# Grain market integration and marketing margin in China

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## Key to symbols used in tables

| | |
|---|---|
| n.a. | not applicable |
| .. | not available |
| - | zero |
| . | insignificant |

## Abbreviations

| | |
|---|---|
| ADF | augmented Dickey–Fuller |
| SGC | state grain company |

# Grain market integration and marketing margin in China

With China's accession to the World Trade Organization (WTO) , the country's enormous population and market have captured the world's attention. Access to China's agricultural markets (especially its grain markets) has become a primary focus for major agricultural commodity exporters. The question of how well China's grain marketing system works, however, still causes concern. Can China's grain producer/farm gate, wholesale and urban/retail markets coordinate efficiently? What is the nature of the relationships among them? How much attention should the Chinese government pay to wholesale, retail and producer markets? Questions like these are being asked with increasing frequency and urgency both within China and around the world.

Research on spatial market integration shows that China's grain markets are not highly integrated (Tian Weiming 1998; Luo Xiaopeng and Crook 1997; Liangbiao Chen 1997; Wan Guanghua 1997), and that the government should therefore rescind controls on grain trade.

Using integration and marketing margin analysis, this paper examines the relationships among Chinese producer markets, wholesale markets and retail markets, to determine how well the Chinese grain market works. The findings should be able to assist the Chinese government in the management and construction of a grain marketing system, and also provide information about Chinese grain markets to domestic and foreign grain traders.

## Development of Chinese grain markets and prices

By the mid 1990s, China had developed a complete market system in the agricultural sector, including central and local wholesale markets and urban and rural free markets. Under this multi-channel marketing system, both the state and private traders could engage in agricultural product trade. State grain companies (SGCs) practiced state procurement, buying products according to two kinds of price—the state-set procurement/quota price and the negotiated price. After delivering part of their produce to the government and retaining some for their own consumption, farmers were allowed to sell the surplus in rural free markets where prices were freely determined. This situation continued until the advent of the 1998 policy on agricultural marketing, according to which only SGCs were allowed to purchase grain from farmers.

In order to keep the market system running freely during the first half of the 1990s, the central government took two important measures. The first of these, taken in 1990, was to increase grain reserves. Previously, China had built a grain reserve system on the basis of three sources: the state grain reserve, local government reserves and rural household

reserves. The state grain reserve was used to reduce price fluctuation (buffer stock) and to maintain security (security stock), while local government reserves were mainly for balancing regional demand. Farmers stored grain for two main purposes: routine household consumption and future sale at higher prices. In 1990, the government began to increase the state grain reserve.

The second measure taken by the central government was to create a support price system. It did this twice, in 1993 and in 1996. The first support price system worked poorly, since support prices were actually far lower—130 per cent lower on average during the period 1993–1995—than market prices (Liangbiao Chen 1997). In 1996, the government enhanced the support price system—stipulating that most state-set grain procurement prices must be near or higher than rural free market prices—and boosted its execution in every province. This time, the support price system did have some impact on market activities, but only a few farmers enjoyed its benefits. The scheme required huge expenditure, either from fiscal income or from SGCs, but the government could not afford to provide this, and the SGCs had no responsibility for it. This is one of the reasons a new agricultural policy was created in 1998, according to which only SGCs could buy farmers' surplus grain. Since 2000, however, this kind of control on grain traders has been gradually rescinded, with large and medium-sized private enterprises also allowed to purchase grain directly from farmers.

**Development of agricultural product markets**
Since 1978, free markets in both rural and urban areas have developed very quickly. The trade value of rural free markets has increased greatly since 1992, reaching 541.37 billion yuan in 1995, 22.7 per cent more than in 1994, although the total number of rural free markets decreased by 3,583. This indicates that the efficiency of rural free markets has greatly improved. In 1999, the trade value of rural free markets reached 1,000 billion yuan (Figures 1 and 2).

Since the mid 1980s, the government has continued to develop rural free markets and also begun to develop multi-channels in order to improve marketing and trade. Since the country's first formal central grain wholesale market was established in Zhengzhou in 1990, China has established many provincial wholesale markets, such as those in Changchun, Wuhan, Haerbing, Changsha, Jiujiang and Wuxi. In 1991, the first grain futures market was established in Zhengzhou. Since then, China has created a three-level grain market system, comprising the state-level wholesale and futures markets, the regional wholesale markets and the rural and urban free markets. Market agents include state-owned, collective and private enterprises. Table 1 shows the 13 standard wholesale markets built by central and provincial governments.

