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# Markets, Specialization and China's Agriculture

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**First Sections**

**The Emergence of Agricultural Commodity Markets in China**

As seen in the previous sections, China's reformers, more than anything, have followed a strategy based on providing incentives through property rights reforms, even though in China the shift to private ownership is today far from complete. The reforms started with the Household Responsibility System (HRS), a policy of radical decollectivization that allowed farmers to keep the residual output of their farms after paying their agricultural taxes and completing their mandatory delivery quotas. Farmers also began to exercise control over much of the production process (although in the initial years, the local state shared some control rights and in some places still do today). In this way the first reforms in the agricultural sector reshuffled property rights in an attempt to increase work incentives and exploit the specific knowledge of individuals about the production process (Perkins, 1994). In executing the property rights reforms, leaders also fundamentally restructured farms in China. Within a few years, for example, reformers completely broke up the larger collective farms into small household farms. In China today there are more than 200 million farms, the legacy of an HRS policy that gave the primary responsibilities for farming to the individual household. McMillan, Whalley and Zhu (1989), Fan (1991), Lin (1992) and Huang and Rozelle (1996) have all documented the strong, positive impact that property rights reforms had on output and productivity.

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 (John McMillan, 1997; World Bank 2002). These institutions were either absent in the Communist countries or, if they existed, were inappropriate for a market system. Somewhat surprisingly, despite their importance in the reform process there is much less work on the success that China has had in building markets and the effect that the markets has had on the economy.

In part in response to the lacunae of research on markets and their impacts on the China's rural economy, in this section of the paper our major goal is bring together the facts on the emergence of China's markets. To do so we will have three specifics objectives. First, we document the policy environment that has unfolded during the reform era. Second, we examine the data: looking at spatial patterns of market prices contours over time and examine the extent to which market prices are integrated. Finally, we examine how the emergence of markets has affected the ability of farmers to specialize and how urban markets have started to change and affect the supply chain. In the next section, we then explore whether or not organizations have emerged in China that will allow small farmers to operate within the increasingly marketized environment. Specifically, we will track the progress of the emergence of farmer cooperatives (in China there are called Farmer Professional Associations) and understand what barriers are keeping them from becoming a greater aid to small farm development.

**Commodity Price and Marketing Policies**

Price and market reforms are key components of China's transition strategy to shift from a socialist to a market-oriented economy. The price and market reforms initiated in the late 1970s were aimed at raising farm level procurement prices and gradually liberalizing the market. These reforms included gradual increases in the agricultural procurement prices toward market prices, reductions in procurement quota levels, the introduction of above quota bonuses for cotton, tobacco, and other cash crops, negotiated procurement of surplus production of rice, wheat, maize, soybean, edible oils, livestock, and most other commodities at price levels higher than those for quota procurement, and flexibility in marketing of surplus production of all categories of agricultural products by private traders. It is interesting that in the initial years there was little effort to move the economy to one in which most all resources and factors were allocated according market price signals.

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 (Rozelle et al., 2000). After a record growth in grain production in 1984 and 1985, a second stage of price and market reforms was announced in 1985 aimed at radically limiting the scope of government price and market interventions and further enlarging the role of market allocation. Other than for rice, wheat, maize and cotton, the intention was to gradually eliminate planned procurement of agricultural products; government commercial departments could only continue to buy and sell at the market. For grain, incentives were introduced through the reduction of the volume of the quota and increase in procurement

prices. Even for grain, after the share of grain compulsory quota procurement in grain production reached 29% in 1984, it reduced to 18% in 1985 and 13% in 1990. While the share of negotiated procurement at market price increased from 3% only in 1985 to 6% in 1985 and 12% in 1990.

Because of the sharp drop in the growth rate of grain output and rise in food prices in the late 1980s, the pace of marketing reform stalled. 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. The increase in the nominal agricultural procurement price, however, was lower than the inflation rate, which led to a decline in the real grain price (Huang et al., 2004).

As grain production and prices stabilized in the early 1990s, however, another attempt was made to abolish the grain ration system. Urban officials discontinued sales at ration prices to consumers in early 1993. For a year and a half, the liberalization move succeeded. Then, while it appeared that both the state grain distribution and procurement systems had been successfully liberalized, food prices rose sharply; other price in the economy also rose. Some people blamed the nation's inflation on the rises in food prices. As a result, the state compulsory quota system was again re-imposed in most parts of China in 1995, but at a lower procurement level. The share of grain compulsory quota procurement in total production kept at only 11% in 1995-97.

Since the middle 1990s, several new policies—some pro-market, others anti-market—were implemented. Immediately after the price rises in the middle 1990s, China started the provincial governor's "Rice Bag" responsibility system. The policy was

designed to strengthen food security and grain markets by making provincial governors and governments responsible for balancing the supply and demand of cereals in their provinces and for stabilizing local food markets and prices. Policies under the system included re-imposing grain rationing to poor consumers, investing in production bases inside the province and attempting to keep grain from being shipped outside of the province. If implemented, this policy may have reduced short-run agricultural price fluctuations, however, it would not have been without costs. It has been widely believed that the policy may have adverse impact on the efficiency of resource allocation, diversification of agricultural production, and farmer's incomes. Moreover, a great number of efforts to restrict the flow of grain were not successful. Market flows continued as the share of total government procurement (both quota and negotiated procurement) in domestic production reduced from 26% in 1994 to 22% in 1996, being driven by the profits that traders could earn by shipping grain from low to high priced areas (Huang et al., 2004).

With three record levels of grain production in China in the late 1990s, and almost zero or negative inflation since 1997, rising grain stocks and declining food prices showed the economy had bounced back. However, in some sense, the government's policies were a victim of their own success. With prices falling sharply, leaders worried of a repeat of the mid 1990s. Instead of proceeding with market reform, leaders actually opted to try to exercise greater control over grain prices by price protection policy..

In fact, leaders in the late 1990s attempted to curb market forces more than in earlier retrenchments but a complete different measure. Market intervention policy shifted from taxing grain producers through lower government quota procurement price

(lower than market price) to prevent grain price falling through implementation of grain protection price (higher than market price). To reduce the financial burden of protection price policy, in 1998 the central government initiated a controversial policy change prohibiting individuals and private companies from procuring grain from farmers.[1] In contrast to past policies, grain quota procurement prices were first time set at a level more than market prices, which meant a transfer in favor of those farmers able to sell at that price (Huang and Chen, 1999). Leader expected that they could monopolize grain markets through the commercial arms of grain bureau, and that the grain bureau would be able to sell the procured grain at an even higher in the market and meet the nation's goal of raising farmer income. If the state could have exercised monopoly power in grain markets, it is possible that they could have implemented the price supports while enabling the state grain companies (i.e., the commercial arms of grain bureau) to earn a profit and while reducing the government's financial burden of maintaining the state-run grain procurement and marketing system. The loser under this policy would have been the consumer who would have had to pay a higher price for grain.

The win-win (from the government's point of view) policies, however, did not work, primarily because the government could not suppress market activities of traders and the commercialized grain system employees. While the above market prices were offered to farmers in some years, cash strapped grain bureaus could not procure all of the grain that farmers wanted to sell. Grain production increased, but since grain bureaus were trying to sell grain to urban and commercial users at above market prices, they had few takers. Unable to stop the activities of millions of private grain traders, urban users

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[1] Farmers were supposed to deal solely with the commercial arm of grain bureaus and the grain reserve system--although traders were allowed to operate in wholesale and retail markets.

continued to buy from their original channels at market set prices. Not surprisingly, stocks started to accumulate, the real price in the market fell even further, and the commercialized grain bureaus that had been forced to buy grain at high prices, now had huge stocks of grain that was worth less than they had bought it for and their debts rose greater than ever.

In the early 2000s, marketing reforms were once more launched. Restrictions on marketing were removed. New efforts to commericialize the grain bureau were begun. The support prices that had been given to some farmers in some areas were eliminated. In short, a new effort was made to push the policy environment to be even more market-oriented. In fact, as seen from this recounting of nearly 25 years of reform, marketing reform has been an on again / off again policy effort. When grain prices are low and grain relatively abundant, markets are liberalized. Policymakers make efforts to curb market actions, however, in times of rising grain prices. What is unclear, however, is how effective the policy were in dampening market activity or facilitating the operation of well-functioning markets. It is to this question that we turn to in the next three sections.

**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.

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) and allows us to look at price behavior after 2000. For maize, on a weekly basis between August 10, 1998 and February 24, 2003, weekly prices are reported 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 (Meyer, 2002). Since September 7, 1998, there is a price from Liaoning for Dalian, the main port from which exports to foreign and other domestic markets (by ship) leave. For a smaller set of markets, between October 26, 2001, and they continue through February 25, 2003 there is another dataset (*dataset 3*) that 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 and seventh day of the week).

**Price Trends and Spatial Patterns of Market Emergence**

In this section, we use the data on prices to describe China's agricultural markets. To do so, 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 more rigorously examine transportation gradients in China's rice, maize and soybean markets. To put the results in perspective, we examine these over time and compare

those of China with those of the US.  Our hypothesis 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, then our data are producing quantitative evidence that China's markets are emerging as functional and increasingly efficient.

**Price Trends**

**Maize**.  Using data set 3, we can see how closely prices in Northeast China track each other (Figure 1, Panels A and B).  In Panel A we plot the Dalian domestic price versus the prices in the three Heilongjiang market sites (chosen because they are the furthest Northeast markets from Dalian).  While varying over time, the Dalian domestic price remains about US$127/mt between December 2001 and February 2003.  During the same period, the prices in each of the three Heilongjiang markets move almost in perfect concert with one another.  While also varying over time, the prices in Heilongjiang during the post accession period are around US$110/mt to US$115/mt.  Visual inspection also 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 (Panel B).   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

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province, Dalian, are easily perceptible.  The narrower price gaps among producer (lower trend lines) and user areas (higher trend line) are a reflection of the closer distance (than when compared to Heilongjiang-Dalian figure).

