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**The Marketization of Rural China:
Gain or Pain for China's 200 Million Farm Families**

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Although the initial reforms in China and other successful transition nations centered on improvements to property rights and transforming incentives (McMillan, Whalley and Zhu, 1989; Fan, 1991; Lin, 1992), the other, equally important task of reformers was to create more efficient institutions of exchange (McMillan, 1997). Markets—whether classic competitive ones or some workable substitute—increase efficiency by facilitating transactions among agents to allow specialization and trade and by providing information through a pricing mechanism to producers and consumers about the relative scarcity of resources. But markets, in order to function efficiently, require supporting institutions to ensure competition, define and enforce contracts, ensure access to credit and finance and provide information (McMillan, 1997). These institutions were either absent in the Communist countries or, if they existed, were inappropriate for a market system. In assessing the determinants of success and failure of 24 transitions during their first decade of reform, Rozelle and Swinnen (2004) demonstrate that improved institutions of exchange were absolutely essential for nations to make progress. Continued success of all transition nations, including China, during the second decade of reform and beyond almost certainly also will depend on continued market development.

Somewhat surprisingly, despite the importance of market performance in the reform process there is relatively little empirical work on the success that China (or any other transition nation) has had in building markets. In China the assessments of market performance that have been conducted have been mixed. On the one hand, China has frequently been praised for promoting market competition among the state-owned,

collective, and private sectors (Qian and Xu, 1998). Authors also have described an explosion in exchange activity in China's rural sector (Sicular, 1995). DeBrauw et al. (2004) have shown the positive effect that market development had on the efficiency of China's agricultural producers and their welfare during the 1980s and early 1990s.

On the other hand, a recent paper by Young (2000) argues that changing patterns of provincial economic structure suggest that China's markets were becoming less rather than more integrated during much of the reform period, which he attributes to internal trade barriers. Poncet, Wan and Lin (1998), Cai and Li (1997) suggests that this is also true in agriculture—though both the Young and others were working with data from before the mid-1990s. Others studying trade in agricultural commodities using traditional measures of price co-movement have raised different concerns (e.g., Hu, 1999). In their view markets have developed but the institutional structures of China lead to benefits for the rich and leave out the poor. In the Chinese literature marketization is not always thought to be a good thing as the fortunes of farmers are subject to the forces of supply and demand.

In this paper we try to make sense of this confusing literature—one that until recently has been mostly addressed by anecdotal studies and not supported by rigorous empirical work that looks at market activities of a broad range of commodities. In briefest terms we have two broad objectives. First, drawing on a large number of our studies of different commodities—including research efforts on grain, oilseeds, fruits, vegetables and fertilizer, we seek to understand how markets have developed in terms of integration, efficiency and competition. The main question to answer in this section is: What is the Nature of China's Agricultural Markets? Second, we also attempt to assess how the

expansion of markets as helped or hurt the rural economy, looking at a wide spectrum of indicators, including the efficiency of the sector and the incomes of farmers. We also will consider a number of the distributive consequences of China's marketization and seek to discover if markets have been pro-poor or not. The overall goal is to understand if the emergence of markets is a positive force that will reinforce China's drive for development or does their emergence represent the appearance of an institutional form that is floundering and could be a source of tension in the coming years.

Anticipating our results, we find that China's agricultural markets—unlike the assertion of some writers—have begun to integrate, improve in efficiency and become more competitive. Whether out of benign neglect or on the basis of a pro-market economic strategy, in today's rural China, there are few regulations and entry by sellers and buyers into the market—at every segment of the marketing chain—is relatively easy. If our findings are correct, then it means that China has almost made the complete transition—at least in agriculture—from a Socialist economy with no markets to one in which markets rival those as some of the most unfettered in the world. And while markets do expose farmers to increasing amount of price variability, there have been positive effects. Our paper documents that the emergence of markets has been accompanied by rising productivity; rising specialization; and rising incomes associated with moving into new specialty crops.

Because the overall goal of our paper is so ambitious, we need to limit its scope. Although agriculture is a good sector to focus on in any study of integration and market efficiency given its relative simple nature and the homogeneity of some of the crops (e.g., maize and soybeans), it still represents only a small part of China's economy. In 2005,

less than 15 percent of GDP was from the agricultural sector and less than 50 percent of employment (CNSB, 2006). In addition, although data availability allows us to examine agricultural markets for some commodities at the national level, for other commodities we were only able to look at regional markets because we had to use our own survey data. Therefore, it is possible that our choice of regions do not represent all of China. We also do not look at international markets – though, in fact, many of the conclusions for domestic markets in this paper are also mostly true for international markets.

Liberalization and Retrenchment: 25 Years of Stop and Go Marketing Policies

In addition to property rights reform and transforming incentives, the other major task of reformers is to create more efficient institutions of exchange. Markets—whether classic competitive ones or some workable substitute—increase efficiency by facilitating transactions among agents to allow specialization and trade and by providing information through a pricing mechanism to producers and consumers about the relative scarcity of resources. But markets, in order to function efficiently, require supporting institutions to ensure competition, define and enforce property rights and contracts, ensure access to credit and finance and provide information (McMillan, 1997). These institutions were either absent in almost all Communist countries or, if they existed, were inappropriate for a market system. In China, as in most countries with central planning agencies that directed production and other economic transactions, directives from planners served to enforce contracts involving exchanges among various agents in the chain. Market liberalization, however, requires the elimination of central planning, but to do so successfully liberalization requires that the process to be executed in a way that will

allow producers to continue to have access to inputs and marketing channels while the necessary market-supporting institutions are emerging.

In this section, we examine the policy path that China has taken in its effort to liberalize markets. The most prominent characteristic of China's market liberalization policies is that gradual way in which they have unfolded. Because these policies have been documented elsewhere in detail (e.g., Sicular, 1988; 1995; deBrauw et al., 2004), we only briefly touch some of most important policy shifts. In the rest of the paper, our goal is to see if China has been successful in creating markets that are competitive, efficient and equitable.

In contrast to transitioning countries in Central and Eastern Europe, leaders in China did not dismantle the planned economy in the initial stages of reform in favor of liberalized markets (Swinnen and Rozelle, 2004). Sicular (1988; 1995), Perkins (1994) and Lin (1992) all discuss how China's leadership had little intention of letting the market play anything but a minor supplemental guidance role in the early reforms period in the early 1980s. In fact, the major changes to agricultural commerce in the early 1980s almost exclusively centered on increasing the purchase prices of crops (Sicular, 1988; Watson, 1994). The decision to raise prices, however, should *not* be considered as a move to liberalize markets since planners in the Ministry of Commerce made the changes administratively and the price changes mostly were executed by the national network of grain procurement stations acting under direction of the State Grain Bureau.

An examination of policies and the extent of marketing activity in the early 1980s illustrate the limited extent of changes in the marketing environment of China's food economy before 1985. It is true that reformers did allow farmers to have increased

discretion to produce and market crops in 10 planning categories, such as vegetables, fruits and coarse grains. Moreover, by 1984, the state only claimed control over 12 commodities, including rice, wheat, maize, soybeans, peanuts, rapeseed, and several other cash crops (Sicular, 1988). However, while this may seem to represent a significant move towards liberalization, the crops that remained almost entirely under the planning authority of the government still accounted for more than 90 percent of sown area in 1984. Hence, by state policy and practice, the output and marketing of almost all sown area was still directly influenced by China's planners.

Reforms proceeded with equal caution when reducing restrictions on free market trade. The decision to permit the reestablishment of free markets came in 1979, but only initially allowed farmers to trade vegetables and a limited number of other crops and livestock products within the boundaries of their own county. Reformers did gradually reduce restrictions. Skinner (1984) describes that the predominant marketing venue during the early 1980s was mainly local rural periodic markets. Farmers also did begin to sell their produce in urban settings, but free markets in the cities only began to appear in 1982 and 1983. In addition to being small and infrequent, traders could not engage in the marketing of China's monopolized commodities that were still under strict control of the state procurement stations.