**Evolution of agricultural product prices**
For a long time, China's grain price system was very complicated. Gradually, however, it has become simpler. During different periods, there existed different types of prices, such

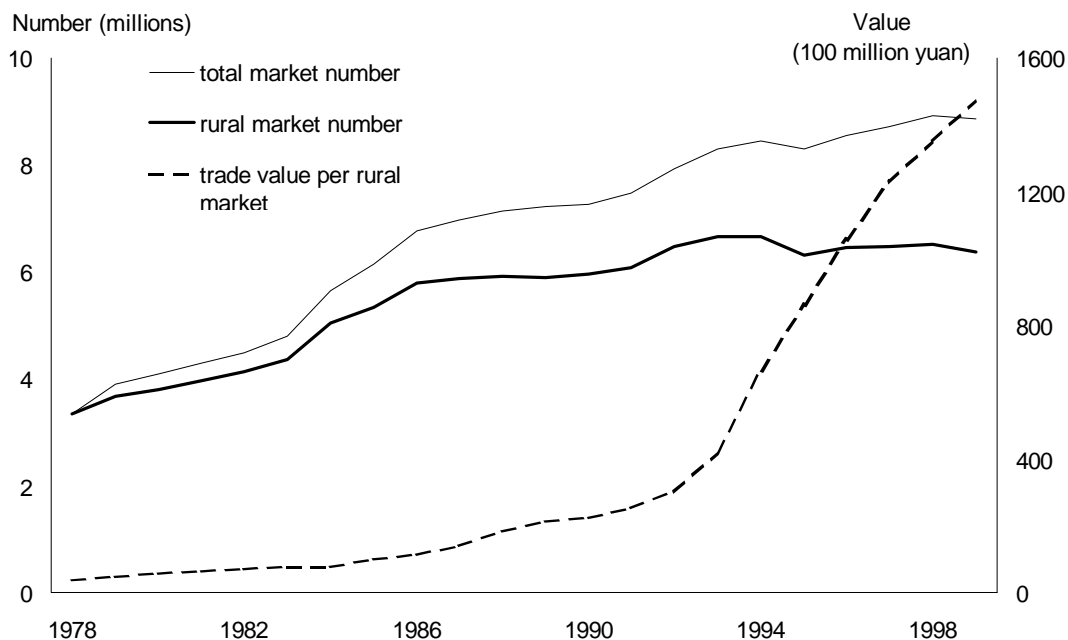**Figure 1  Number of rural and urban markets and average trade value of rural markets, 1978–99**



**Figure 2  Retail value of whole society and retail value in rural and urban areas, 1978–99**
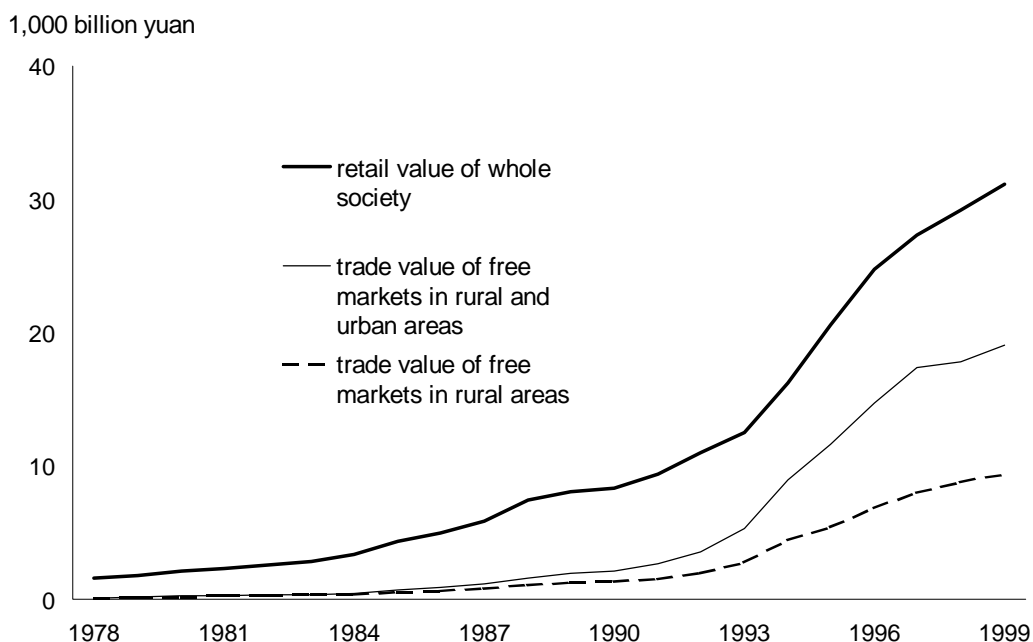
## Table 1    Wholesale markets built by central and provincial governments

| Location | Major products traded | Owner | Year built |
|---|---|---|---|
| Zhengzhou | Wheat | Ministry of Domestic Trade and Henan Province Government | 1990 |
| Changchun | Corn | Jilin Province Government | 1991 |
| Meihekou | Rice | Jilin Province Government | 1991 |
| Wuhu | Rice | Anhui Province Government | 1991 |
| Jiujiang | Grain | Jiangxi Province Government | 1991 |
| Wuhan | Grain | Hubei Province Government | 1991 |
| Chengdu | Meat | Sichuan Province Government | 1991 |
| Tianjin | Sugar | Ministry of Domestic Trade and Tianjin City Government | 1992 |
| Guangzhou | Sugar | Ministry of Domestic Trade and Guangdong Province Government | 1992 |
| Shanghai | Meat | Shanghai City Government | 1993 |
| Haerbing | Grain | Heilongjiang Province Government | 1993 |
| Changsha | Grain | Hunan Province Government | 1993 |
| Beijing | Grain | Beijing Grain Bureau | 1993 |

**Source:** Xu Boyuan and Lirong, 2000. *Study of Agricultural Product Wholesale Markets*, China Agricultural Press, Beijing.

as state-set prices/quota prices, above-quota prices for extra purchase, negotiated prices, wholesale prices, retail prices, mixed average prices, prices for special storage, support prices and so on. Reform of the agricultural product marketing system has eliminated some types of prices, for example above-quota prices.