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 (a shift from low to high or high to low) 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 2, demonstrate that prices in Heilongjiang appear to depend on shifts in feed demand and corn availability in Guangzhou and Fujian. Although not report here, we find soybean prices similarly move together for pairs of markets both in the same region and across more distant locations.

**Market Integration in China**

In this section we use more formal tests of market integration.   To do so, we use traditional cointegration analysis to examine how prices move together over time.  We do the analysis in several time periods, the late 1990s for rice, maize and soybeans (using dataset 1).  Because we use the same data as used in Park et al. (2002), we can compare the results with those from the early 1990s.  Using dataset 3, we also examine

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cointegration for maize and soybean markets. For a description of our cointegration methodology see Huang et al. (2004).

The results of the cointegration analysis illustrate that China's markets have continued to develop in the late 1990s, especially when the results are compared to the market integration research in the late 1980s and early 1990s (Table 4). In middle part of the reform era (1988 to 1995), a time when markets were starting to emerge, between 20 to 25 percent of markets showed signs the prices were moving together during the study periods and sub-periods (Park et al., 2002). According to the Park et al. findings, although there were many market pairs in which prices did not move together, between the late 1980s and mid-1990s, there was evidence of rising integration.

Using the results from the early 1990s as a base line and using dataset 1, our current analysis shows that during the late 1990s, China's markets continued along their previous path of maturation. In the late 1990s, examining the co-movement of prices among pairs of markets in our sample, we see a significant increase in the fraction of market pairings that are integrated. In fact, some markets in China are remarkably integrated. In the case of maize, for example, in 89 percent of the cases, prices in one market move at the same time as in another (Table 4, column 2). This is up from only 28 percent of the time in the early 1990s. The share of market pairings (for soybeans, japonica rice and indica rice) that exhibit price integration also increases (rows 2 to 4). The integration of these markets is notable because in many cases, the pairs of market are separated by more than a 1000 kilometers. For example, we find soybean and maize prices in many years to be integrated between markets in Shaanxi and Guangdong provinces and between those in Sichuan province and southern Jiangsu.

Despite the significant progress in terms of integration, our results do also show that there are pairs of markets during different years that are not integrated. After 2000, however, this begins to change. The results of the cointegration analysis for maize in the post 2000 period (using dataset 3) also support both our descriptive findings and the conclusions of the determinants of commodity price analysis. Using our statistical analysis, all pairs of markets in the Northeast are integrated in a statistically significant way (Table 5). Compared to the results in the late 1990s (reported in Table 4 and discussed in the previous subsection) our analysis shows that during the post-2000 period maize markets in China have continued to become more integrated. Literally all pairs of markets (100%) in the Northeast sample are integrated.

Soybean markets in the post 2000 period are also integrating rapidly. Correlation coefficients among all major soybean markets show the high degree of price comovement (Table 7). In 28 out of 36 unique pairs of markets, the correlation coefficient exceeds 0.9. In most cases, the coefficients are above 0.95. In the other 8 cases, the correlations are still high. In no case does the coefficient fall below 0.86. Clearly even between markets as distant from each other as Heilongjiang and Guangdong, prices are correlated. Formal cointegration analysis confirms the results of the correlations. According to our results, all of China's major soybean markets are now integrated with markets in China's two regions in the nation's soybean markets, Heilongjiang and Guangdong (Table 8).

**Market Emergence and Specialization**

Few authors have attempted to quantify the gains from market liberalization. Part of the problem may be the short period of analyses, the inability of standard methodologies and measures or indicators of market liberalization to separate efficiency

gains of market reform from overall gains in the reforming economy. According to our reading of the literature, in only three papers have there been an attempt to isolate empirically the effect of reforms that facilitate the emergence of markets. In deBrauw et al. (2004) it is shown that there is a positive effect of increasing marketization on productivity. Lin (1992) and Huang and Rozelle (1996) finds a similar results. In all three of these papers, the authors conjecture (without an empirical basis) that the gains are due in part to increasing 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 national representative survey of 400 communities. 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 speciality commodity.

The results of our survey show that indeed specialization has been occurring in China's agricultural sector. Between 1995, the percentage of villages that are specializing in an agricultural commodity has increased sharply and has done so in every province (Table XX, columns 1 and 2). On average, throughout our sample from across China, 30.33 percent of China's villages are specializing, up from 21 percent in 1995. Although the percent of villages that specialize has risen in all of our sample provinces, some (e.g., Liaoning, Inner Mongolia and Shanxi) have risen faster than others (Hebei, Henan and Shaanxi). The percent of area sown to the speciality crops has also risen,

rising across our sample average from 13 percent of total sown area in 1995 to 24 percent in 2004 (columns 3 and 4).

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 speciality products is what is driving the specialization (Figure XX). 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. The diversity of specific crops can be seen in Appendix Table 1.

Interestingly (and perhaps surprisingly), the propensity to specialize is not correlated with either income levels or the geographical location of the village, implying that poorer farmers may be equally or even more responsible for the rise of specialization (Table XX). For example, in villages that have incomes in the top 25th percentile, only XX percent of villages are specialized; in contrast, XX percent of those in the poorest 25th percentile are specialized (rows XX). Villages further away from county seats are less likely to be specialized than those that are further away (rows XX). While initially this may be somewhat surprising, when it is remembered that many speciality crops are labor intensive (Huang and Chen, 1999) and that access to off farm jobs is more favourable to those that are in better off and less remote areas (deBrauw et al., 2002), the rise of China's markets can be seen to have provided new possibilities for those rural residents that are poorer, have lower opportunity costs and live in more remote areas.

## Institutional Environment in China's Marketized Economy

The purpose of the section is to document the nature of some of the important institutions that will shape (or have the potential to shape) the environment within which farmers live and work in the coming years. Because markets are so competitive, if the institutions that are emerging during this time affect financial returns and economic opportunities in the rural sector, they could have a dramatic effect on producer well-being. In particular, we will examine two institutions: the supermarket sector and farmer professional associations.

### Supermarkets in China

Before the early 1990s, the structure of China's food retail markets was fairly simple. Most of the fresh fruits and vegetables and a large fraction of the meat were sold through private traders operating in wet market venues that were set up and regulated by urban marketing authorities. Groceries and other dry food goods and other miscellaneous goods were mostly sold through state-owned food stores. In some metropolitans by the 1980s a fraction of the state-owned food stores were contracted out to individuals that were gradually beginning to operate their outlets as private businesses. In other metropolitan areas, a small *denovo* sector was gradually emerging. However, food retailing was still heavily influenced by state policies and regulations and the distribution system was highly fragmented. There were no large-scale, self-service format stores like those that were so common in most developed countries.

In contrast, the food retail sector changed extremely fast in the 1990s. In this section, we use the term "supermarkets" for simplicity to mean the full set of modern retail formats (supermarkets, hypermarkets, club and discount stores, cash and carry all as

large formats, and chains of convenience stores), and differentiate where needed.  Note that the China Chainstore and Franchise Association (CCFA) defines a hypermarket as selling food and nonfood products, and having more than 5,000 sq. meters of floor space; a supermarket has from 300 to 4999 square meters, and a convenience store, less than 200 square meters. These definitions are similar to those internationally.

*Patterns in Growth in the Supermarket Sector in China*

Above all, supermarkets have spread extremely quickly and have radically changed the face of food retailing.  In comparison with the experience in the US and Western Europe, China's supermarkets have emerged rapidly.  The growth has even surpassed that in regions known for the rapid rise in supermarket, such as Latin America and Central & Eastern Europe.

In fact, the supermarket growth is best described as an exponential curve. Starting from a literal handful in Shanghai in 1991, the number of supermarkets has risen to many thousands by 2003.  Table 1 shows this growth.  Growth was fast but from a low base in the first half decade from the start in 1990 to 1994.  By 1995 it was a billion dollar industry. By 2002 it had become roughly a 55 billion dollar industry: the data in Table 1 are from CFFA (2003) and show fully Chinese chains as well as the 22 foreign-invested chain sales, and totals 55 billion dollars in 2002. The additions to sales and stores each year are very large numbers, even though the rate of growth has "slowed" (although not nearly as much as wholesale markets growth slowed at the same point) from the rates of the early years to "only" about 30-40% a year, still much faster than GDP/capita growth. All indications are that even this very fast growth rate is now set to

multiply, based on the plans for massive investments by foreign and domestic chains alike, with the relaxation of the retail FDI regulations this year.

Individual chain expansions give a specific "window" through which to see this amazing expansion. CIES Food Business Forum News of the Day (April 5, 2004) notes: "Chinese retailer Lianhua Supermarket Holdings announced on Friday a 29% rise in net profit to 163.6 million yuan (US$19.8 million) for 2003. The company said that the profit increase was driven by store expansion and sales growth. Total revenue rose 59% to 9.28 billion yuan (US$1.1 billion). Lianhua, which is China's largest supermarket operator, plans to invest 600 million yuan (US$72 million) in opening 700 new outlets this year. The retailer currently runs around 2,500 grocery stores across several formats."

By 2002, approximately 36,700 of the stores making these sales are large format (supermarkets, hypermarkets, discount stores, club stores) and 16,400 are chain convenience stores. CCFA (2003) notes that in 2002, the average hypermarket had 28 million dollars in sales and 9400 square meters (with 22k the largest), an average supermarket, 4.4 million dollars and 1960 square meters of floor space, and a convenience store, 216,000 dollars with 109 square meters.
Hence, convenience store chain sales only represent roughly 3.5 billion dollars of sales, about 5% of the supermarket sector's sales; this is very much in the range one finds in for example Latin America, with numerous stores but low share of total sales.