The record of the expansion of rural and urban markets confirms the hypothesis that market liberalization had not yet begun by the mid 1980s. Although agricultural commodity markets were allowed to emerge during the early years of reform, their number and size made them a small player in China's food economy. In 1984, the state procurement network still purchased more than 95 percent of marketed grain and more

than 99 percent of the marketed cotton (Sicular, 1995). In all of China's urban areas, there were only 2000 markets in 1980, a number that rose only to 6000 by 1984 (deBrauw et al., 2004). In Beijing in the early 1980s, there were only about 50 markets transacting around 1 million yuan of commerce per market per year. Each market site would have had to serve, on average, about 200,000 Beijing residents, each transacting only 5 yuan of business for the entire year. In other words, it would have been impossible for such a weak marketing infrastructure at that time to even come close to meeting the food needs of urban consumers.

After 1985, however, market liberalization began in earnest. Changes to the procurement system, further reductions in restrictions to trading of commodities, moves to commercialize the state grain trading system, and calls for the expansion of market construction in rural and urban areas led to a surge in market-oriented activity (Sicular, 1995). For example, in 1980 there were only 241,000 private and semi-private trading enterprises registered with the State Markets Bureau; by 1990, there were more than 5.2 million (deBrauw et al., 2004). Between 1980 and 1990, the per capita volume of transactions of commerce in Beijing urban food markets rose almost 200 times. Private traders handled more than 30 percent of China's grain by 1990, and more than half of the rest was bought and sold by commercialized state grain trading companies, many of which had begun to behave as private traders (Rozelle et al., 2000). China moved equally slow in its liberalization of input markets (Stone, 1988; Ye and Rozelle, 1994).

Even after the start of liberalization in both output and input markets in the mid-to late 1980s, the process was still partial and executed in a start and stop manner (Sicular, 1995). For example, in the case of fertilizer, Ye and Rozelle (1994) show that after an

early attempt at market liberalization in 1986 and 1987, perceived instability in the rural economy in 1988 led to sharp retrenchments. Agricultural officials only took controls back off fertilizer marketing and began encouraging private trade in the early 1990s. Lin, Cai, and Li (1996) argue that leaders were mainly afraid of the disruption that would occur if the institutions through which leaders controlled the main goods in the food economy (such as fodder, grain, and fertilizer) were eliminated without the institutions in place to support more efficient market exchange.

As the right to private trading was extended to include surplus output of all categories of agricultural products after contractual obligations to the state were fulfilled, the foundations of the state marketing system began to be undermined (Sicular, 1995). During the late 1980s the second stage of price and market reforms gradually began to limit the scope of government price and market interventions and enlarge the role of market allocation. By the early 1990s, other than for rice, wheat, maize and cotton, reformers gradually began to eliminate planned procurement; government commercial departments still existed, but they could only continue to buy and sell at the market. For grain, incentives were introduced through the reduction of the quota volume and increase in procurement prices. In subsequent years, although mandatory procurement of rice, wheat, maize, soybean, oil crops and cotton continued, to provide incentives for farmers to raise productivity and to encourage sales to the government, quota procurement prices were raised over time (Huang et al., 2004).

True to the spirit of gradualism, as grain production and prices stabilized in the early 1990s, plans to abolish the grain ration system led a new round of reform (Rozelle et al., 2000). Urban officials discontinued sales at ration prices to consumers in early

1993. Although the state compulsory quota system was not eliminated, in most parts of China in the mid-1990s, leaders once again lowered procurement level. The share of grain compulsory quota procurement in total production was kept at only 11 percent in the mid 1990s. Local government grain bureaus and stations were encouraged to trade on their own accounts as way to increase the marketing of agricultural commodities and increase the incomes of grain bureau officials (Park and Rozelle, 1998).

However, the start and stop process was still not over. As food prices rose in the mid-1990s, another round of retrenchment-oriented policies were announced. For example, the “Rice Bag” responsibility system sought to replicate the policies of the late 1980s and early 1990s and once again restrict grain flows among provinces and attenuate market activity in order to force local officials to raise the level of self sufficiency of food production of their districts (Nyberg and Rozelle, 1999). Zhu Rongji pushed the policies further in the late 1990s when he issued an edict strictly limiting the free trade of agricultural products. Grain bureaus were directed to remonopolize grain trade and collect and store vast amounts of grain to insure the nation’s supply of food as the rest of the economy was in the midst of a 10 percent per year growth.

The policies in the late 1990s, however, in no trivial way did not work in the same way as they had done in the 1980s (Park et al., 2002). At the local level private traders emerged as an economic force that was difficult, even with considerable policing effort, to suppress. In fact, it was documented that a great number of efforts to restrict the flow of grain were not successful. Market flows continued as the share of total government procurement in domestic production fell; trade was driven by the profits that traders could earn by shipping grain from low to high priced areas (Huang et al., 2004).

Personnel in the grain bureaus that had been partially privatized in the early period were among the most avid traders. The grain bureaus that did follow government edicts amassed enormous stocks of grain and the debt of the grain bureaus themselves and of their local government counterparts rose to astronomical levels.

In the early 2000s, marketing reforms were once more allowed to proceed—although initially with little public encouragement (Huang et al., 2004). Restrictions on marketing were removed. New efforts to commercialize the grain bureau were begun. Government intervention in grain prices (that had been given to farmers in certain regions of the country) was eliminated. In short, a new effort was made to push the policy environment to be even more market-oriented and encourage farmers to begin a period of structural adjustment (*jiegou tiaozheng*).

It was not until the switch of the new government of Hu and Wen in 2002, however, that Zhu's policies were reversed and another round of market liberalization policies were officially sanctioned (Rozelle et al., forthcoming). During this period, officials pushed a new set of structural adjustment policies exhorting producers to shift their output into crops in which they had a comparative advantage. Private trade was legalized. Grain bureau reform was implemented with unprecedented aggressiveness and finally in 2003 and 2004 they were shut down completely. The size of the grain storage system was reduced dramatically. The goal of the government finally explicitly was to make the agricultural economy fully market driven.

In summary, then, China's agricultural marketing policy has been on a roller coaster path. Since the early 1980s, leaders have liberalized, retrenched and reliberalized and re-retrenched. There has been at least three cycles. Finally, however, while it took

more than 20 years to achieve, gradually China's policy environment became one that condoned the market and sought to influence production primarily through the signal generated by market prices.¹ What is unclear, however, is how effective the policies were in creating a functional market system—one that was relative integrated, efficient and competitive. Unsurprisingly, during this time there has been a debate about whether or not markets have in fact emerged. It is to this question that we turn to in the rest of the paper.

Data

To assess the nature of China's markets in the last 10 years, we use data from a number of different sources. First, we use a set of price data collected by China's State Market Administration Bureau (SMAB—*dataset 1*). Nearly 50 sample sites from 15 of China's provinces report prices of agricultural commodities every 10 days. This means there are 36 price observations available for each market site for each commodity each year. The prices are the average price of transactions that day in the local rural periodic market. The Ministry of Agriculture assembles the data in Beijing and makes them available to researchers and policy makers. Unfortunately, after 2000, the quality of the data has deteriorated.

Using the SMAB data, we can examine rice, maize and soybean prices from the early 1990s to 2000 (except for maize that was only available through 1998). The three crops are produced and consumed in nearly every province in China. Rice price data are available for 31 markets. Because of quality differences among rice varieties in different regions of China, we look at price integration among markets within four regions, South

China (South), the Yangtze Valley (YV), the North China Plain (and Northwest China--NCP) and Northeast China (NE). For the provinces included in the sample, rice prices are available for over 90 percent of the time periods. Prices for maize and soybean data are available for 13 and 20 markets, respectively.² Product homogeneity in the case of maize and soybeans makes it possible to examine price integration among markets across a broader geographic range. We compare our results for the late 1990s (1996 to 2000) to results from 1988 to 1995 that were produced with the same data and published in Park et al. (2002).³

The second source of data on China's domestic market (*dataset 2*) comes from a price data set collected by the Jilin Province Grain and Oil Information Center (GOIC). For maize, we use data on prices that are reported on a weekly basis between August 10, 1998 and February 24, 2003 for 15 of China's main maize production and consumption provinces, including Heilongjiang, Jilin, Liaoning, Hebei, Shandong, Jiangsu, Zhejiang, Shanghai, Hubei, Sichuan, Hunan, Fujian, Guangdong, and Guangxi.