Before the implementation of the new agricultural policy in 1998, there existed the following types of prices.

**State-set prices, or quota prices.** These are the prices governments pay to farmers by contract. The main purpose of government procurement by contract is to meet the demand of city residents, the army, university and college students, and so on.

**Negotiated prices, or above-quota prices.** These are the prices farmers get for above-quota deliveries. They are determined through negotiation between farmers and government-appointed enterprises. For a long time, state-set prices for agricultural products were low, and so, in order to encourage farmers to sell more grain to the government, a policy of purchasing farmers' above-quota grain at negotiated prices was created. For a long time, negotiated prices were generally higher than state-set prices. Since 1998, however, the state-set prices of many products have been higher than the negotiated prices.

**Free market prices.** These are the prices formed freely by farmers and traders in rural/ farm gate markets.

**Support prices**. These are the prices the government pays farmers during periods when free market prices drop in order to maintain farmers' incomes. In 1997, governments enhanced support-price policy and set support prices equal to the state-set prices of contract procurements.

**Wholesale prices**. These are formed by grain supply and demand in wholesale markets. They therefore reflect the conditions of grain trade between farmers and retailers.

**Consumer prices**. These are the prices urban and rural consumers pay to retailers. They are directly related to consumer income and living standards.

For a long time, up until 1996, state-set procurement prices for agricultural products were significantly lower than negotiated prices and much, much lower than free market prices. By the second half of 1996, state-set prices in general had risen to equal to, or higher than, market prices. During this period, state-set prices were higher than support prices, and support prices higher than free market prices. In the first half of 1998, the central government implemented the new grain marketing policy and prohibited private grain traders' activities. The government again monopolised grain trade. Since then, there have been only quota prices and support prices, negotiated prices having been merged with support prices.

## Test for interaction of farm gate, wholesale and retail markets

Here, data on rice, wheat, corn and soybeans are used to analyse the relationships among producer markets, wholesale and retail markets. Two questions concern us. First, are grain markets integrated vertically? Second, what are the directions of market influence? Theoretically, the first step should be to look at market interaction. It is difficult, however, to collect data for related marketing margin models, for example transportation and processing costs. Instead, we compare farm gate prices and retail prices to determine the contribution made by farmers to the value of the final products, since this can also provide information about market interaction.

For farm gate and wholesale markets, we refer to two regions each, the northern region and the southern region. For farm gate markets, the sample regions lie mainly in major producing areas. For wholesale markets, the sample regions' location is what concerns us—one of them lies in the north, the other in the south. For retail markets, we use average consumer prices in 36 large and medium-sized cities, since it is difficult to collect provincial retail prices. Meanwhile, differences in consumer prices across regions are not as big as differences in wholesale and farm gate prices across regions. In this paper, the retail prices for rice, wheat, corn and soybeans refer to the prices of rice, wheat flour, corn flour/powder and soybeans respectively. Table 2 presents the samples.

Rice is mainly planted in southern areas, including Jiangsu, Zhejiang, Hunan and so on. In recent years, production in northeastern areas—for example, Heilongjiang, Jilin, Liaoning and Tianjin—has increased greatly. Jilin and Jiangsu are therefore selected as

**Table 2     Research sample: commodities and regions**

| Commodities | | Farm gate prices | Wholesale prices | Retail prices |
|---|---|---|---|---|
| Commodities | | Rice | Rice | Rice |
| Regions | North | Jilin (Jilin) | Heilongjiang (HLJ) | Average |
| | South | Jiangsu (JSu) | Hunan (HuN) | |
| Commodities | | Wheat | Wheat | Wheat flour |
| Regions | North | Henan (HeN) | Henan (HeN) | Average |
| | South | Shandong (ShD) | Hubei (HuB) | |
| Commodities | | Corn | Corn | Corn flour/powder |
| Regions | North | Jilin (Jilin) | Heilongjiang (HLJ) | Average |
| | South | Shandong (ShD) | Hubei (HuB) | |
| Commodities | | Corn | Corn | Corn flour/powder |
| Regions | North | Heilongjiang (HLJ) | Heilongjiang (HLJ) | Average |
| | South | — | Fujian (FuJ) | |

**Note:** Henan is in fact located in the central area, but for convenience it is classified here as northern; average refers to average consumer prices in 36 large and medium-sized cities.

samples of northern and southern areas respectively. For wholesale prices, the samples are Heilongjiang Grain and Oil Wholesale Market and Hunan Grain Wholesale Market.

Wheat is an important grain crop in northern areas. Main producing provinces include Henan, Shandong and Hebei. In southern areas, only some provinces along the middle and upper reaches of the Yangzi River produce wheat, and output is very small, less than 10 per cent of total output. For farm gate prices, therefore, only Henan is selected as a sample. The wholesale market samples are Zhengzhou Grain Wholesale Market (Henan province) and Hubei Grain Wholesale Market (Hubei province).