The rise of a sector that generates 55 billion dollars of sales, even taking into account the overall expansion of all retail in China as incomes soared over the past decade, means a considerable number of small shops, not to mention SOE foodstuff stores, were put out of business. There are no statistics on this, but one can imagine the

following: Mousteraski (2001) estimate that an average supermarket has about 20 times the sales of a small shop (and as a convenience store), one of which has about 200,000 dollars of sales a year. The supermarket sector is thus the equivalent of about 350,000 small shops (the number is probably larger because most traditional mom and pop stores are smaller than convenience stores). Some (perhaps large) portion of that number had to go out of business to "make way" for the supermarkets; this is confirmed by the various retail interviews we undertook.

In addition, there is evidence of consolidation and multi-nationalization of the supermarket sector in China, much as has been happening around in the developing regions in the 1990s/2000s (Reardon, Timmer, Barrrett, Berdegue, 2003). Table 2 shows that the top 9 Chinese-only chains (as reported by CFFA 2003) had 9.4 billion dollars of sales. As noted above, the top 6 foreign-invested chains (Carrefour, Wal-mart, Metro, (Taiwanese) Trustmart (being purchased by Tesco) and (Taiwanese) RTMart), all of which are similar in size range to the top 9 Chinese-only chains, have another 6 billion dollars of sales. Hence, the top 15 have about 16 billion, or only about 26% of the supermarket sector (a similar level of concentration to that in the U.S. circa 1985). This means that for the sales of the top 15 chains, the foreign share has gone from near nothing in mid 1990s to 43% today; CCFA (2003) reports that the 22 foreign chains have together 15 billion dollars of sales. According to Reardon et al. (2004), consolidations in China's supermarket industry are just starting.

Finally, supermarkets are spreading throughout China. The movement also is going in multiple dimensions. For example, supermarkets have spread well beyond their initial niche in the middle/upper-income neighborhoods of the largest cities of the central-

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eastern and southeastern coastal regions – into other regions, small cities and towns, and beginning to penetrate the food markets of the urban poor. Chains are also differentiating their formats as they spread. The general evolution of formats in the 1990s was from small to larger supermarkets and then the introduction of hypermarkets (first by foreign chains and then by domestic chains), which are usually introduced to reach the mass market, at the end of the 1990s and early 2000s. In recent years, retailers have used new formats to penetrate low-income niches with a low cost, no frills format. Other chains have introduced membership clubs for bulk buying.

*Supermarkets: From processed to fresh*

Supermarkets are also making inroads first into fresh foods. In the early years, most all sales were of processed foods and those foods that did not perish. Large storage facilities and bulk merchandising give supermarkets an advantage over small shops (and when one adds self-service, over SOE foodstuff stores) in selling processed, packaged and bulk foods, such as edible oil, grains, noodles, and condiments. These factors allowed supermarkets to quickly penetrate the processed dry foods markets in the 1990s in urban China. For example, ACNielsen (2003) notes for example that in a subset of processed foods, "crispy snack food", the supermarket share went from 50% in 2000 to 65% in 2001 in urban China.

A second category into which supermarkets have moved very quickly in the past half decade is processed semi-fresh foods such as dairy products, tofu, and processed meats. Recent evidence shows that supermarkets in the main cities have been a key factor driving, and have captured the majority of the milk products market, in turn a market that has grown extremely fast over the past half decade (Hu, Fuller, and Reardon, 2004; dairy

products marketing specialist in Shanghai wholesale firm, personal communication, March 2003, and USDA, 2002).

However, the slowest market penetration by supermarkets, by product category, is of fresh foods such as FFV, meats, and fish. For instance, it is roughly estimated that supermarkets only have a 10 or at most 20% share in fresh foods in the major cities (Gale, 2004). The wetmarkets are still dominant, due to (usually) lower prices due to not paying taxes, freshness, and variety. In China, the penetration is slower because consumers have traditional patterns of daily purchase of fresh products that only slowly are dismantled under the impetus of retail market transformation.

There are several signs, however, that this is changing, perhaps faster than most market analysts figure. (1) Over the past year, major chains have begun a policy of pricing the fresh product "staples" (such as basic greens, some fruit, chicken, perch, and pork) at the same prices as in the wetmarkets. According to Reardon et al. (2004), the expansion of the fresh food market share reflects the strong intention of supermarket chains to quickly become competitive in fresh products.

As FFV sales have risen, one hypothesis is that there will be major changes in fresh foods procurement systems. According to interview of leading supermarket chains, the shifts in FFV procurement started over the past few years is accelerating. There are also a lot of discussion about the types of changes that want to be made. In other countries, it is often hypothesized that the demands of supermarket procurement means that smaller, poorer, more remote farmers will be left out in favor of larger farmers that are closer to cities, producers that are better able interact with the procurement firms that are making new and stringent demands on buyers. Interestingly, while we do see

increasingly specialization (a sign that would be consistent with the rise of more demanding procurement conditions, as seen in the last section, the specialization has been taking place mostly in the poorer, more remote areas. (Unfortunately, our survey data did not include questions on channels of procurement so it is unclear if the rise in specialization is a response to the rise of traditional wholesale markets or the rise of supermarket-driven procurement.

**Farmer Professional Associations**

In a modern society which is dominated by markets and assets and information are mostly in the hands of private individuals and enterprises, the government is going to be unable to look out for the needs of farmers, especially in the pursuit of farm production and marketing activities. Hence, the government needs partners to carry out its task of trying to ensure farmers can make a living from agriculture in an economy dominated by markets. This is especially true when farmers have little land and a lot of labor and markets function well. In such a situation, the returns to land and labor are going to leave the farmer with only a low income. Farmers need to be able to have access to the best technologies and be able to capture more of the marketing chain in order to raise their incomes. The pursuit of many of the tasks needed to do this, however, when a farmer is on his/her own is almost expensive and sometimes impossible. Acting together in some cases can allow individual farmers to overcome the high costs of technology acquisition and marketing. As such it is important at this point of its development that China begins to encourage the development of truly independent non-state organization, including those organizations that will act as information networks, business support groups, marketing systems and credit cooperatives. In looking at the

experience of Japan, Korea and Taiwan, the rural economy in China is in need of the emergence of active and strong Farmer's Professional Association (FPAs) to help the rural population carry out a number of the productive and consumption-oriented activities that are needed for rapid growth. This role, however, needs to be understood because of the pervasiveness of markets and the rise of institutions, such as supermarkets, that potentially could radically change relative prices faced by farmers as well as access to marketing channels.

Surprisingly, although the role of FPAs in rural China is beginning to be discussed again in academic and policy making circles, such institutions in China are still relatively low profile and little is known about them. It has been stated that there are more than 100,000 farmer associations in China (World Bank, 2003). The Ministry of Agriculture claims that the current association includes millions of farmers (Zhou, 2003). The source of these numbers, however, is unclear. Any numbers that are reported also have to be treated with caution since the structure of most is still ill-defined and there are no standards on which reports from FPAs are based..

To overcome the absence of information on such a key part of China's future development process, the main goal of this section is to report on the results of a survey designed to provide a picture of the current status of FPAs in China. In this section, we try to establish a baseline of the size of the FPA movement in China, its rate of growth and the scope of their activities and seek to find what factors are inducing the emergence of FPAs.

*Data*

At the heart of our analysis is our data set. We use a unique set of data on the institutions and development investments in rural China collected by the authors in 2003. The authors and several Chinese and foreign collaborators designed the sampling procedure and final survey instrument with the village as the unit of analysis. The field work team, made up of the three authors and 30 graduate students and research fellows from Chinese and North American educational institutions (all with PRC citizenship and an average education level higher than a masters degree), chose the sample and implemented the survey in 6 provinces and 36 counties in a nearly nationally representative sample. The sample provinces were each randomly selected from each of China's major agro-ecological zones. In total when visiting 36 counties, our enumerator teams visited 216 townships and surveyed more than 2400 village leaders.

after answering questions about the economic, political and demographic conditions of their villages in 1997 and 2003, the respondents answered a set of 25 questions about the activities of FPAs (if there were any) that were operating in or around their villages. The questionnaire was designed to elicit information about the size of the association, its coverage, its main functions, information about its charter, registration rules and internal organization. The survey also included a section that attempted to understand how the actions of government agencies affected the start up of the associations.

**Farmer's Professional Associations in China**

In this sub-section we will examine the number of villages that report to have any sort of FPA, regardless of the characteristics. We then will use information to identify those FPAs that have met a number of criteria (e.g., having a certification or being

officially chartered) that are thought to typically define a *formal association*. We also will identify those FPAs that have characteristics (e.g., they are not registered as a commercial entity at the Market Administration Bureau or those associations in which government officials do not have decision making authority) that make them appear to be a *functional association*. In most of the report, we will examine the nature of FPAs according to both of these definitions.

When leaders from the 2459 sample villages were asked the *unqualified* question, "Are any farmers in your village currently participating in an FPA?" only a small fraction of the respondents responded affirmatively. According to our data, 251 villages reported that their farmers participated in some form of FPA. Since some villages had farmers in more than one FPA (2 village reported activity in 4 FPAs; 3 villages reported activity in 3 FPAs; 23 village reported activity in 2 villages), in total during the course of our survey enumerators discovered 290 FPAs were at least present in the sample villages.

Although the sample size was relatively small (only 0.35 percent of China's villages), with a number of assumptions the random nature of our sample allows us to make an estimate of total FPA activity in China. When we account for the probability of observing each of our villages according to their population proportion (that is weighting our descriptive statistics by the sizes of the population of township, county and region of each observation), our survey finds that 10.21 percent of China's villages have FPAs (Table 1, column 1, row 1). Using the weighted statistics (*as we do in the rest of the report*) and extrapolating from our sample to the rest of China, we estimate by about 75 thousand villages at least nominally have FPAs (row 2). Moreover, according to our data on average 28.5% of the households in each village is part of the village's FPA. Hence,

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our data suggest that about 2.91 of China's farm households, or about 6.93 million households, nominally have an association with an FPA (rows 3 and 4). Interestingly, these numbers of unqualified FPAs are surprisingly close to the figures reported by the Ministry of Agriculture which has reported during various speeches and interviews that about 100,000 villages had FPAs, which includes 4 to 5 percent of China's households. In short, although as a percentage of all of villages only a small share of China's village have FPAs, but in total we do find that there is a large absolute level of FPA activity in China.