To examine maize markets in the northeast regions of the country and between major producing and consuming regions of the country in the post- WTO accession period, we use another set of data collected by the Jilin Province GOIC (*dataset 3*). The data in this dataset were first available after October 26, 2001; they continue through February 25, 2003. This dataset is more detailed than data in dataset 2 for two reasons. First, it is more spatially disaggregate. The dataset includes prices from three markets in Heilongjiang; three markets from Jilin; three markets from Liaoning (including two in production regions and Dalian); and market sites in Guangdong, Fujian, Jiangsu and

Hubei. Dataset 3 also reports data more frequently, typically twice a week (every third day, then every fourth day).

The soybean data come from the same source, the Jilin Provincial GOIC, but are collected a bit differently (*dataset 4*). Soybean data are only available on a monthly basis. There are data for 20 markets. Similar to the maize data in datasets 2 and 3, the soybean data series are complete and overall the quality of the data appears to be high.

Although we do not have consistent price data over time for fruit and vegetable production, we have collected two datasets on horticultural production in the Greater Beijing Area and in Shandong province. The data sets were both collected using a stratified randomized approach that were able to be used to get regional representative pictures of horticultural production and marketing in two of northern China's most important producing areas. See Wang et al. (2007) and Huang et al. (2007) for detailed descriptions of the data. During the same survey efforts, data were collected on horticultural traders and wholesalers.

Price Trends and Spatial Patterns of Market Emergence

In this section, we use our price data to sketch a picture of China's agricultural markets. We divide our analysis into two parts. The first part looks at the rise in the integration and efficiency of markets. The second examines the competitiveness of markets in the late 1990s and 2000s. In the following section we examine whether or not the rise of these markets have benefited producers—especially those in poor households.

To look at whether markets are becoming integrated/efficient or not, we first plot the data over time and examine how prices move together in markets in the same

geographic region and in markets separated by long distances. Next, we examine how price data points from different markets across space (but during the same time period) relate to one another graphically (which is done by tracing out *transportation gradients* in China's rice, maize and soybean markets). To put the results in perspective, we examine these over time and compare transportation gradients in China's markets with those in markets in the US. Our assumption is that if prices in markets in different parts of China move together and if they create spatial patterns similar to those found in more market-oriented economies (like the US), our data are suggesting that China's markets are becoming increasingly integrated and efficient.

Examining Integration: Through Price Trends

Maize. Using dataset 3, it can be shown that prices in different markets closely track one another in Northeast China (Figure 1). In the figure we plot the Dalian domestic price versus the prices in the two Heilongjiang market sites (chosen because they are the furthest Northeast markets from Dalian). While varying over time, the Dalian domestic price remains between US\$120/mt and US\$130/mt between December 2001 and February 2003. During the same period, the prices in both Heilongjiang markets move almost in perfect concert with one another; maize prices in Heilongjiang are around US\$110/mt to US\$115/mt. Most importantly, visual inspection shows that although the market in Dalian and those in Heilongjiang are more than 1000 kilometers apart and prices vary by US\$12/mt to US\$17/mt, the prices in many periods are moving together. When the prices in Dalian move up (down), the prices in Heilongjiang tend to move up (down).

Similar patterns of price movements are found to exist between the two markets in western and central Liaoning and Dalian (not shown in figure). In fact, the prices in the two Liaoning producing areas track each other even closer than the markets in Heilongjiang, a finding that perhaps is not surprising given the fact that Liaoning is a smaller province with better transportation and communication infrastructure. The co-movements of prices among the producing areas in Liaoning and the consumption center of the province, Dalian, also are easily perceptible. The narrower price gaps among producer (lower trend lines) and consumer areas (higher trend line) are a reflection of the closer distance (than when compared to Heilongjiang-Dalian figure—Panel A).

Using data set 1, the patterns of movement across further points of China display similar patterns of close movements of prices (Figure 2, Panels A and B). While prices have moved together since the mid-1990s between Dalian and Guangdong and between Dalian and Fujian, the tracking among markets appears to be even closer in recent years. Almost every turning point in Guangdong and Fujian can be found in the Dalian market. The close movement of prices occurs even though the primary way grain moves between the two sets of markets is by ocean going vessel. With the advent of private shipping and commercial trading, there are now many shipping lines and trading companies that move grain between the Northeast and South China's main consumption areas. The results from Figure 2, Panels A and B, when linked with those from Figure 1, demonstrate that prices in Heilongjiang appear to depend on shifts in feed demand and corn availability in Guangzhou and Fujian.

Soybeans. Using dataset 4, we find soybean prices similarly move together for pairs of markets both in the same region and across more distant locations. The bottom

two price series in Figure 3 trace the price trends for soybeans in Heilongjiang and Jilin. The two series are almost indistinguishable from one another with Heilongjiang prices slightly lower from almost the entire period. The Guangdong price series, the top line in the figure, also shows that prices move in concert with one another inside China's domestic market even though the markets are thousands of kilometers apart. In only two short periods—early 2000 and late 2002—does the gap between the two markets deviate from a fixed margin which is almost equal to the transport price between the Northeast and the South.

In more rigorous cointegration analysis, the results of the descriptive statistics are confirmed and it can be seen that China's markets have integrated over the 1990s into the early 2000s. In this analysis we examine statistically the degree of integration of all pairs of markets in our rice, maize and soybean samples (see Huang et al, 2004 for complete set of results). In case of rice there were more than 300 pairs of markets; in the case of maize and soybeans there were more than 500 pairs.

According to our data, only around 25 percent of maize, soybean and rice markets were integrated before 1995 (Table 1, column 1). By 2000 the degree of integration had risen to above around 50 percent for rice and around 70 to 90 percent for maize and soybeans (column 2). Interestingly, our results are consistent with the findings of Park et al. (2002) who find that market were becoming more integrated even during periods in the late 1990s when the retrenchment policies of Zhu Rongji were being implemented. These results suggest that once the “genie was let out of the bottle” (or once private traders began to trade) that it was difficult to stop them.

By 2003, however, the impacts of the market liberalization policies of the Hu and Wen regime are even clearer (Table 1, column 3). In the case of maize and soybean markets nearly all pairs of markets are cointegrated. This means that during any 1 week period (or so) during these years, if the price in one market moved, those in another would likewise move.

Importantly, the results in this paper are also found to hold in Huang et al. (2004) for villages that are China's poorest areas. In their work, it is shown that prices are not only integrated across provinces and between traders in major marketing towns, there is evidence that even those in China's poor villages are integrated into China's national market. When poor areas suffer production shocks, for example, a sharp fall in their output due to some natural disaster, it is found that there is no change in price that is not associated with shifts in prices outside of the village. Such a finding is in stark contrast to Mexico where most of the nation's poorest villages exist in their own subsistence economies.

Examining Integration: Price Patterns Across Space

We also can use our data descriptively and in conjunction with relatively simple multivariate analysis to examine price behavior across space, holding time constant. If China's markets function well, then there should be well-defined relationships across space. At any given point of time, the price in the consumption center should be the highest, while the price in the most remote production location lowest. If all prices are plotted as a function of their distance from the consumption center, the plot of these points traces out a "transportation gradient." It is called the transportation gradient because in the absence of other distortions, the fall of the line reflects the rising

transportation costs. Higher per kilometer transport costs and distance-varying distortions and other costs also will increase the steepness of the line. Thought about in this way, then, the nature of the transportation gradient can be used to measure the efficiency of a marketing/transportation system.

A simple plotting of the relationship between the price of maize in Dalian and those in Liaoning, Jilin and Heilongjiang during post-accession period (after December 2001) illustrates a price contour that is consistent with the existence of well-functioning markets (Figure 4). Since the main demand center in the Northeast and point of export for maize to foreign markets and the point of transshipment to south China is Dalian, one would expect that in an integrated marketing system, as a market became more remote, the price should fall according to a well-defined “transportation gradient.”⁴ Indeed, the price in a market a 1000 kilometers away from Dalian (e.g., the Jilin market) is, on average, about RMB 70/mt lower than the price in Dalian. In percentage terms, this means the price of Jilin maize is about 6 percent lower than the price of maize in Dalian.