Corn is mainly produced along a so-called 'Corn Belt' that stretches from northeast to southwest China. The three northeastern provinces of Heilongjiang, Jilin and Liaoning are the major producers, with a combined output of nearly 35 per cent of total national corn output. If Shandong, Hebei and Henan are taken into into account, the combined output of the six provinces is about 65 per cent of total national output. For farm gate markets, therefore, Jilin and Shandong are selected as samples. The wholesale market samples are Heilongjiang Grain and Oil Wholesale Market and Hubei Grain Wholesale Market.

The main soybean-producing areas are in the north. They include Heilongjiang, Shandong and Henan. The combined output of the three northeastern provinces of Heilongjiang, Jilin and Liaoning comes to about 40 per cent of total national soybean output. Heilongjiang is the biggest producer, with an output that accounts for about 30 per cent of total national output. Soybean outputs in the south are lower. Sichuan has the highest, but its accounts for only 7 per cent of total national output. Thus, we select Heilongjiang as a farm gate market sample. Heilongjiang Grain and Oil Wholesale Market and Fujian Grain Wholesale Market are the wholesale market samples.

The data used here are monthly prices, covering the period from January 1996 to December 2000. For farm gate prices from before 1998, we have used the Information Centre of the Chinese Ministry of Agriculture's records of rural market prices. Since 1998, however, rural free market trade has been illegal, and so for farm gate prices between 1998 and 2000 we use state grain enterprises' purchasing prices. Wholesale prices are derived from the Chinese Grain, Oil and Food Information Net, and retail prices from the State Price Information Centre. The econometric software EViews is used to run the model used.

**Market integration test**

The co-integration method is very useful in integration analysis. Co-integration means that: (I) two variable series, say $P_{it}$ and $P_{jt}$, are each non-stationary in levels but stationary in first differences, that is, $P_{it} \sim I(1)$ and $P_{jt} \sim I(1)$; (II) there exits a linear combination between these two series that is stationary, that is, $P_{it}$-a-b$P_{jt} \sim I(0)$. So, the first step of co-integration is to test whether the series are stationary. If they are both I(1), then the second step is to test for co-integration.

Here, to test for stationarity, we use the augmented Dickey–Fuller (ADF) method, which tests the null hypothesis that $P_t$ is non-stationary by calculating a t-statistic for b=0 in

$$\Delta P_t = \alpha + \beta P_{t-1} + \gamma t + \sum_{k=2}^{n} \delta_k \Delta P_{t-k} + \xi_t \qquad (1)$$

where $\Delta P_t$=$P_t$-$P_{t-1}$; $\Delta P_{t-k}$=$P_{t-k}$-$P_{t-k-1}$; k=2,3,...,n; $P_t$ is the price at time t; a, b, g and $d_k$ are parameters to be estimated; and $x_t$ is the error term.

If the value of the ADF statistic is less (that is, more negative, because these values are always negative) than the critical values, it shows that $P_t$ is stationary. If $P_t$ is non-stationary, it should be determined whether $P_t$ is stationary in the first difference (that is, to test $DP_t$-$DP_{t-1} \sim I(1)$) by repeating the above procedure. If the ADF test can be rejected for the null hypothesis, as is usually the case with price series, it may be concluded that $P_t \sim I(1)$, and the second step of testing for co-integration can be taken.

To test for co-integration, the two-step, residual-based test developed by Engle and Granger (1987) is commonly used. The first step is the OLS regression (or co-integrating regression) of one I(1) price series, say $P_{it}$, on another I(1) price series, say $P_{jt}$, plus a constant and a time trend, as follows

$$P_{it} = j + wP_{jt} + ht + e_t \qquad (2)$$

where $P_{it}$ is the price in market I at time t; $P_{jt}$ is the price in market j at time t; j, w and h are parameters to be estimated; and $e_t$ is the error term.

The second step is to test whether the residuals, $e_t$, from the co-integrating regression are non-stationary by using the modified ADF test,

$$\Delta e_t = \lambda e_{t-1} + \sum_{k=2}^{n} \theta_k \Delta e_{t-k} + \mu_t \qquad (3)$$

where $De_t = e_t - e_{t-1}$; $D e_{t-k} = e_{t-k} - e_{t-k-1}$; $e_t$, $e_{t-1}$, $e_{t-k}$ and $e_{t-k-1}$ are, respectively, the residuals at times t, t-1, t-k, and t-k-1; l and $q_k$ are parameters to be estimated; and $m_t$ is the error term.