When more carefully categorizing the reported FPAs into those that follow more *formal* rules (without regard to how they function); those that *function* according to standard definitions of associations (as opposed to commercial units or government programs); and those that are only nominally FPAs (or those that are merely FPAs in name), we produce what we believe are more informative estimates of FPA activity in China. The exact method of sorting FPAs into those that are functioning and those that are formal is discussed in Shen et al. (2004), but the bottom line is that after removing both those FPAs that clearly were operating as firms (and only using the name of an FPA) and those FPAs that were inoperable and/or completely ineffective, there were significantly fewer FPAs (Table XX).

We also can use our data to try to paint a picture of role that FPAs are playing in China and where they are appearing. When examining the emergence of FPAs, there are three fairly distinct time periods: the early reform era; the mid-1990s; and the recent years (Table 4). The early reform period was one of almost no systematic activity in terms of FPAs. In our sample of more 2000 villages, only 14 villages saw any

FPA activity before 1994 (rows 1 to 6). During the first half of the reform era, only 5 percent of all of the post-reform FPAs emerged (column 2). Moreover, the activity appears to be relatively idiosyncratic. In short, before the mid-1990s there was almost no FPAs in China and when they did arise, they appear literally all over the map.

In the mid 1990s, however, just at the time that fruit and vegetable production began to expand rapidly in China, there was a noticeable rise in FPA activity (Table 2, rows 7 to 10). Between 1994 and 1997, on average, about 8 to 9 new FPAs emerged each year. While the total rise of FPAs only accounts for 11 percent of the total increase in the reform era, it is perhaps notable that it was occurring at all given the focus of China's government at this time on grain fundamentalism.

The fastest expanding period of FPAs has occurred during the past 5 years. Villages started fully 84 percent of all FPAs since 1998. On average, nearly 40 FPAs per year were started in our sample villages during the recent 6 year period, a time in which the government certainly was giving farmers mixed signals: promoting structural adjustment on one hand, while beginning a period of a subsidizing staple grains on the other. In other words, during the past five year there has been a noticeable acceleration in activity; indeed if the accelerating trend were to continue, there is no doubt that FPAs would begin to become a more formidable and widespread institution.

According to our data we find that all of the sample provinces have FPAs, though some have more than others. When weighting by provincial populations (instead of regional populations as we do in the rest of the paper), we find that Sichuan province has the most FPAs (Table 5, columns 2 to 4). No matter if we are examining total number of reported FPAs (32 percent), formal FPAs (35 percent) or functional FPAs (35 percent),

Sichuan ranks first in terms of number of associations. It should be cautioned, however, that the main reason that Sichuan has the most FPAs is due to the size of its population. Sichuan also has the largest population share of any of the sample provinces (column 1). When considering this, then, Sichuan actually is about average when it comes to FPA participation. The share of FPAs is almost the same as its population share.

Although our data are fairly well distributed across provinces (with certain exceptions as noted above), when examining our FPA participation data by county, we find that there appears to be a significant amount of clustering that occurs at the county level (Table 6). For example, there are three counties (8 percent of the sample counties) that have no FPAs at all (column 1) and 21 counties (58 percent) that have only 79 FPAs (27 percent—column 2). In contrast, in 12 sample counties, we find 211 FPAs (column 3). In other words, one third of the counties hosts nearly three quarters (73 percent) of the FPAs. While we have not pinpointed the reason for such clustering—it is possible that it is due to either local policy effort or because some regions have higher demands for the services of FPAs—a finding is still of interest and would be important to those wanting to study or work with FPAs.

When examining the location of FPAs along a rich region/poor area spectrum, we find that there are consistent non-linear patterns that occur with examining total reported FPAs, formal FPAs and functional FPAs (Table 7). For example, in the case of functioning FPAs, villages in the poorest quartile have formed 21 percent of the associations (column 3). The FPA participation rate, however, falls to 15 percent for the second quartile (the lower, middle income category). As villages move into the third and highest income quartiles villages again become more likely to participate. Indeed,

villages in the richest one-quarter of our sample have formed 40 percent of the functioning FPAs. While the results suggest that households in better off villages have a higher propensity to being functioning FPAs, those in poor ones also do. Interestingly, although as we saw above there is considerable difference between the cohort of villages that have formed functioning FPAs and those that have formal FPAs, the pattern across income space is fairly similar.

An even more distinct, although still somewhat non-linear, pattern appears when examining the location of FPAs in relation to China's main economic centers (Table 8).[2] When examining the villages in the most remote quartile (i.e., the 25 percent of the villages that are in counties at least 460 kilometers away from an economic center), we find little FPA activity of any kind (row 2). For example, only 5 percent of functioning FPAs are in the most remote quartile. In contrast, 59 percent of functioning FPAs are in the quartile of villages closest to China's main economic centers. If functioning FPAs are providing technological and marketing services for farmers that are seeking to interact with institutions that are emerging with the rise of China's agricultural marketing system, our data shows that either leaders or farm households (or both) are more willing to start FPAs in regions that are closer to China's large centers of economic demand. According to Fulton (2004) such patterns of FPAs with respect to income and proximity to a metropolitan region are unique; cooperative activity in most countries is typically highly correlated (positively) with income and proximity.

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[2] In our analysis we assume that China's economic centers are the metropolitan cities that lie in the center of G. William Skinner's core-periphery macro regions (Skinner, 1994) and assign a number, measured in kilometers, to each county based on the distance of the county from the nearest major economic center. For example, in Sichuan we measure the distance of each county from Chengdu. In Gansu, since there is no economic center in the province, we measure the distance between each county and Xian, the capital of the neighboring province, Shaanxi.

When villages in China finally do begin to form associations, the targeted activities includes a wide range of activities in the rural China (Table 9). According to our data, 70 FPAs (or 24 percent of FPAs) are involved in cropping activities, which includes all field crops, cash crops and vegetable and specialty crop producing organizations. While grain and cash cropping FPAs are the most prevalent across China in terms of sown area, the proportion of villages with FPAs that are primarily involved with grain and cash crops are relatively rare. Only 31 percent of cropping FPAs (9 percent for grain—6 FPAs— and 20 percent for cash crops—14 FPAs) are devoted to grains or cash crops. In contrast, vegetables and specialty crops have relatively more FPAs, given their relative shares of sown area. More than one-quarter of cropping FPAs focus on vegetable production (18 FPAs). More than 40 percent concentrate on specialty crops (27 FPAs), such as medicinal herbs, mushrooms and watermelons. However, more than any other group, the most intensive activity occurs in fruit producing areas. Although the orchards only make up about 5 percent of China's sown area, they account for 18 percent of all FPAs (Table 9). In part, the greater intensity of FPAs for orchards may be explained by the greater needs for farmer assistance in both upgrading orchards technologically and in assisting them in their marketing efforts. Finally, the largest concentration of FPAs is engaged in livestock operations. Just less than half (44 percent or 128 FPAs) are involved with livestock (Table 9).

*Determinants and barriers to FPA emergence*

In summary, then, there are a number of findings and implications of our work. First, FPAs do exist in China; however, they are still in a fairly early stage of emergence. About 7 percent of villages in China have functioning FPAs. Only around 2 to 3 percent

of China's households participate in any type of FPA. Although the level of participation is low, in recent years the pace of emergence has risen rapidly and appears to be accelerating.

We also find that although FPAs summarily are in richer villages, there are substantial numbers poorer areas. There is a non-linear relationship between income and FPA participation. One of the most distinctive correlates of FPAs is the distance from a major economic center. As villages move further away from major economic centers, FPA activity falls rapidly. This means that if households in more remote areas are going to start FPAs, they will require substantially more help than in the past.

It is difficult currently to determine what is aiding the emergence of FPAs and what is blocking their emergence. Interestingly, we find little spontaneous (or strong) relationship between specialization and marketization (for small businesses) and FPA emergence. It could be that our measures are just not very sensitive. However, it could be that the environment is such that household can not easily or spontaneously begin FPAs. If procurement channels of supermarkets are demanding specialization, it is unclear if FPAs will emerge in a way that will aid producers in those areas that need technical and marketing assistance.

On the other hand, the government clearly has a big influence on the emergence of FPAs—of all types. The pervasiveness of government influence may mean that they have been a disruptive force (since many do not function) or it may mean that FPAs need the government to initiate them. Such a finding may mean the those in charge of the rural economy may consider to adopt a system like that used in other countries in which government employees are hired with the explicit job to be an advocate for the starting

and operating of FPAs.  Such an official would be rewarded to the rapid expansion of

FPAs as long as they developed in a way that were pro-farmer and positively affect rural

welfare.

Although the impetus to meet and act as a group must be from the farmers

themselves, the government can create an environment in which FPA can thrive.  *First*,

leaders need to develop laws and regulations that promote and protect FPA.  The legal

status of groups needs to be clear.  FPA need to have the ability to enter into contracts

and take loans.  Also beneficial would be regulations that enable farmers to organize

themselves into locally-run credit cooperatives.  FPA need the authority to be able to act

for the members of their group as well as to be subject to well-designed regulations that

protect the membership from the leadership, including the way in which the leadership is

selected and monitored.  FPA leaders tell us the lack of formal, annual membership fees

is hurting their efforts to expand, since every effort to act as an FPA often must be

accompanied by an assessment of fees on members.

Finally, the experience of FPA in other countries has shown that even when a

favorable legal and regulatory framework exists, an independent catalyst (that is,

someone or group outside the government) is often needed to get FPA started, expand

and perform better.  While China has a number of FPA-promoting agencies, these

institutions are controlled by the Government. Alternative models should be sought to

create catalysts that are first and foremost responsive to the needs of farmers' and FPAs.