Like maize, a simple plotting of the relationship between the price of soybeans in China’s ports (Beijing/Tianjin/Hebei; Shanghai or Guangdong) and those in the inland producing and consuming areas (e.g., Heilongjiang, Jilin, Henan, Shandong or Jiangxi) during study period (1999 to 2003) illustrates a price contour that is consistent with the existence of well-functioning markets (Figure 5). Since the main demand centers are in the vicinities of the ports, one would expect that in an integrated marketing system, as a market became more remote from the ports, the price should fall. Indeed, the average price in a market in the port (2250—say, Hebei/Beijing/Tianjin) and one that is a 1000 kilometers away from port (2100—say, Jilin) is, on average, about RMB 150/mt different.

In percentage terms, this means the price of Jilin soybean is about 6 to 7 percent lower than the price of soybean in the Beijing area.

The patterns of the price data (that is, the transportation gradients) are even more evident when using dataset 1 to look at the case rice (Figure 6). In Figure 7 the points at the origin are those in one of four of China's main consumption points and the rest of the points are prices in the markets that are in supply points of the marketing areas that service the consumption points. Specifically, in southern China main demand point is Guangzhou and the supply points are markets in the southern China indica marketing region (e.g., Guangdong's rural area, Hunan, Fujian, Guangxi and Yunnan). In the Yangtse River Basin the main consumption point is Shanghai and the other marketing points are in supply regions up the Yangtse River. In northern China the main consumption center is Beijing/Tianjin and the marketing points are in supply regions up the Yellow River Basin. And, in the northeast the main consumption center is Dalian and the main marketing points are in Liaoning and Heilongjiang. When data are arranged like this, rice prices in China's four marketing regions trace out a well-defined transportation gradient.⁵

When looking at *average transportation gradients* for 1998 to 2000 for maize, soybeans and rice in China and the US, Table 1 suggests that China's markets are indeed performing relatively efficiently.⁶ First, the transportation gradients for all crops are falling over time. Although we can not pinpoint the exact source of the fall in the transportation gradient, according to Park et al. (2002), the patterns are consistent with a marketing environment in which there is an improving infrastructure and more competitive markets. Second, the results show that the transportation gradients in China

are similar to those found in the US. When plotting similar data and running similar regression on corn in the Mississippi valley we find pattern of spatial price spread similar to those in China—especially in the case of maize. According to our analysis, then, China’s commodity markets after 2000 are as efficient as those in the US. Clearly it does appear as if the marketing reforms (as well as aggressive investment in roads and other infrastructure projects in the past decade—Luo et al., 2006) have dramatically improved the ability of traders to move agricultural commodities (at least maize) around China at costs that rival those of the US.

Competitiveness

In addition to better infrastructure, the rising integration that is observed throughout the 1990s and early 2000s could also be a function of increasing competitiveness. In this section we look at competitiveness mainly by examining the number and nature of traders as well as their pricing behavior.

Perhaps the most convincing metric of the rising competitiveness of China’s markets is the increasing number of traders. According to our interviews in the markets into which datasets 2 to 4 come from, despite the attempts by the government to remonopolize grain trade in the mid-1990s, tens of thousands of private traders were dominating grain trade by 2001 and 2002. According to a survey by Xie (2002), in 2001 there were more than 2000 private rice wholesalers trading in Beijing, more than 3000 in Shanghai, and more than 5000 in Guangzhou. Nearly all rice, maize and soybean moves through their hands, completely bypassing the state. During our interviews of wholesale markets in 2005 and 2006, while no one would even guess at the number of traders of

grain, the average guess at the expansion of trade since 2000 was over double the number of traders.

Input trade—in particular that for fertilizer—was increasingly dominated by the private sector and the number of traders has grown over time. By the mid-1990s, about 50 percent of fertilizer was sold by private traders. In 2000, according to a national representative survey of 1200 households in six provinces, fertilizer sales at the farmgate level was almost exclusively handled by the private sector. In a 2004 survey of fertilizer use and procurement by households in 8 provinces, the Center for Chinese Agricultural Policy found that all fertilizer was purchased from private individuals and the number of traders was rising dramatically (Zhang et al., 2005). During the preplanting season, in almost any village in China literally scores of fertilizer traders can be found in permanent shops, periodic markets, on the sides of roads and acting as itinerant traders moving from village to village and trying to make to-the-door sales.

Perhaps the most competitive markets are those for horticultural products. According to our data, despite the rise of supermarkets, restaurants and processors—or actors that dominate the downstream segments of horticultural marketing chains, in China's villages during the harvest season the buying and selling of fruit and vegetables is almost completely between small producers selling to small traders. Specifically, although there has been a lot of discussion about the potential effect of the rise modern supply chains on welfare in rural areas, according to our data, supermarkets are completely absent (Table 2). Indeed, not one of the 201 village leaders that we interviewed reported the presence supermarkets for the procurement of any horticultural goods (Panel A, column 1). Likewise, village leaders reported that only 2 percent of

procurement from farmers was by specialized suppliers and only 2 percent was by processing firms (columns 2 and 3). Hence, in the Greater Beijing area in 2004, only 4 percent of all horticultural goods were procured by those operating in firms that could be described as part of the modern supply chain. Although not shown, the data from the households that were part of the intensive survey in 50 of the 201 villages in the extensive survey in Greater Beijing show the exact same patterns: Households sold almost all of their output to small traders—either in the village or in local wholesale markets. Not one household reported that they sold to a supermarket or a specialized supplier.

A similar picture emerges from the farmers that participated in the focus groups in the 72 Shandong tomato and cucumber villages (Table 3). Fully 99% of farmers in the Shandong tomato producing village in both 2000 (22+77) and 2004 (15+84) stated that they either sold their tomatoes to small traders that visited their villages or to small traders in the local wholesale markets (columns 1 and 2). While the percentage that was sold to small traders in the wholesale market rose (from 77 to 84 percent, shifting from direct sales to small traders in the village), there were still less than 1% of sales in all other channels. Cucumber producers showed similar trends; more than 90% of all sales of cucumbers were either to small traders in the village or to small traders in the wholesale market (columns 3 and 4). Interviews with traders from trading firms in the wholesale markets in both Beijing and Shandong (which on average consisted of 4 employees, almost always family members or close friends) confirm that the procurement channels between the farmer and the wholesale market have changed very little and that the supply

of horticultural products in China largely flow through traditional small-trader dominated supply chains (tables not shown, but available in Wang et al., 2007).

Not only was there little evidence of procurement from farmers by the newly emerging players in the retail segment of the supply chain, there was almost no change in the contractual terms under which most transactions took place. In Greater Beijing sample there was nearly zero contracting over either price or quantity, there was no provision of input or credit by the buyer and all transactions took place on a cash, spot market basis. This was true for both 2000 and 2004. In Shandong tomato and cucumber producing villages, the exact same pattern held for both 2000 and 2005. Clearly in our study sites, which cover some of the most productive and commercialized horticultural areas in China, transactions show little penetration by actors in modern supply chains.

In fact, there is evidence that horticultural markets are extremely competitive by examining the number of traders to whom farmers could sell without even leaving their village. For example, it was estimated by producers in 120 randomly selected villages in Shandong that on average farmers in each village had a choice of selling their crop to more than 100 different traders. Interviewed independently, village leaders generated similar estimates.

The profit margins of traders between village and market and between rural and urban wholesale market confirms the competitiveness of China's horticultural markets. Profit margins are razor thin and often traders make one or two *fen* (1/100th of a yuan) per kilogram. The income of the typical small traders of horticultural commodities in China

is only somewhat higher than the average producer. During our surveys of markets, after controlling for the quality of fruits and vegetables, when we interviewed traders in Beijing who were handling commodities from Shandong, the prices were only different by the transportation cost plus 3 percent. There was almost no difference among traders inside the market on any given day for a commodity of the same quality.

A quantitative study by Park et al. (2002) that was supplemented by qualitative interviews confirm that over time the transaction costs of moving commodities across space have fallen. While increasing competitiveness is only one possible reason for this, it is consistent with this observation. The empirical work (as well as interviews by the authors) suggests that sales of grain between production/surplus and consumption/deficit areas are only made after many phone calls are made and the price gap between the two areas come close to the cost of transportation.