The constant and time trend are not included because the residuals from the co-integrating regression will have a zero mean and be detrended. The null hypothesis that l=0 is tested again, but this is a test of residual stationarity rather than original time series. If the t-statistic value of the l coefficient is less than the relevant critical value, the null hypothesis is rejected and two price series are said to be co-integrated, meaning two markets are integrated. Table 3 shows the stationarity test results. Since most of the prices

### Table 3    Results of stationarity test

|  | Intercept no trend | Intercept and trend | No intercept or trend |
|---|---|---|---|
| **Rice** | | | |
| JSu farm gate price | -2.992 | -3.165 | -2.807 |
| Jilin farm gate price | -4.873 | -5.032 | -4.665 |
| HuN wholesale price | -2.973 | -2.981 | -2.858 |
| HLJ wholesale price | -3.928 | -3.841 | -3.918 |
| Retail price | -3.296 | -3.361 | -2.948 |
| **Wheat** | | | |
| HeN farm gate price | -4.481 | -4.748 | -4.102 |
| ShD farm gate price | -3.329 | -3.343 | -2.935 |
| HeN wholesale price | -3.997 | -4.066 | -3.435 |
| HuB wholesale price | -4.076 | -4.013 | -3.719 |
| Retail price | -4.002 | -4.156 | -3.929 |
| **Soybeans** | | | |
| HLJ farm gate price | -4.102 | -4.045 | -3.912 |
| HLJ wholesale price | -4.421 | -4.386 | -4.068 |
| FuJ wholesale price | -4.158 | -4.050 | -3.953 |
| Retail price | -3.440 | -3.461 | -3.434 |
| **Corn** | | | |
| Jilin farm gate price | -5.149 | -5.100 | -5.179 |
| ShD farm gate price | -3.176 | -3.235 | -3.101 |
| HLJ wholesale price | -4.607 | -4.571 | -4.554 |
| HuB wholesale price | -4.414 | -4.373 | -4.230 |
| Retail price | -5.175 | -5.124 | -5.221 |
| **Critical value** | | | |
| 1 per cent | -3.5523 | -4.1314 | -2.6048 |
| 5 per cent | -2.9146 | -3.4919 | -1.9465 |
| 10 per cent | -2.5947 | -3.1744 | -1.6189 |

**Note:** The data in the table are the ADF test statistics provided by EViews with a three-period lag. The tested hypothesis is $H_0$: non-stationary and $H_1$: stationary.

**Table 4    Results of integration tests**

| | | Farm gate–wholesale | Wholesale–retail | Farm gate–retail |
|---|---|---|---|---|
| Rice | North | Jilin–HLJ | HLJ–retail | Jilin–retail |
| | | -2.943 | -2.266 | -3.031 |
| | South | JSu–HuN | HuN–retail | JSu–retail |
| | | -2.545 | -1.991 | -3.912 |
| Wheat | North | HeN–HeN | HeN–retail | HeN–retail |
| | | -2.389 | -2.656 | -2.938 |
| | South | HeN–HuB | HuB–retail | ShD–retail |
| | | -2.280 | -3.664 | -3.149 |
| Corn | North | Jilin–HLJ | HLJ–retail | Jilin–retail* |
| | | -2.577 | -2.261 | -1.674 |
| | South | ShD–HuB | HuB–retail* | ShD–retail* |
| | | -2.778 | -1.884 | -1.818 |
| Soybeans | North | HLJ–HLJ | HLJ–retail | HLJ–retail |
| | | -2.868 | -2.406 | -2.955 |
| | South | HLJ–FuJ | FuJ–retail | .. |
| | | -2.771 | -2.627 | .. |

**Note:** The MacKinnon critical values for co-integration tests at 1 per cent, 5 per cent and 10 per cent significance levels are -2.60, -1.95 and -1.62.

pass this test, we proceed to do integration tests between farm gate and wholesale prices; between wholesale and retail prices; and between farm gate and retail prices. The results of these tests are presented in Table 4.

Except for three pairs of corn markets (marked by asterisks), all pairs of markets tested in Table 4 are integrated. This shows that a stable, long-term price relationship exists among farm gate, wholesale and retail markets for sample products. Two pairs of corn markets between farm gate and retail (Jilin–retail and ShD–retail) and one pair of corn markets between wholesale and retail (HuB–retail) are not integrated. There are several reasons for this deviation. First, we chose corn flour as the final product of corn, but in fact corn flour does not constitute the largest part of corn consumption, since corn is mainly consumed as feed. Since it is difficult to collect feed corn prices, however, we select corn flour to compare with corn. Second, for retail data, we use average retail prices instead of regional data. If regional data were applied then the results could be improved. Because, however, regional retail prices are difficult to collect, we use average data instead.

The test results show that there is in fact integration from farm gate to retail markets for the sample grain products. If a pair of series is co-integrated, then there must be Granger Causality in at least one direction, that is, the direction of influence on prices between markets. The next step, therefore, will be to determine the causality patterns of market influence using the Granger Causality test.

## Granger Causality test

The Granger Causality test is a commonly used econometric method. Theoretically, if the present or lagged terms of a time series variable, say X, determine another time-series variable, say Y, there exists a Granger Causality relationship between X and Y, in which Y is Granger-Caused by X. Bessler and Brandt (1982) first used the test to determine leading markets in market integration research. Continuing from the above analysis, the model is specified as follows

$$\Delta P_{it} = \theta_{11}\Delta P_{it-1} + ... + \theta_{1n}\Delta P_{it-n} + \theta_{21}\Delta P_{jt-1} + ... +$$
$$\theta_{2n}\Delta P_{jt-n} - \gamma_1(P_{it-1} - \alpha P_{jt-1} - \delta) + \varepsilon_{1t} \tag{4}$$

$$\Delta P_{jt} = \theta_{31}\Delta P_{jt-1} + ... + \theta_{3n}\Delta P_{jt-n} + \theta_{41}\Delta P_{it-1} + ... +$$
$$\theta_{4n}\Delta P_{it-n} - \gamma_2(P_{it-1} - \alpha P_{jt-1} - \delta) + \varepsilon_{12} \tag{5}$$

