003 (0.003)	-0.007 (0.002)***
Constant	-0.778 (0.88)	1.940 (0.82)**	0.47 (0.77)	-1.080 (0.99)
Log likelihood	-102.96	-127.89	-62.51	-28.15
Observations	198	198	198	198

Note: Standard errors in parentheses.

\* Significant at 10%.

\*\* Significant at 5%.

\*\*\* Significant at 1%.

**Table 7**  
**Estimation of simultaneous technology and market channel equations**

Vegetable			Fruit		
	Technology index	Market channel index		Technology index	Market channel index
Technology index		-0.151 (0.38)	Technology index		0.027 (0.21)
Market channel index	2.152 (1.18)*		Market channel index	1.113 (0.64)*	
Per capita cultivated land	-0.557 (0.27)**	0.275 (0.16)**	Per capita cultivated land	0.084 (0.25)	0.049 (0.12)
Percent of educated labors	0.807 (2.24)	-1.561 (0.56)***	Percent of educated labors	1.997 (2.21)	-0.661 (0.97)
Labor price	0.071 (0.06)	0.008 (0.03)	Number of labors	-0.0004 (0.001)	0.00002 (0.001)
Distance to Beijing	-0.020 (0.01)**	0.005 (0.01)	Distance to Beijing	-0.011 (0.01)	0.001 (0.002)
Distance to county	0.002 (0.003)	0.0005 (0.002)	Distance to county	-0.013 (0.01)*	0.006 (0.003)*
Distance to all-year road	-0.019 (0.06)	-0.059 (0.04)	Distance to all-year road	-0.001 (0.01)	
Rural periodic market	0.856 (0.60)	0.012 (0.24)	Rural Periodic market	-0.038 (0.57)	-0.113 (0.19)
Well depth	-0.007 (0.01)		Well depth	0.004 (0.003)*	
No. of private businesses		-0.001 (0.01)	No. of private businesses		-0.0008 (0.0004)*
No. of agricultural brokers		0.030 (0.03)	No. of agricultural brokers		0.005 (0.002)**
Percent of off-farm labors		1.669 (0.81)**	Percent of off-farm labors		0.249 (0.48)
New processing factories		0.142 (0.23)	Number of Vehicles		-0.001 (0.0008)*
New county road project		0.056 (0.24)	Number of Managers		0.568 (0.16)***
New irrigation project		0.020 (0.17)			
Inverse Mills ratio	0.465 (0.58)	0.103 (0.29)	Inverse Mills ratio	1.494 (2.53)	-0.720 (0.86)
Constant	-0.384 (2.11)	-0.085 (0.91)	Constant	1.017 (0.69)	0.238 (0.81)
Observations	46	51	Observations	100	100
$R^2$	0.13	0.13	$R^2$	0.13	0.28
$F$ -test value	1.66	2.39	$F$ -test value	3.02	6.13

Note: Standard errors in parentheses.

\* Significant at 10%.

\*\* Significant at 5%.

\*\*\* Significant at 1%.