The main role of such an advocacy organization is not to control FPA, but to facilitate

their creation and provide information that allows its members to promote the interest of

the association.

**Conclusions**

In this paper, we have shown in a number of ways the steady improvement in agricultural commodity markets that have occurred in China during the past decade. Regardless of using descriptive statistics or more formal techniques, our results are consistent with the emergence of markets for rice, maize and soybeans. Moreover, markets are robust, even when looking across long distances and at different time periods. Transaction costs also appear to have continued to fall.

Although people that visit rural China are not surprised, such a picture of markets may be surprising when juxtaposed against the policy background. During this period when we have measured the steady increase in performance of markets, there has been a unbroken cycle of reform and retrench. Hence, despite attempts to slow down or stop the operation of markets during this time commodity markets have steadily strengthened in rural China.

The power of markets to continue to integrate despite policy intervention attempts perhaps more than anything shows the power of China's gradual method of transition. As argued by McMillan (1997), China's market reform has really been one of entry-driven competition. In case of China entry has come from both the commercialization of the state and the emergence of a private trading sector. In doing this, China enfranchised millions of individuals to be involved in commodity trade. While this has produced the rise in integration and fall in transaction costs that has been documented in the paper, it also has eroded the power of the state to control the markets with the traditional command and control methods. Our results suggest that if the nation's leaders want to

control markets in the future, they are going to have to devise new ways to intervene, ones that use indirect methods instead of trying to suppress traders. There are now just too many traders to deal with as shown by the integration trends that continued to increase even when the nation tried stop trading.

Indeed, one of the real lessons of our work is that both China's leaders and domestic and foreign traders and other observers should realize that rural China now has among the least distorted and most integrated agricultural markets in the world. Of course, for poverty alleviation and other purposes this is often a two-edged sword. However, with good markets, if policy makers make good investments and execute good policies, those that are involved with the production and consumption activities will benefit and such policies can be executed with a minimum amount of distortion.

**Table 1. Price and Log Price Determination Regression for All Periods (10/2001-3/2003).**

| Explanatory Variables | (1) Dependent Variable: Price at level (RMB) | (2) Dependent Variable: Log Price |
|---|---|---|
| Distance from Dalian (1000 km) | -54.4* (30.2) | -0.056* (30.35) |
| Distance*Group Dummy | -0.0235* (9.66) | -0.00003* (10.54) |
| Group Dummy | -89.55* (9.90) | -0.093 (10.02) |
| Constant | 1058.84* (165.24) | 6.97* (1064.88) |
| Time Period Dummies | Included | Included |
| Adjusted R-square | 0.82 | 0.83 |
| No of Observations | 1152 | 1152 |

Note: In the parentheses are t statistics. Coefficients marketed with * indicating statistically significant from zero at 1 % level.

The group dummy (gd) pick up one time period effect. When gd = 0, indicating early WTO accession period, gd = 1, indicating the recent period.

The F test statistic in (1) is $F[2, 1022] = 120.87$, in (2) is $F[2, 1022] = 133.66$. Both model reject the null hypothesis that there is no structure change.

Data source: Dataset 3.

**Table 2. OLS Regression Explaining Rice Prices in China 's Main Marketing Regions, 2000 (data source: dataset 1)**

| Explanatory Variable | Full Sample | South China | Yantze River | Yellow River |
|---|---|---|---|---|
| Dist-Port | -0.00004** | -0.0004** | 0.0001 | -0.00007** |
| | (-1.89) | (-4.38) | (1.30) | (-2.13) |
| Dist-Port$^2$ | +1.9*e-8** | +2.7*e-7** | -1.5e-7** | 2.8*e-8** |
| | (2.99) | (5.59) | (5.02) | (3.31) |
| Dist-Road | -0.005** | -0.004** | -0.008** | 0.0003 |
| | (11.6) | (7.10) | (5.36) | (0.31) |
| Dist-Rail | -0.001** | -0.001** | -0.0001 | -0.002** |
| | (5.60) | (7.18) | (0.06) | (3.22) |
| Region Dummies | | | | |
| South | 0.20** | | | |
| Yangtze | -0.04** | | | |
| Northeast | -0.06** | | | |
| Period Dummies | Included | included | included | Included |
| No. of Obs. | 1132 | 304 | 327 | 501 |

Table 3. Percentage change in price for every 1000 kilometers of distance from port

|  | **Maize** | **Soybean** | **Rice** |
|---|---|---|---|
| China 1998 | -4% | -10% | -10% |
| 1999 | -4% | -11% | -9% |
| 2000 | -3% | -8% | -7% |
| **US – 1998** | **-5%** | **-3.5%** | **na** |

Notes: Figures for column 3 (rice, China) from Table 2 (and sim ilar regressions for 1998 and 1999); figures for columns 1 and 2 (maize and soybeans, Chin a) from regressions for maize soybeans for China that are similar to those for rice. Fi gures for US from spot market pric es reported by the Chicago board of trade for 15 mark ets in 1998.

Table 4. Percentage of Market Pairs that Test Positive for Being Integrated based on Dickey Fuller Test in Rural China, 1988 to 2000.

| Commodity | 1989-1995 | 1996-2000 |
|---|---|---|
| | (Percent of Market Pairs) | |
| Maize | 28 | 89 |
| Soybeans | 28 | 68 |
| Rice, Yellow River Valley (mostly japonica rice) | 25 | 60 |
| Rice, Yangtze Valley and South China (mostly indica rice) | 25 | 47 |

Note: Results for two periods both use data from the State Market Administrative Bureau (SMAB). For results from 1989 to 1995 for maize and rice, see Park et al. (2002). Rice results are for the whole country in 1989-1995. Results from soybeans for 1989 to 1995 from Wang (1998). Results from 1996 to 2000 are by authors using Dataset 1.

**Table 5. Cointegration Tests on Northeast Maize Markets and Dalian Market**

| Region | Test Statistics | Lags | 5% Critical Value | Conclusion |
|---|---|---|---|---|
| **Augmented Dickey-Fuller Tests** | | | -2.89 | |
| 1. Center HLJ | -1.98 | 9 | | Each one is unit root and Proved to be I(1), stationary at $1^{st}$ difference |
| 2. East HLJ | -1.99 | 9 | | |
| 3. West HLJ | -1.78 | 9 | | |
| 4. Center JLN | -1.99 | 9 | | |
| 5. East JLN | -1.72 | 9 | | |
| 6. West JLN | -1.62 | 9 | | |
| 7. Center LNG | -2.24 | 10 | | |
| 8. West LNG | -2.07 | 10 | | |
| 9. Dalian port | -2.80 | 16 | | |
| | | | | |
| | | | | |
| **Augmented Dickey-Fuller Tests for Pair Markets** | | | | |
| 1. Center HLJ/Dalian | -3.34 | 9 | | All pair markets are cointegrated Dalian market is integrated with all other regional markets. |
| 2. East HLJ/Dalian | -3.49 | 9 | | |
| 3. West HLJ/Dalian | -3.16 | 9 | | |
| 4. Center JLN/Dalian | -3.49 | 9 | | |
| 5. East JLN/Dalian | -3.24 | 9 | | |
| 6. West JLN/Dalian | -3.33 | 9 | | |
| 7. Center LNG/Dalian | -3.98 | 9 | | |
| 8. West LNG/Dalian | -3.84 | 9 | | |
| | | | | |
| | | | | |
| Notes: 1. Augmented Dicky-Fuller test was implemented over the pair markets. 2. Guass program file "adf-test.prg" is used. 3. Data set used: dataset 2. Price series is bi-weekly and data are analyzed at the market level (that is, there are more than one observations per province) | | | | |
| | | | | |

**Table 6.  Cointegration Tests on Major Maize Consumption Markets and the Dalian Market, 1999 to 2003.**

| Region | Test Statistics | Lags | 5% Critical Value | Conclusion |
|---|---|---|---|---|
| **Augmented Dickey-Fuller Tests** | | | -2.89 | |
| 1. Dalian port | 0 | 7 | | Each one is unit root and proved to be I(1), stationary at $1^{st}$ difference |
| 2. Hubei | -0.8 | 4 | | |
| 3. Jiangsu | -1.89 | 10 | | |
| 4. Fujiang | -1.8 | 7 | | |
| 5. Guangdon | -1.71 | 7 | | |
| | | | | |
| **Augmented Dickey-Fuller Tests for Pair Markets** | | | | |
| 1. Hubei/Dalian | -2.46 | 6 | | Hubei and Dalian are not cointegrated |
| 2. Jiangsu/Dalian | -2.71 | 6 | | Pair markets are cointegrated with Dalian, 5%. |
| 3. Fujianf/Dalian | -5.09 | 6 | | |
| 4. Guangdon/Dalian | -6.15 | 6 | | |
| | | | | |
| | | | | |
| Notes:  1. Augmented Dicky-Fuller test was implemented over the pair markets.<br>2. Guass program file "adf-test.prg" is used.<br>3. Data set used: dataset 2 and 3. Price series are monthly and at the provincial level.<br>4. Johansen Test on all markets confirmed the results that there are 3 cointegrating equations.<br>. | | | | |
| | | | | |

**Table 7.  Correlation Coefficients between Each Price Series for All Soybean Markets in Data.**

|  | Guang-dong | Shang-hai | Jiang-su | Jiangxi | Hebei | Henan | Shan-dong | Tianjin | Heilong-jiang |
|---|---|---|---|---|---|---|---|---|---|
| Guang-dong | 1 | 0.998 | 0.997 | 0.996 | 0.874 | 0.914 | 0.916 | 0.865 | 0.926 |
| Shanghai | 0.998 | 1 | 0.999 | 0.998 | 0.874 | 0.918 | 0.920 | 0.863 | 0.926 |
| Jiangsu | 0.997 | 0.999 | 1 | 0.998 | 0.877 | 0.923 | 0.924 | 0.867 | 0.927 |
| Jiangxi | 0.996 | 0.998 | 0.998 | 1 | 0.891 | 0.933 | 0.935 | 0.881 | 0.940 |
| Hebei | 0.874 | 0.874 | 0.877 | 0.891 | 1 | 0.956 | 0.965 | 0.992 | 0.956 |
| Henan | 0.914 | 0.918 | 0.923 | 0.933 | 0.956 | 1 | 0.990 | 0.948 | 0.966 |
| Shandong | 0.916 | 0.920 | 0.924 | 0.935 | 0.965 | 0.990 | 1 | 0.955 | 0.971 |
| Tianjing | 0.865 | 0.863 | 0.867 | 0.881 | 0.992 | 0.948 | 0.955 | 1 | 0.946 |
| Heilong-jiang | 0.926 | 0.926 | 0.927 | 0.940 | 0.956 | 0.966 | 0.971 | 0.946 | 1 |

Data source:  Dataset 4.