The following two hypotheses are tested to determine the Granger Causality relationship between prices

$q_{21} = ... = q_{2n} = g_1 = 0$ ($P_j$ does not Granger Cause $P_i$) and

$q_{41} = … = q_{4n} = g_2 = 0$ ($P_i$ does not Granger Cause $P_j$)

On the basis of the results of the above integration test, we did Granger Causality tests for the integrated pairs of markets. The results reveal interesting facts about inter-market causality relationships (Table 5). First, for rice, the causality directions between farm gate and wholesale markets are from farm gate to wholesale in both northern and southern areas. Here, the farm gate markets are markets in major producing areas. This indicates that rice wholesale markets still function poorly in terms of farmers' selling behaviour. For soybeans, however, the causality directions are from wholesale to farm gate in both northern and southern areas. This indicates that soybean wholesale markets can function well in terms of farmers' selling behavior. As for wheat and corn, in northern areas, the causality directions are all from wholesale to farm gate. In southern areas, however, it is a different matter. Wheat and corn are major grain products in northern areas, and wholesale markets also play an important role in these areas.

Second, between wholesale and retail markets there exists closer interaction. Two pairs of markets have both directions of Granger Causality relationship. This means that wholesale markets are geared towards marketisation, and so they can be more closely integrated. In terms of grain types, the relationship of integration and causality for rice and wheat is better than that for corn and soybeans.

**Table 5    Results of Granger Causality tests**

|  |  | Farm gate–wholesale | Wholesale–retail | Farm gate–retail |
|---|---|---|---|---|
| Rice | North | Jilin => HLJ | HLJ <=> retail | Jilin => retail |
|  |  | (6.359) | (8.107, 2.642)** | (12.910) |
|  | South | JSu => HuN | HuN => retail | Jsu => retail |
|  |  | (2.445) | (2.071) | (2.912) |
| Wheat | North | HeN <= HeN | HeN => retail | HeN => retail |
|  |  | (4.836) | (8.074) | (4.384) |
|  | South | HeN => HuB | HuB <=> retail | ShD => retail |
|  |  | (1.920) | (8.813, 2.734)** | (6.381) |
| Corn | North | Jilin <= HLJ | HLJ <= retail | Jilin–retail* |
|  |  | ( 3.415) | (1.580) | n.a. |
|  | South | ShD => HuB | HuB–retail* | ShD–retail* |
|  |  | (1.926) | n.a. | n.a. |
| Soybeans | North | HLJ <= HLJ | HLJ => retail | HLJ <=> retail |
|  |  | (2.926) | (10.007) | (2.871,4.231)** |
|  | South | HLJ <= FuJ | FuJ => retail | n.a. |
|  |  | (4.361) | (11.032) | n.a. |

**Note:** The numbers in parentheses are F statistics. The signs '=>', '<=' and '<=>' show direction of causality; the pairs of markets marked by an asterisk (*) are not integrated, and so their Granger-Causality relationships are not displayed; where both directions of causality operate (<=>), two F statistics are given (marked by two asterisks (**)), the first being the F statistic for the '=>' relationship and the second the F statistic for the '<=' relationship.

Third, causality direction between farm gate and retail markets is from farm gate to retail for both rice and wheat. For soybeans, causality goes in both directions. We can conclude, therefore, that farm gate markets lead retail markets.

**Marketing margin**

For marketing margin, we compare prices in farm gate, wholesale and retail markets in order to determine the shares of farm gate and wholesale prices/value in final product prices. On average throughtout the nation as a whole over the last five years, the share of farmer's gains from selling grain in the value of final products has tended to decrease. Since 1998, however, it has been more stable. From 1999 to 2000, for corn it remained at about 30 per cent, for wheat it was about 45–48 per cent and for rice it was around 50 per cent. For soybeans, however, it was not as stable as for wheat, rice or corn. During the first half of 2000, it was above 50 per cent, but later it dropped to below 50 per cent.

In order to show detailed information about the marketing margin, we have done the analysis by products and regions. The samples coincide with those in Table 5. An interesting point to be made is that in some cases farm gate prices are actually higher than wholesale prices. China's wholesale markets are not yet perfect, and do not yet function well enough to meet traders' demands. Meanwhile, only a small part of grain is sold to wholesalers for trade in wholesale markets. Finally, government interventions—for example, support price and related policies—also cause such anomalies.