When one observes how the selling price in a village is struck between a buyer and seller, it is clear that most sellers are aware of the going market price in the locality and the buyers are constantly calling their home offices to check on the highest bid price that they are allowed to make (always denominated in fen). In a recent survey in 140 villages in Shandong, although farmers wished they had better price information, they were mainly wanting to know what the price was to be in the future. Almost no one ever said that they sold without a good idea of what the current market was. When ranking price discovery at the time of the sale of the crop versus a list of other production and marketing constraints, Shandong farmers ranked it far down the list. Discussions with more than 30 focus groups of producers across Shandong with grape, apple, tomato and cucumber farmers found that most farmers had a very good idea of what the price was at

the time that they sold it. There are many sources of price discovery in a market that is made up of thousands of traders and many market sites.

In short, it is little wonder that China's markets are so efficient. The competitiveness of grain, input and horticultural markets are clearly very high. All markets are dominated by private individuals. Most traders work for themselves, in groups of 2 to 6 or as incentivized agents for a downstream buyer. Wholesale markets are also dominated by hundreds if not thousands of traders (Wang et al., 2007). With so many traders moving around the country, the integration analysis suggests that when small gaps in prices between two regions appear, the margins are quickly arbitrated away. Discussions with researchers in other countries have found that China has perhaps the most competitive markets of any developing nation in the world. With the increasing concentration in the food markets in the US, EU and Japan, they may be more efficient, competitive and integrated than most developed countries also.

Performance

It is often said that a market is a two-edged sword (Huang et al., 2004). Since the job of a well functioning market is to transmit information about shifts in supply and demand as price signals quickly throughout the region or nation, the net impact on producers of the rise in markets will depend on the nature of the supply and/or demand shocks in the economy as a whole. Therefore, if there are positive supply shocks (over supply) or negative demand shocks (reduced demand), instead of helping farmers, markets would be responsible for reducing the farmgate price of agricultural commodities.

In this way, it could be argued that, in fact, the emergence of markets have not been good for farmers and that farmers in a very real sense have been a victim of their own success in raising productivity. Between 1980 and 2005, with the exception of price spikes in 1988 and 1995, the real price of rice, wheat and maize has fallen due to the fact that supply has outpaced demand (Rozelle et al., forthcoming). When using a regression approach to measure the trends, grain prices have fallen in real terms between 33 percent (maize) to 45 percent (wheat) between the late 1970s and early 2000s. The falling prices of agricultural products have been tied to both the flagging performance of agriculture and rising interregional inequality during the 1980s and 1990s (Rozelle, 1996).

In horticultural markets, likewise, emerging markets can be tied to adverse welfare consequences. Nationally, the real prices of fruits and vegetables have fallen over time (Huang et al., 2004). There are endless stories of farming communities which have spent enormous time and effort in expanding orchards or greenhouses only to find that the prices on which they based their initial investments had collapsed and that they were earning much lower profits than originally anticipated (or even incurring losses). During focus groups intraseason price variability—which is a natural phenomenon in almost all fruit and vegetable economies due to the perishability of the crops—was noted as the major price concern of producers.

In summary, then, in a broad sense, markets are not a panacea for raising incomes. If markets are emerging and transmitting information in the form of lower prices (due to underlying supply and demand reasons), everything else held equal, poverty could be exacerbated, rather than alleviated. In fact, well functioning markets should be expected to be neutral in terms of their effect on farmers through their effect of transmitting higher

or lower prices. However, it should also be noted that the fact that prices are higher or lower is a function of other factors—outside of markets—and markets per se should not be blamed or attributed to the functioning of the market itself.

The Positive Effects of Improved Markets

Although few authors have attempted to quantify the gains from market liberalization, in the few papers that do exist, it is found that farmers have been gaining from increased allocative efficiency. For example, Lin (1992) and Huang and Rozelle (1996) argue that there is a positive effect of increasing marketization on productivity. In these two papers, the authors conjecture that the gains are due in part to increasing specialization or increased efficiency of markets. Unfortunately, these conjectures are made without an empirical basis. In this section, we seek to provide an empirical sketch of how the emergence of markets has affected specialization, efficiency and productivity of farmers.

Markets and Specialization

In order to try to understand whether or not specialization has occurred since the mid-1990s when markets began to emerge and integrate, in 2004 we conducted a randomly chosen, national representative survey of 400 communities (see Huang and Rozelle, 2005 for a complete description of this survey). In the survey of community leaders we asked the following question: Are farmers in your village specializing in any particular crop or livestock commodity? The question was asked about 1995 and 2004. If the respondent answered affirmatively, we asked for the commodity in which they were specializing. If the farmers in the community were specializing in a cropping activity, we asked for the area sown to the specialty commodity.

The results of our survey show that indeed specialization has been occurring in China's agricultural sector. Between 1995 and 2004, the percentage of villages that are specializing in an agricultural commodity has increased sharply and has done so in every province (Table 4, columns 1 and 2). On average, throughout our sample from across China, 30 percent of China's villages are specializing, up from 21 percent in 1995. When examining the composition of the output of villages that are specializing, it is clear that the rise in the demand for horticulture and other specialty products is what is driving the specialization. In our sample, fully 60 percent of those villages that are specializing are producing either fruits (28%) or vegetables (13%) or other cash crops (28%--e.g., sugar cane, tobacco and cotton). There also are villages that are specializing in livestock commodities, oil seed crops, forest products and other commodities. In our Shandong community survey in 2006, found that more than 60 percent of villages were producing a crop or other agricultural commodity that they considered to be a commodity in which their village specialized.

Markets, Efficiency and Improved Welfare

The only truly systematic attempt at trying to measure both the improvements in markets and their returns due to efficiency is in deBrauw et al. 2004. This paper develops measures of increased responsiveness and flexibility within a dynamic adjustment cost framework to estimate the return to market liberalization reforms, holding the incentive reforms and other factors constant. The authors find that the behavior of producers in China has been affected by market liberalization. Gains in responsiveness (that are measured by price elasticities of factor demand for variable inputs—in this case, fertilizer) between the early and late reform periods are attributed to the gradual market

liberalizing changes of the late 1980s. Farmers also have increased their speed of adjustment of quasi-fixed factors (which in the case of China's agriculture includes labor and sown area) to price changes between the early and late reform period.

The work in deBrauw et al. (2004) also measures the effects on overall welfare of the increased flexibility and responsiveness. Although the direct gains by 1995 were relatively small (which might be expected given the gradual nature of changes to markets), it is found that the magnitude of the gains in efficiency from increased responsiveness and flexibility in the late reform period is positive and statistically significant.

Structural Adjustment and Improved Incomes

If the increased flexibility of markets and reductions in restrictions on the choice of activities by farmers, as argued, is allowing more and more farmers to shift into the production of new commodities, such as, fruits, vegetables, livestock and dairy, there is an emerging empirical literature that shows that farmers that engage in the production of these nontraditional crops are raising their incomes. For example, in Greater Beijing it has been shown that horticultural producers—both those that produce and market fruits and vegetables—have higher incomes, *ceteris paribus* (Wang et al., 2007). The same results are found for grape, apple, tomato and cucumber producers in Shandong province (Huang et al., 2007a; Huang et al., 2007b).

Beyond the cropping sector, producers that shift into livestock commodities also are shown to increase their earnings. Bi et al. (2007) demonstrates that hog and poultry

producers have higher incomes, *ceteris paribus*, than their counterparts that are mainly producing grain. Wu et al. (2007) shows that dairy production enhances income—even of those small farmers with five and fewer dairy animals. To the extent that structural adjustment policies have allowed specialization and to the extent that those that specialize have been going into the production of crops and animal activities, the rise of markets is surely associated with a significant improvement in rural welfare.

Perhaps most importantly, the work by Wang et al. (2007) shows that, unlike the fears of policy makers who believed it might be the rich that would benefit from the new opportunities in the production of higher valued commodities (Farina and Machado 1999), at least in some areas of China, it has been the poor that has benefited. According to our data, farmers in poor villages and poor farmers are actually increasing their share of the production of horticulture crops (Table 5). To show this, we divide villages in our Greater Beijing sample into quartiles, according to each village's reported income per capita. Between 2000 and 2004 we find that farmers in the very poor and poor village categories (i.e., those farmers living in villages with incomes below the median income level) have increased their share of total sown area of horticultural crops, in general (top row). In fact, by 2004 farmers in very poor and poor villages produced more than half ($23+32=55$ percent) of horticultural crops in Greater Beijing. Even more significantly, farmers in the very poor villages increased their share of vegetables, fruits and nuts between 2000 and 2004 from 15 to 22 percent (rows 2 to 4, columns 1 and 2).