**Table 8.  Cointegration Tests on China's Soybean Markets with Heilongjiang and Guangdong Markets as Center Markets.**
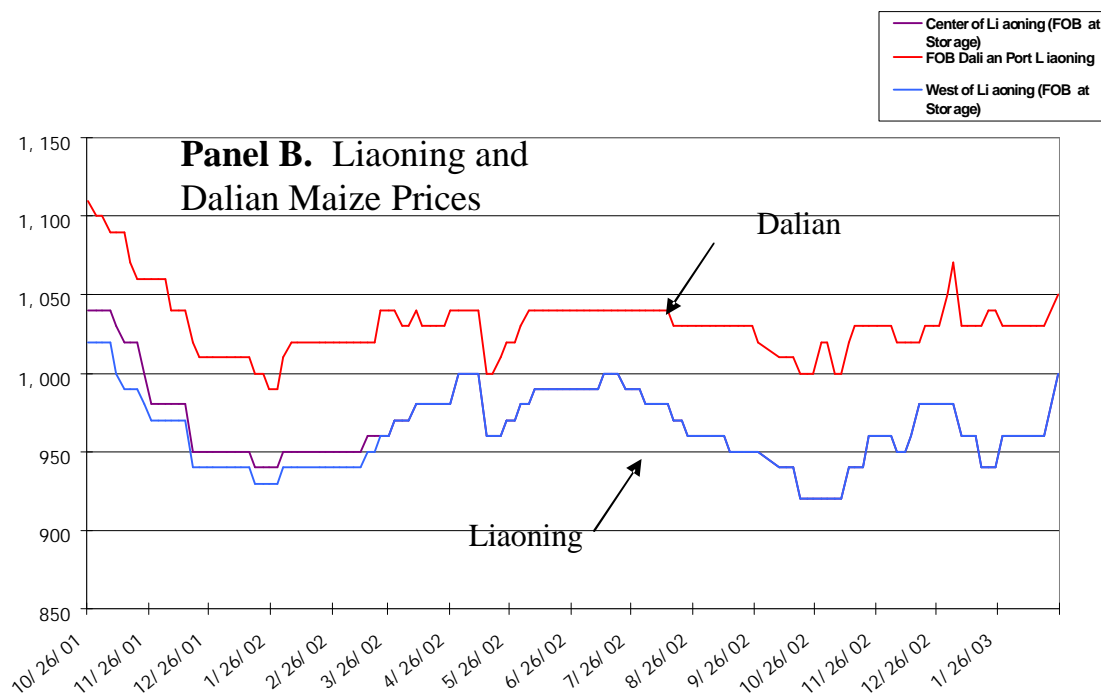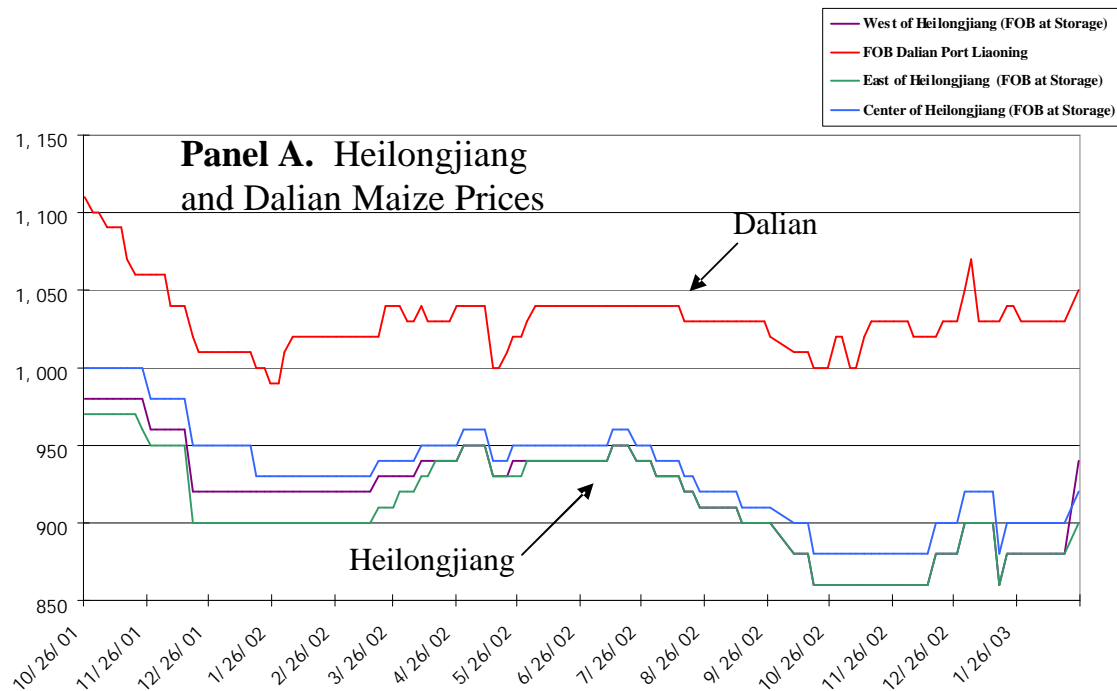
| Market | Test Statistics | | Conclusion |
|---|---|---|---|
| **Augmented Dickey-Fuller Tests** | 5% critical value with constant | | |
| | | | |
| Heilongjiang | -1.05 | | Each one is unit root, and thus, I(1). |
| Tianjin | -0.48 | | |
| Hebei | -0.26 | | |
| Shanghai | -1.15 | | |
| Jiangsu | -1.08 | | |
| Jiangxi | -1.09 | | |
| Shangdong | -0.33 | | |
| Henan | -0.17 | | |
| Guangdong | -1.22 | | |
| **Augmented Dickey-Fuller Tests for Pair Markets** | ritical value with constant and trend: (5%) -3.46 (1%) -4.06 | | |
| **Center Markets: Heilongjiang** | | | |
| | | | |
| Tianjin | -3.87* | | All markets are integrated with Heilongjiang market |
| Hebei | -3.73* | | |
| Shanghai | -4.11** | | |
| Jiangsu | -4.07** | | |
| Jiangxi | -4.23** | | |
| Shandong | -4.77** | | |
| Henan | -4.8** | | |
| Guangdong | -4.01* | | |
| | | | |
| **Center Markets: Guangdong** | | | |
| | | | |
| Heilongjiang | -4.1** | | All markets are integrated with Guangdon market. |
| Tianjing | -3.6* | | |
| Hebei | -3.54* | | |
| Shanghai | -3.61* | | |
| Jiangsu | -3.63* | | |
| Jiangxi | -3.67* | | |
| Shandong | -4.27** | | |
| Henan | -4.52** | | |
| | | | |
| Note: 1. Augmented Dicky-Fuller test was implemented over the pair markets.  2. Program in Eviews.  3. Data source:  Dataset 4 | | | |

Table 9. Ordinary Least Squares Regression Explaining Effect of Local Grain Availability on the Price Level of Major Crops in China's Villages in 2000 (Dependent Variable: Village-Level Price).

| Explanatory Variable | Rice | Wheat | Maize | Soybean |
|---|---|---|---|---|
| **Local Grain Availability** | | | | |
| Village Level Climate Shocks (Production Shock) [a] | - | - | - | - |
| Village Level Grain Storage at the Beginning of Year (Grain Storage) [a] | - | - | - | - |
| Interaction: Production Shock * Grain Storage [a] | -3.15e-06 (1.31) | 7.50e-07 (0.37) | -3.91e-07 (0.33) | .000045 (0.15) |
| **Control Variables** | | | | |
| Distance to the nearest county (km) | -.00074 (0.74) | -.0079 (2.1)* | -.0005 (0.55) | -.032 (2.76)* |
| Variables Representing Proportion of Grain Marketed during Each of First Three Months after Harvest | - | Included | Included | Included |
| Quality Dummies | Included | - | - | - |
| Provincial Dummies | Included | Included | Included | Included |
| Adjusted R-square | 0.16 | 0.38 | 0.50 | 0.15 |
| No. of observations | 31 | 30 | 28 | 17 |

Note: T-ratios in parentheses.  Coefficients marked with *** and ** and * are statistically significant from zero at the 20 and 10 and 5 percent level.
[a] Independent measures of Production shocks and Grain storage are not included in this version. See Appendix Tables 1 and 2 for versions that includes these variables.