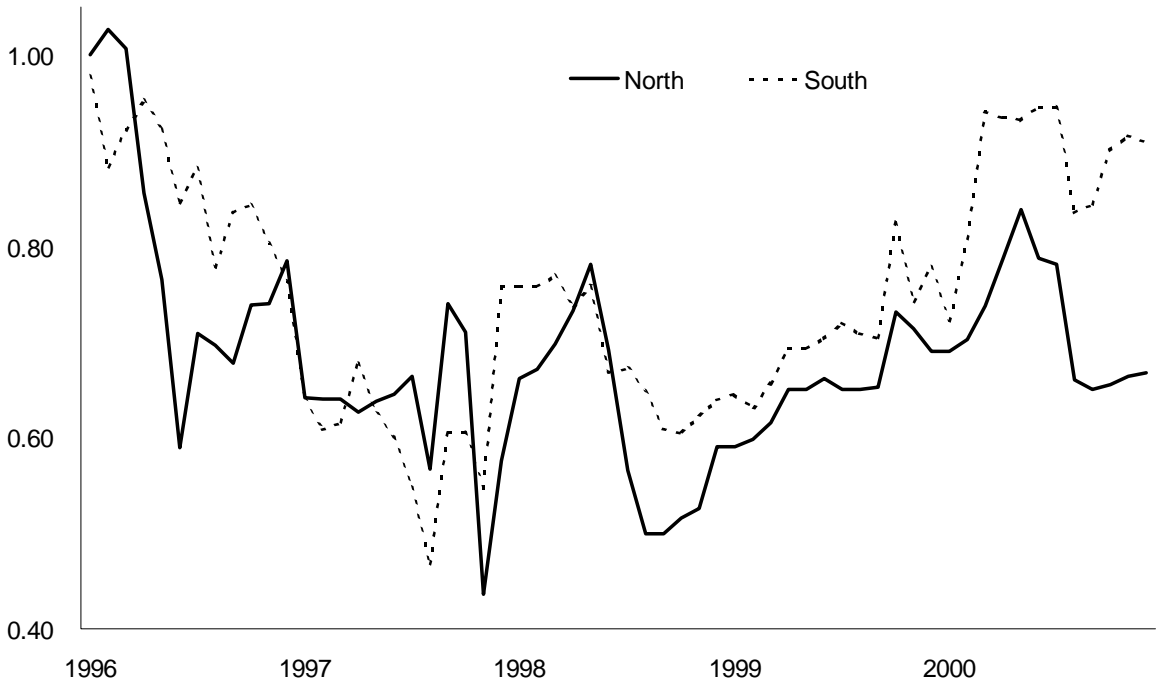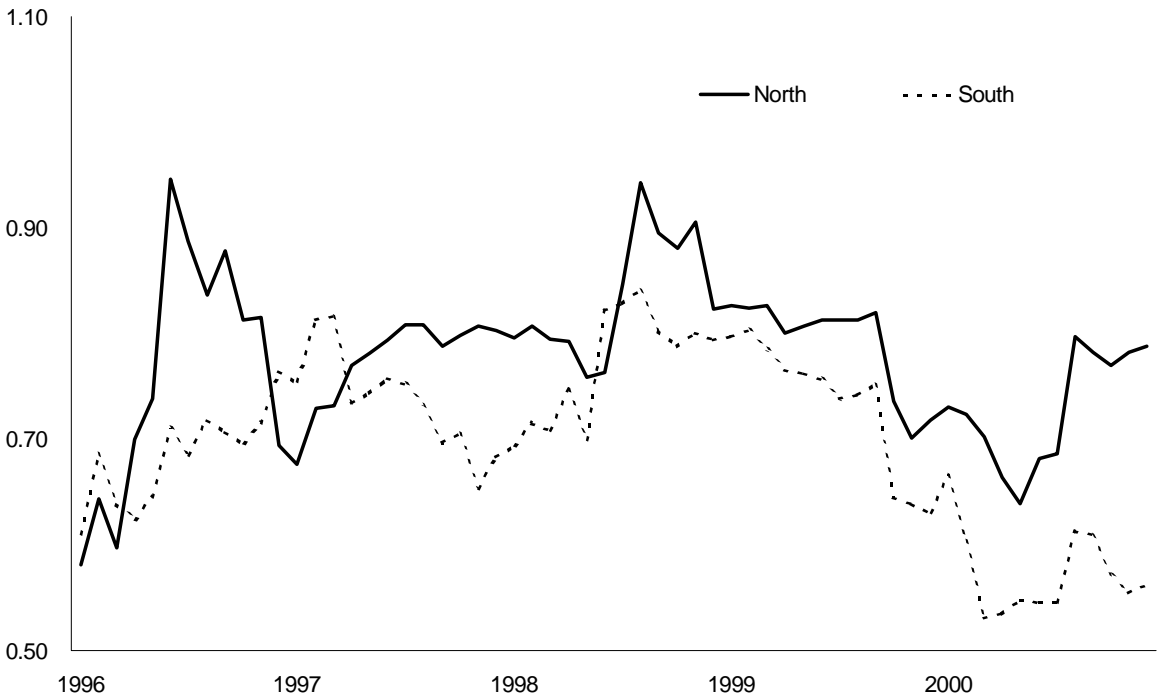**Figure 4    Ratios of farm gate to wholesale rice prices, 1996–2000**



**Figure 5    Ratios of wholesale to retail rice prices, 1996–2000**

**Rice.** Rice marketing margin conditions are illustrated by Figures 4 and 5. When we look at the whole marketing process, we see that farmers' gains from selling rice are generally over 50 per cent of wholesale prices, while wholesalers' gains are generally over 60 per cent of retail prices. In terms of regions, the same trends have pertained in both southern and northern areas. Since the beginning of 2000, however, marketing margin differences between northern and southern areas have increased, to a certain extent reflecting regional comparative advantages. Meanwhile, because of the government's support price policy, in the major producing (southern) areas, farmers' gains from the whole marketing process are increasing—that is, more of the profits from wholesale-to-retail-market trade are flowing to farmers.