A similar picture emerges when examining different categories of horticultural crops (Table 5, rows 2 to 4). For example, in the case of fruit, production is dominated by the farmers in the very poor and poor villages. In contrast, farmers in average income

villages produce most of the vegetables. Of course, one of the most interesting findings of Table 2 is that the farmers in the richest village are not the driving force (or beneficiary) of vegetables, fruits or nuts.

Work in other parts of China and in other sectors produce similar findings. Our results from Shandong show that in rich and poor villages farmers have been equally able to enter the horticulture market in the 2000s. In our Beijing sample, we find that it is the poor that are increasing their production of hogs (Bi et al., 2007). In fact, in a much broader sample, Chen et al. (2005) show that this trend is occurring throughout China's hog producing regions.

Conclusions

Despite some writings of researchers in the past, in fact, China's domestic markets—at least in agriculture—have become increasingly integrated, efficient and competitive. There are few regulations. There is easy entry. In fact, compared to agricultural markets in many other countries, that often on highly regulated, China certainly (and somewhat surprisingly) can now be considered to be part of a group of nations (that includes Australia; New Zealand, Brazil) that have some of the most competitive, free agricultural markets in the world. This is remarkable, given the fact that 30 years ago, there were almost no free markets and agriculture was run as part of the planned economy. Equally remarkable is that except for the recent emergence of a grain subsidy program (which in many parts of the country is being run as a decoupled income transfer scheme), the state has almost completely disappeared from agricultural markets.

So what has been the impact of these liberalized, flourishing markets? As markets any where, good markets pass merely through signals about supply, demand and uncertainty that are inherent in the fabric of the economy. Therefore, markets have exposed farmers to increasing amount of fluctuation – both good and bad – which in the past may have gone unnoticed by farmers that were living in isolated localities. Farmers do feel exposed to the larger forces of markets and, in this sense, have less control of their lives.

But, as we have seen, there have been many positive effects: Rising productivity; rising specialization; and rising incomes associated with moving into new specialty crops. Above all, one of the most surprising findings is that these new, competitive markets, far from excluding poor farmers, have sought them out and given poor, small farmers new opportunities – which they have done based on their own decisions – to become a part of China’s thriving economy.

Marketization in Rural China: Source of Crisis or Source of Opportunity?

So what is the final word? At least for the markets that we have looked at in the agricultural sector, farmers appear to be gaining a lot of information from the emergence of markets. Not all of the information that they receive, of course, is positive. At the very least, because China is changing so fast, the information that they will be getting will be challenging farmers to be in constant motion.

Is there more gain or more pain? To the extent that change is difficult, there will be *pain*. And, of course, some households / communities will be better able and willing to adjust than others. But, we have also shown that there is a lot of gain. There is increased

specialization. There is improved efficiency. Income gains are linked to the activities that markets have allowed farmers to move into.

Of course, this is in the past. Fast growing economies, striving for modernization, if anything, are defined by change. There is urbanization. There is industrialization. There is globalization. There is growth. And with growth will come changes in preferences and changes in the demand put on China's agricultural producers. Hence, it will likely be that there will be a lot more wrenching changes that farmers have to go through. However, if the rural population wants to be part of China's surge towards becoming a modern society, markets will be part of the greater process that facilitates that change.

In short, there will be pain. But, we believe that our paper is consistent with a view that most of the hard changes will be ultimately healthy and unavoidable. They might best be tagged as GROWING PAINS.

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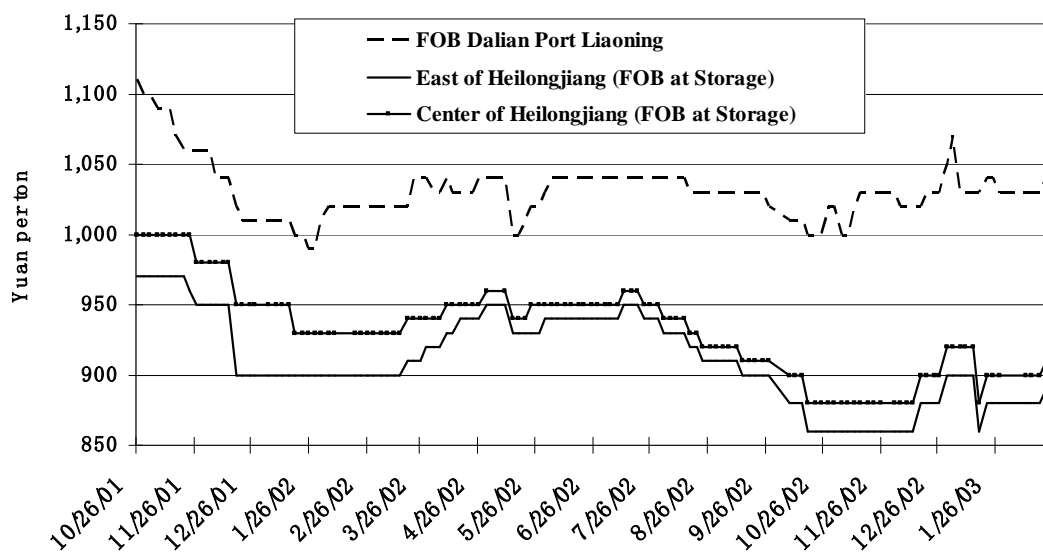
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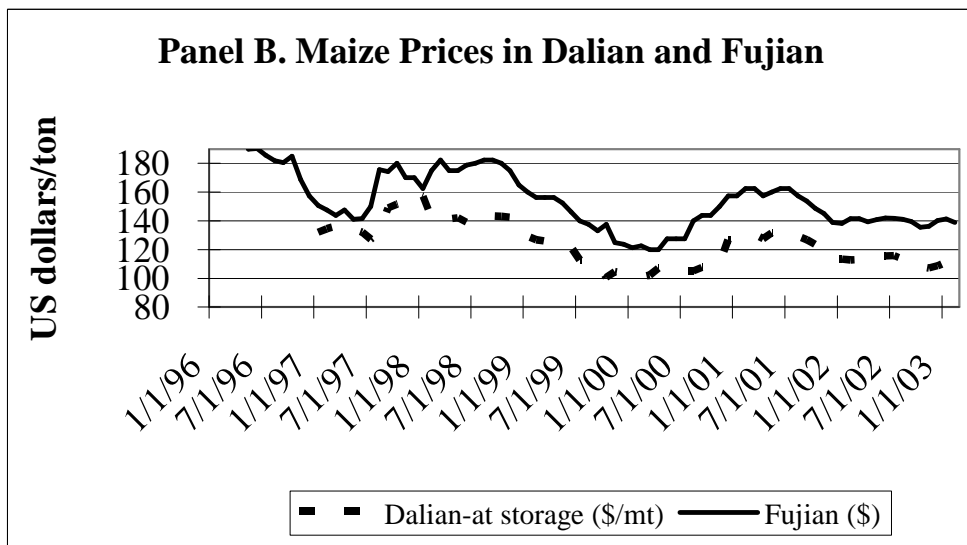
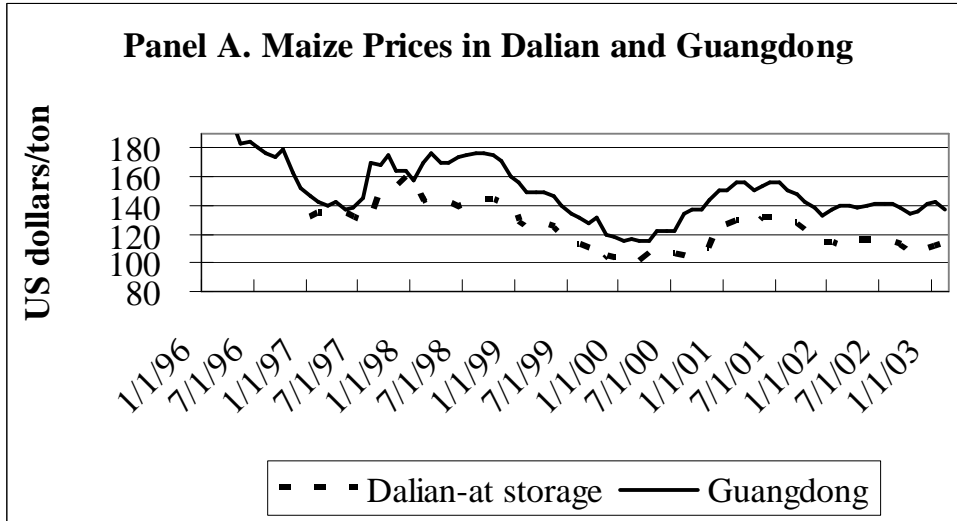
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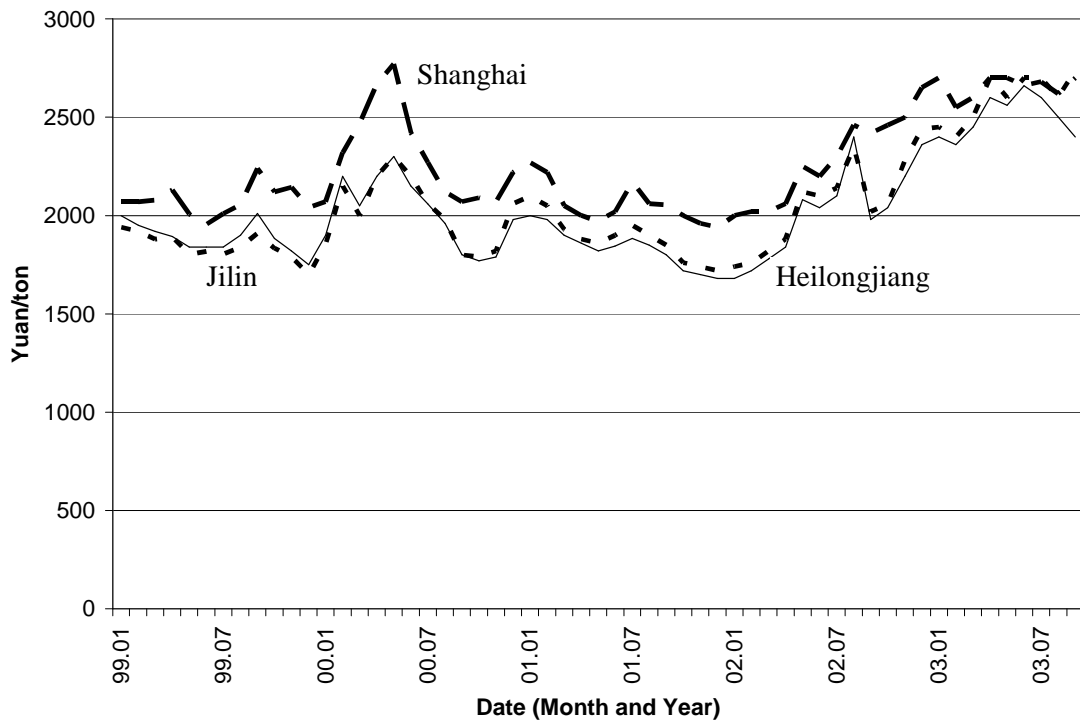
Data source: Dataset 3