**Panel A.** Heilongjiang and Dalian Maize Prices

Legend:
- West of Heilongjiang (FOB at Storage)
- FOB Dalian Port Liaoning
- East of Heilongjiang (FOB at Storage)
- Center of Heilongjiang (FOB at Storage)

Dalian

Heilongjiang



**Panel B.** Liaoning and Dalian Maize Prices

Legend:
- Center of Liaoning (FOB at Storage)
- FOB Dalian Port Liaoning
- West of Liaoning (FOB at Storage)

Dalian

Liaoning

Data source:  Data set 3

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

Panel A. Guangdong and Dalian Maize Prices



Panel B. Fujian and Dalian Maize Prices
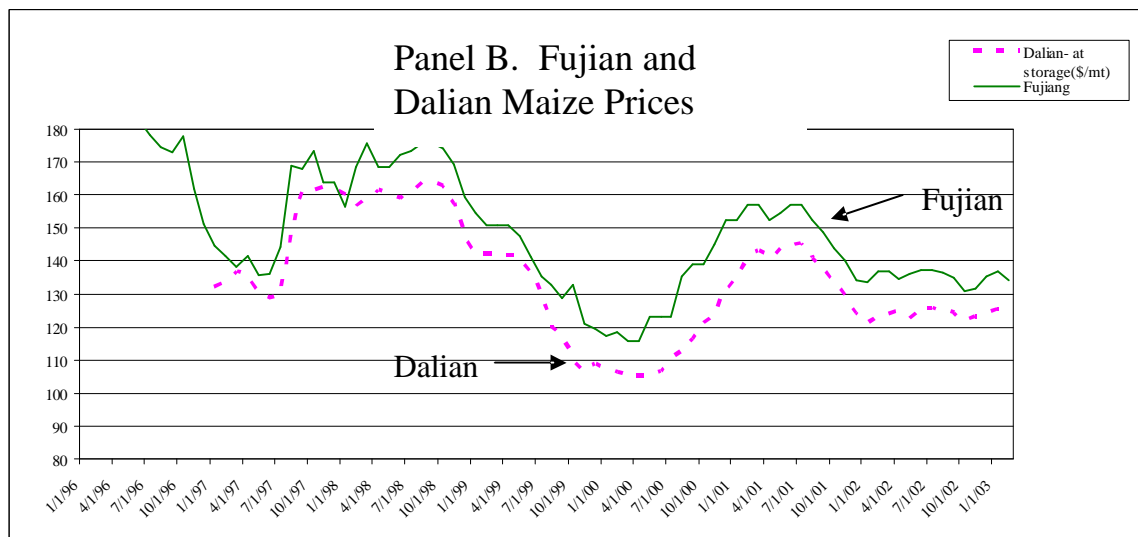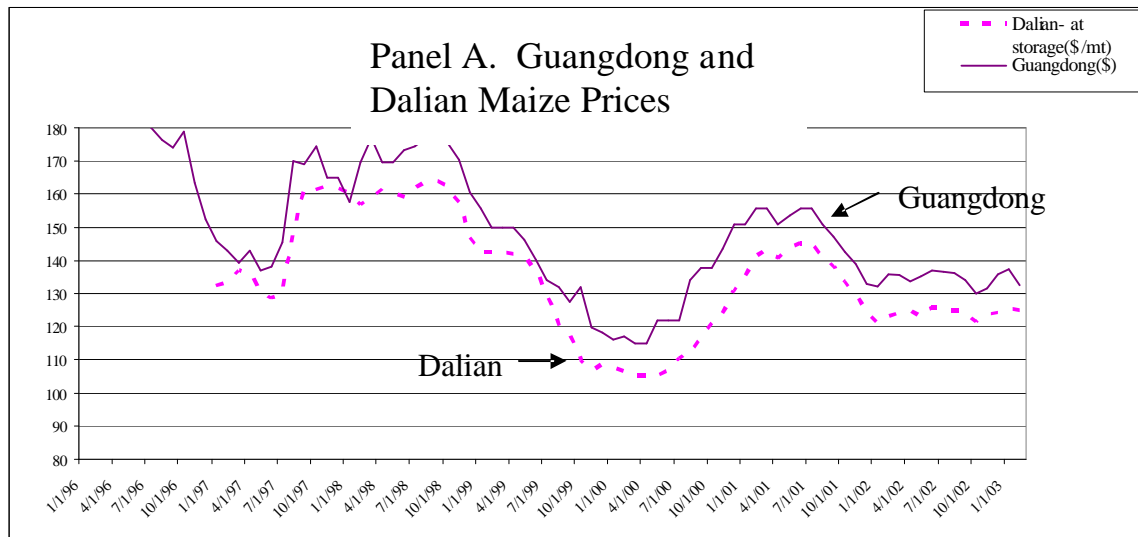
Data source: Dataset 2

**Figure 2. Maize Prices in Guangdong, Fujian and Dalian (RMB/mt), 1996 to February 2003**
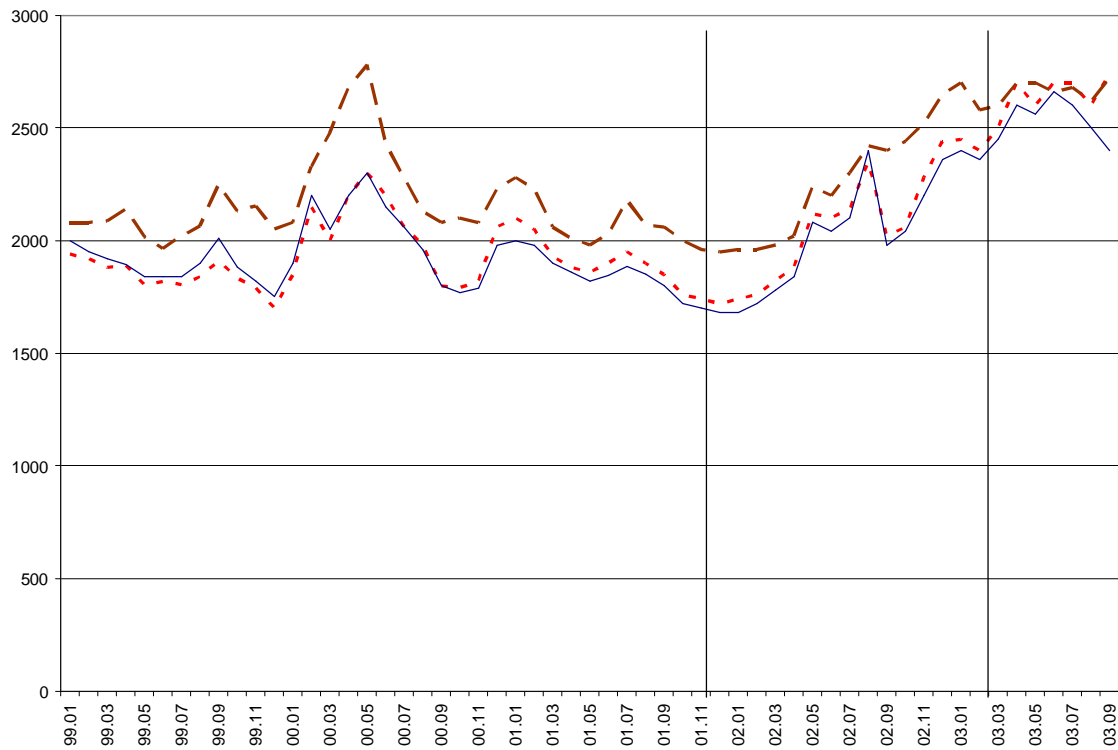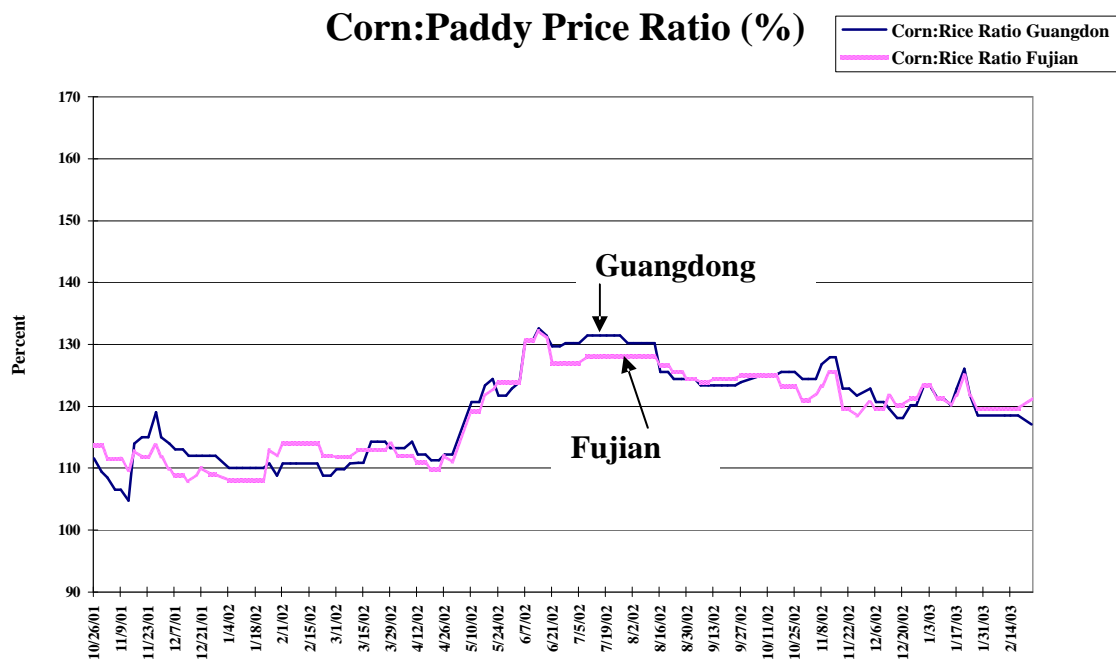
**Panel B.** Guangdong, Shanghai and Jiangsu Soybean Prices
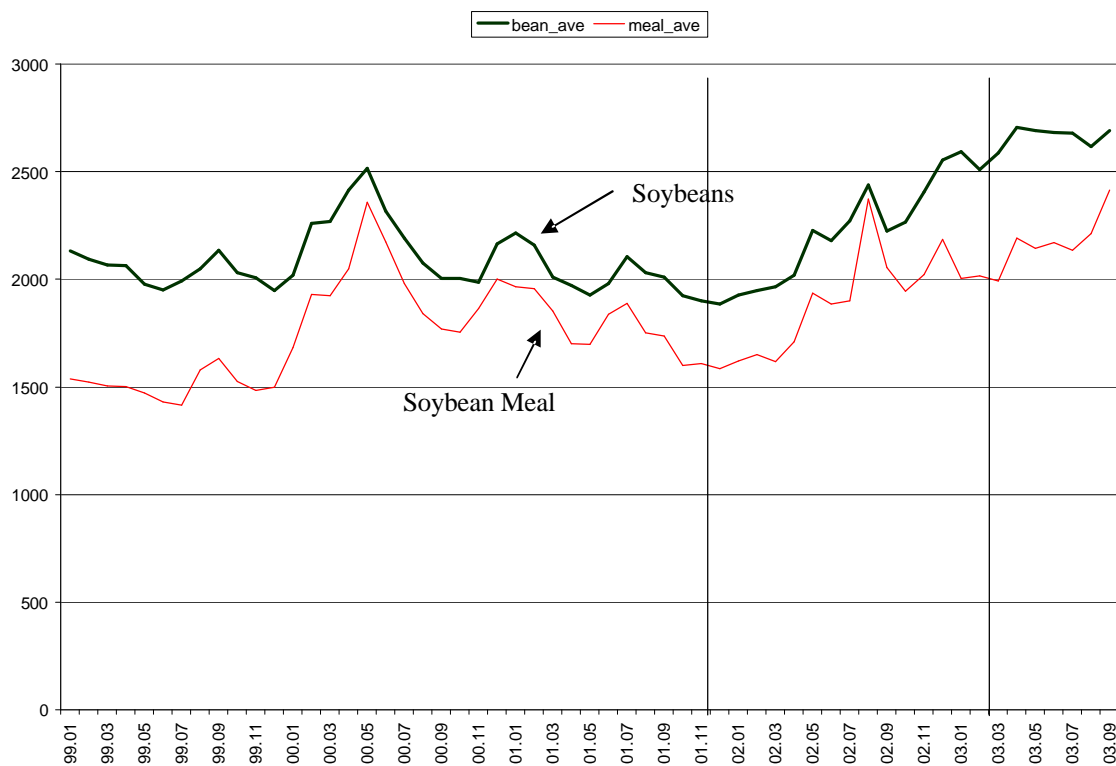