Figure 1. Maize Prices in Heilongjiang and Dalian (RMB/mt), October 2001 to February 2003.



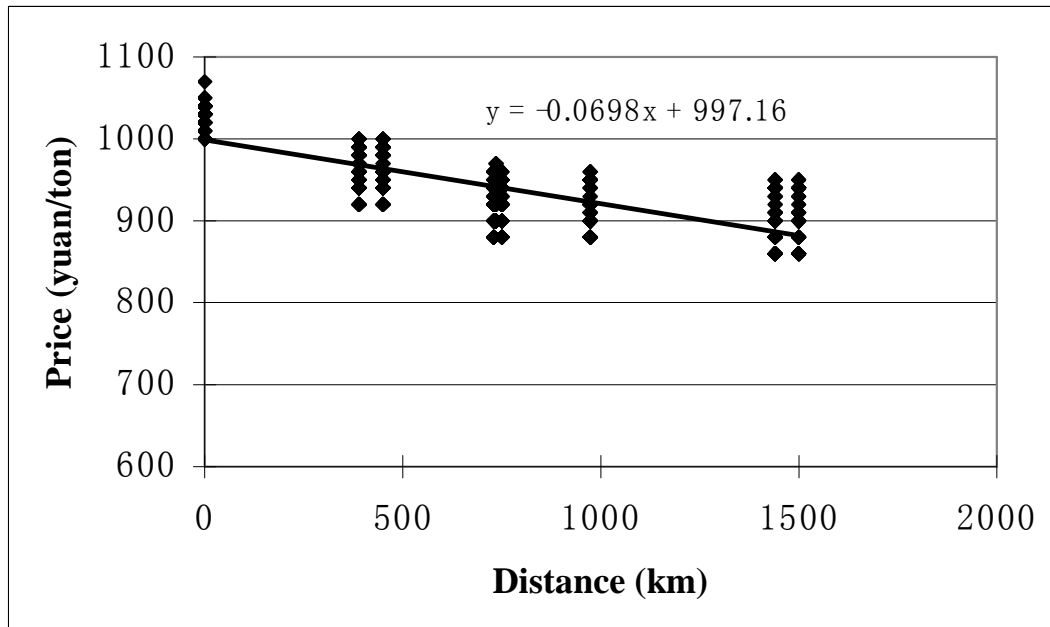
Data source: Dataset 2

Figure 2. Maize Prices in Guangdong, Fujian and Dalian, January 1996 to February 2003



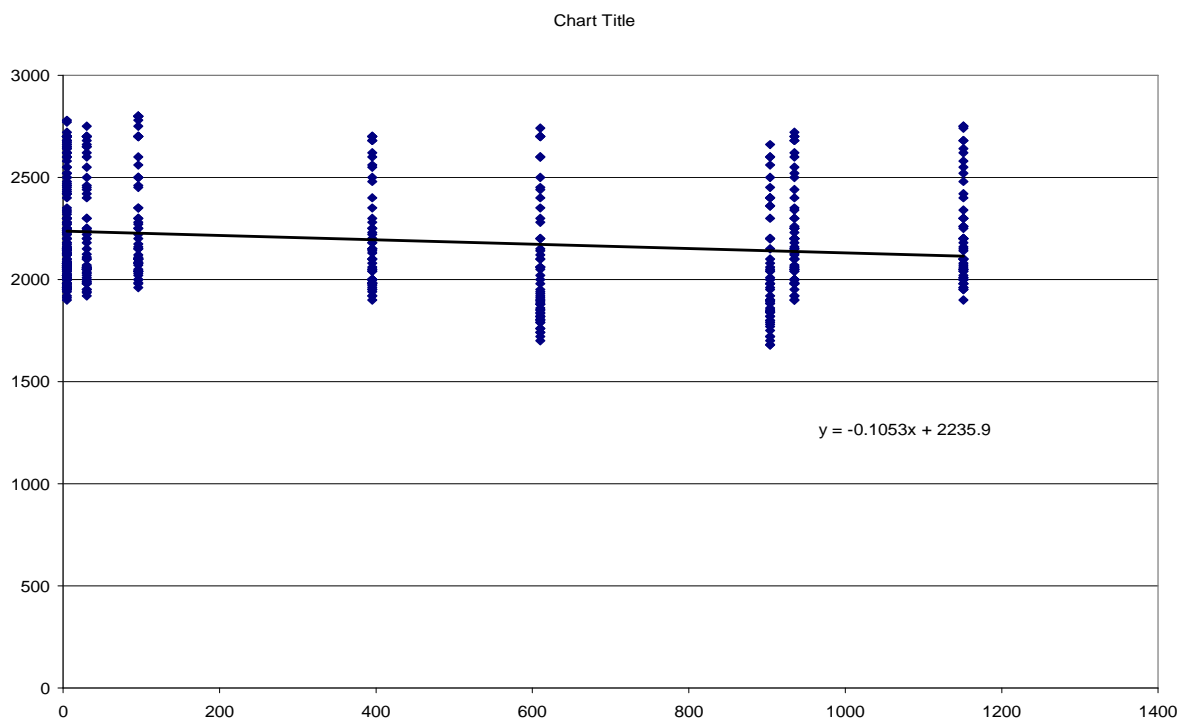
Data source: Dataset 4

Figure 3. Soybeans Prices in Heilongjiang, Jilin and Shanghai, January 1999 to September 2003



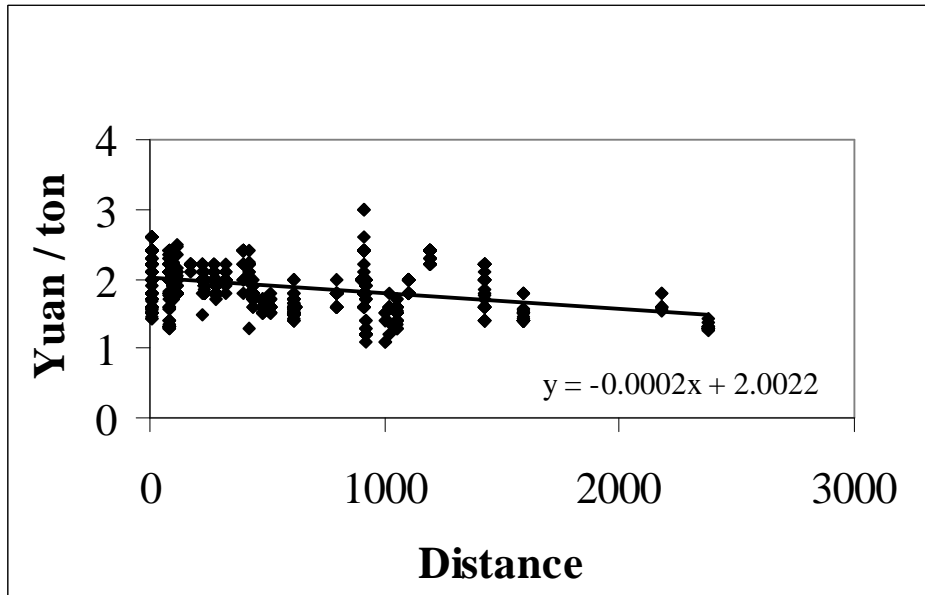
Data source: Jilin Oil and Grain Information Center (Dataset 3).

Figure 4. Changes in Maize Prices across Northeast China as Markets Increase Distances from the Port of Dalian, 2000-2003.



Data Source: Dataset 1.

Figure 5. Price of Soybeans (RMB/Metric Ton) and the Distance from the Ports of Tianjin, Shanghai and Guangdong (Kilometers) in China, 1999 to 2003.



Data source: Jilin Oil and Grain Information Center (Dataset 1).

Figure 6. Changes in Rice Prices across China as Markets Increase Distances from Port Cities, 2000.

Table 1. Percentage of Market Pairs in Rural China That Test Positive for Integration Based on Dickey-Fuller Test, 1988–2003

Commodity	1989–95	1996–2000	2002–2003
Maize	28	89	98
Soybeans	28	68	99
Japonica Rice (Yellow River Valley)	25	60	--
Indica Rice (Yangtze Valley and South China)	25	47	--

Note: Results are the two periods in columns 1 and 2 are from the same data set. For results for 1989–1995 for maize and rice, see Park et al. (2002). Rice results are for the whole country in 1989–95. Results for soybeans for 1989–95 and all results for 1996–2000 are from the authors.

Results for column 3 for maize are from Rozelle and Huang (2004); and for soybeans are from Rozelle and Huang (2005).

Source: Database 1; Database 3; Database 4.

Table 2. Supply and Marketing Channels of Horticultural Markets in Greater Beijing Area, 2004

Panel A: First-time buyers (percent)								
	Modern Supply Chains			Traditional Supply Chains		Other Supply Chains		
	Supermarkets	Specialized suppliers	Processing firms	Small traders	Farmers sell in local periodic markets	Cooperatives	Consumers direct purchase from farmers	Others ¹
Horticultural Crops	0	2	2	79	8	0	7	2
Vegetables	0	3	5	82	5	0	1	3
Fruit	0	1	1	75	11	0	9	3
Nuts	0	6	0	88	3	0	3	0
Panel B: Location of First Transaction (percent)								
	Farmer's fields	Village center	Roadside	Periodic markets	Wholesale markets	Urban wetmarkets	Others ²	
Horticultural Crops	65	9	3	6	11	4	2	
Vegetables	64	0	3	6	18	9	0	
Fruit	60	12	3	9	12	3	2	
Nuts	86	11	0	0	0	0	4	
Panel C: Second-time Buyers (percent)								
	Modern Supply Chains			Traditional Supply Chains		Other Supply Chains		
	Supermarkets	Specialized suppliers	Processing firms	Small traders	Traders sell to consumers in	Cooperatives	Others	

					periodic markets		
Horticultural Crops	3	3	10	49	13	0	22
Vegetables	6	0	6	57	11	0	20
Fruit	1	2	9	46	16	0	26
Nuts	3	10	19	50	6	0	12

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

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

Table 3. Procurement channels at the farmgate: the buyer to whom tomato and cucumber producers sold their produce in Shandong sample village, 2000 and 2005.

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

Source: Authors' survey.

Note: Data are from question posed to the farmers in the focus group: To whom did you sell your tomatoes (cucumbers)?

Table 4. Percentage of villages and sown area with specialization by region.

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

Data source: Huang and Rozelle, 2005.

Endnotes

¹ In fact, the reader needs to be careful of a possible alternative interpretation. Although the language in our paper is such that we are attributing much of the observed changes in China's marketing policy to the "effectiveness of state policies," it also is possible that over the last decade is that the government simply "abandoned" the countryside. In other words, the expansion of produce markets we observe today is less a conscious policy choice than the result of state neglect. While the end result—good markets with a number of positive outcomes from farmers—would still be the result, this alternative view might lead to different implications on how things will change in the future in this area. Recent changes after the switch to the new Hu-Wen government in 2003 (in which there is a huge effort being put into rural development), however, would suggest that the government—at least now—is actively interested in the future of the rural economy.

² Since we use data over time, we need to convert prices to a real basis. Nominal prices from our data set are deflated using monthly consumer price indices calculated and reported by the China National Statistical Bureau. Deflation facilitates transaction cost comparisons across time and allows us to disregard transaction cost increases within periods associated with inflation.

³ To produce the results, we run cointegration tests on the each pair of markets using the data for each year. So, in other words, we use 36 observations (since the price data are available every ten days) and count the number of pairs of markets that are cointegrated in a statistically significant way (see next endnote and text for explanation of testing). For example, for the case of soybeans, for the late 1990s (1996 to 2000), this means that we are examining the extent of integration between 190 ($20 \times 19/2$) pairs of markets in each of 5 years, which equals a total of 950 pairs of markets. Hence, since we found that prices in 646 markets were integrated (according to the testing procedure), we report that 68 percent of markets are integrated in the late 1990s. Since we only use 36 observations per test, and since cointegration tests typically perform better with longer time series, by splitting our data into annual increments, we are biasing the results against accepting integration. We do this in order to make our analysis comparable to Park et al. (2002) which follows a similar procedure.

⁴ China's custom data demonstrate overwhelmingly that most of China's maize is exported from Dalian (more than 90 percent over the past 5 years). By far most of the maize from the north part of the nation that moves to the south part of the nation also flows through Dalian.

⁵ See Park et al. (2002) for a complete discussion of the major channels of flow of China's rice trade. According to extensive interviews with rice traders between 1995 and 2001, the largest flows of rice from each of the four clearly designated regions end up in the major consumption centers in Guangzhou, Shanghai, Beijing and Dalian.

⁶ An average transportation gradient (which are reported in Table 1 for maize, soybeans and rice for China for 1998 to 2000 and for maize and soybeans for the US for 1998) is the coefficient on the "distance variable" (a variable that is measuring the distance in 1000 kilometers from the port of the location of the market) from regressions that explain commodity-specific prices for each year (in logs) as a function of the distance variable and a series of period dummies (one for each week of the year). In other words, the coefficient is the average percent change in price for each 1000 kilometers that a marketing site is removed from the port, holding constant the average price change for all sites during each week of the year. Regression results available from authors upon request.