Guangdong, Shanghai and Jiangsu
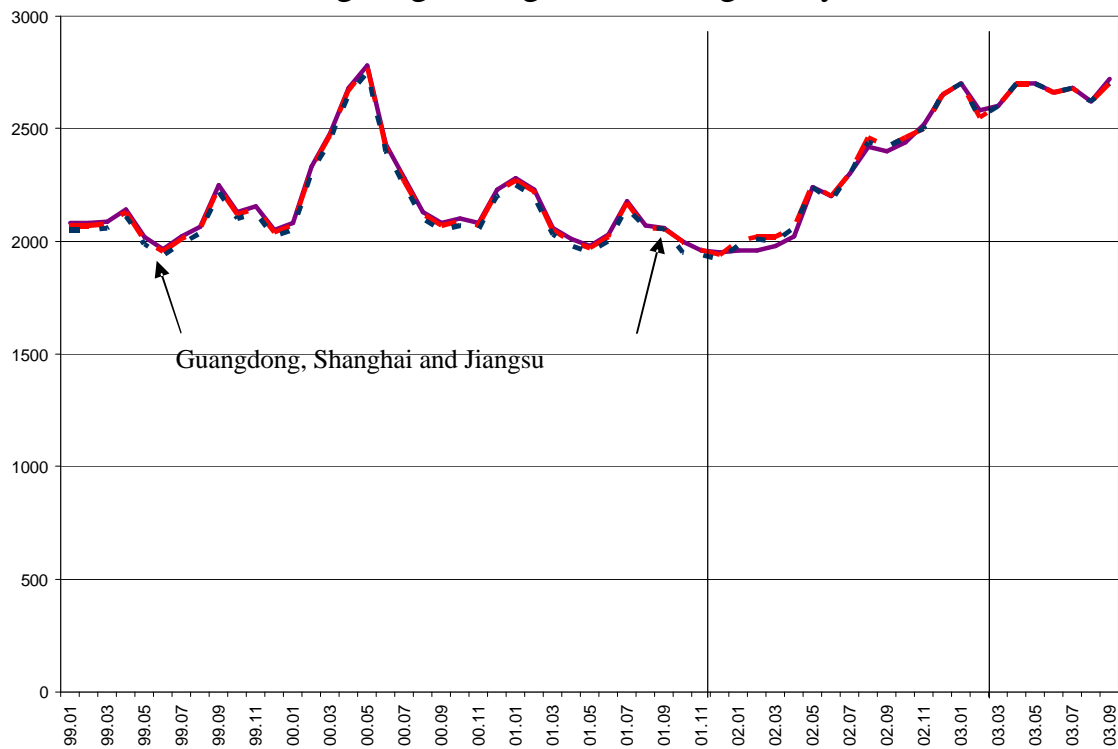
Data source:  Dataset 4

**Figure 3.  Soybeans Prices in Heilongjiang, Jilin, Guangdong, Shanghai and Jiangsu (RMB/mt), January 1999 to September 2003**
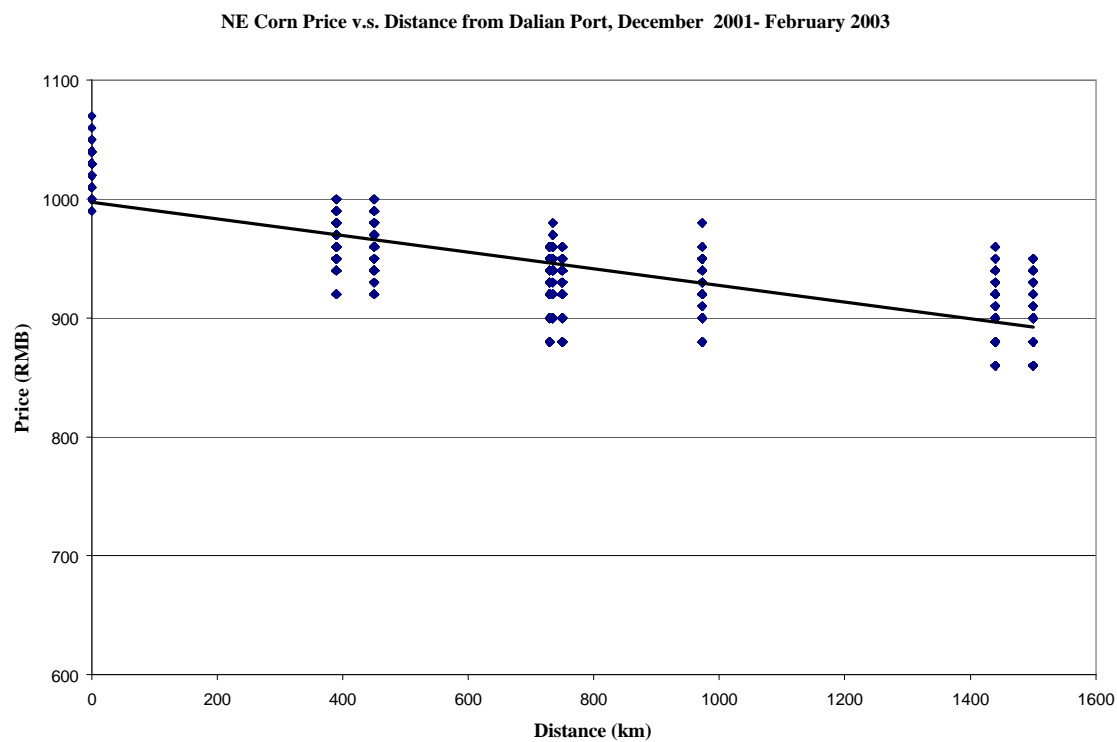
# Corn:Paddy Price Ratio (%)



Data source:  Dataset 3

**Figure 4.  The Ratio of Corn to Feed Rice (Paddy) Prices in Guangdong and Fujian Provinces between October 2001 and February 2003**
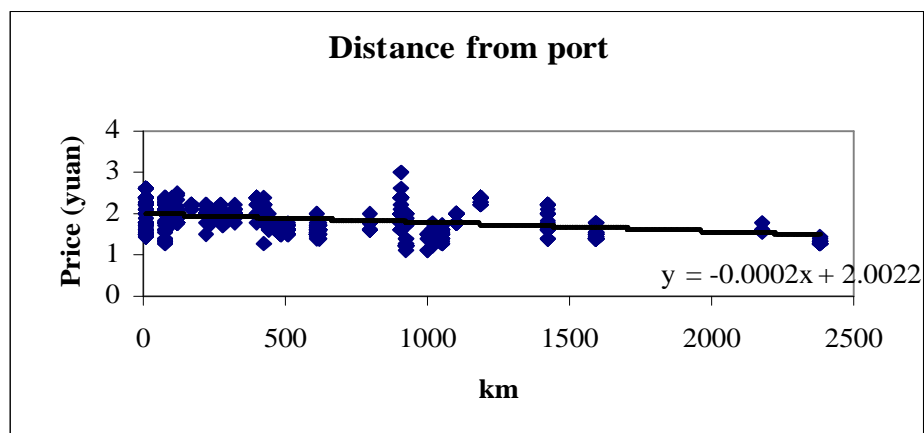
Data source:  Dataset 4

**Figure 5.  Comparisons of China's Average Soybean and Soybean Meal Prices (RMB/mt), January 1999 to September 2003**

Data source:  Dataset 3

**Figure 6.  Changes in Maize Prices across Northeast China as Markets Increase Distances from the Port of Dalian, 2000-2003**

**Distance from port**



$$y = -0.0002x + 2.0022$$

**Data source: Dataset 1**

**Figure 7. Changes in rice price across China as markets increase distance from port (in four marketing areas — southern China, Yangtze River Valley, northern China and Northeast China), July 1998**

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**Endnotes**