The middle of 1998 was a turning point. Previously, the ratio of farm gate to wholesale prices had gone down. After the middle of 1998, they went up. In fact, because of good harvests and government intervention, since 1996, rice prices have decreased. Degrees for different rice types, however, are different. Before the middle of 1998, farm gate and retail prices fell quickly, wholesale prices slowly. After the middle of 1998, because of the effects of the new agricultural policy, though prices still fell, they fell more slowly than before, especially farm gate and retail prices.

Considering the whole process, it can be seen that, at the end of 2000, wholesalers could get about 60 per cent of the value of the final product in the south and 80 per cent in the north. The remaining parts—40 per cent in the south and 20 per cent in the north—are made up of the revenue of retailers, and cover transportation and processing costs as well as retailers' profits. For wholesale prices, 90 per cent flows to farmers in the south and 70 per cent in the north—that is, about 55 per cent of final product value in both northern and southern areas (60% x 90% in the south and 80% x 70% in the north). The remaining parts of wholesale prices—about 6 per cent (60% x 10%) of final product value in the south and 24 per cent (80% x 30%) in the north—constitute wholesalers' revenues.

In all, at the end of 2000, farmers could get 50 per cent of the rice retail price in both the south and the north, wholesalers could get about 10 per cent in the south and 20 per cent in the north, and the remainder—40 per cent in the south and 20 per cent in the north—went to retailers.

**Wheat.** Figures 6 and 7 illustrate wheat marketing margin trends from 1996 to 2000. Up until 1999, farmers' shares decreased slightly. Then they increased sharply, up until mid 2000. In the second half of 2000, however, they decreased again, the main reason being that farm gate prices rose to higher than wholesale prices. Theoretically, this would seem impossible, as we have already mentioned. Thus, it can be said that wheat farm gate and wheat wholesale markets do not interact efficiently and effectively.

From wheat wholesale to wheat retail markets, wholesale-to-retail price ratios have been declining since the beginning of 1996. For most of the second half of 2000, shares in northern areas were at about 40 per cent, while in southern areas they were at 30–40 per cent. At the end of 2000, in both the north and the south, wholesalers could get about 40

**Figure 6    Ratios of farm gate to wholesale wheat prices, 1996–2000**
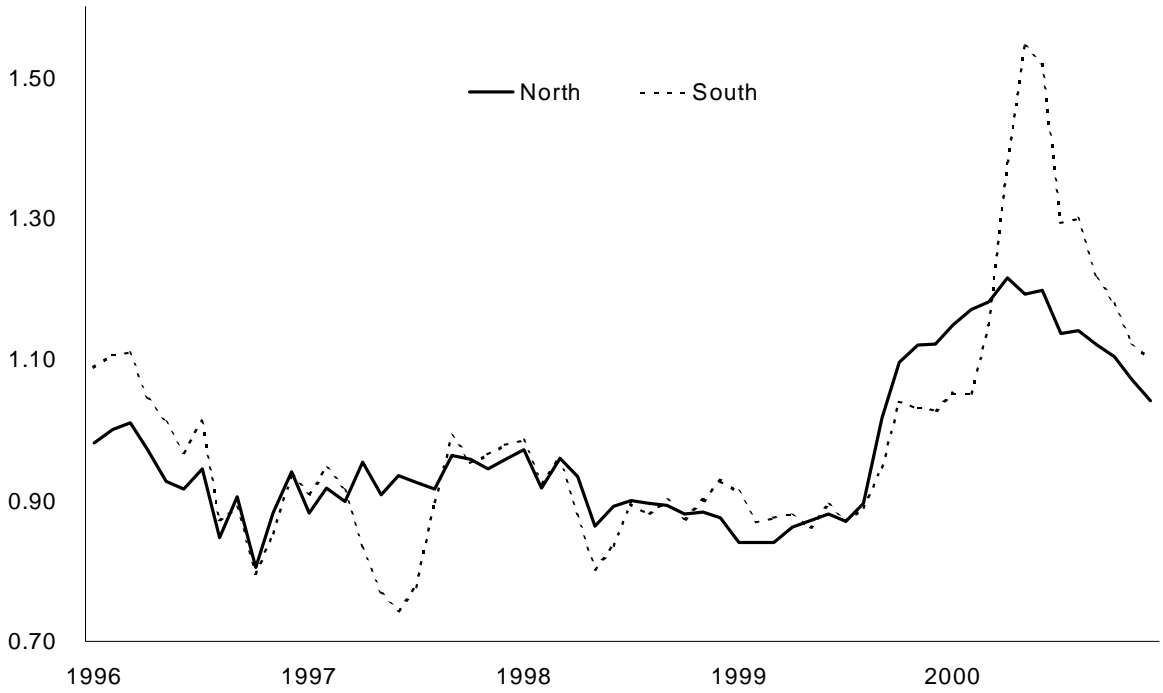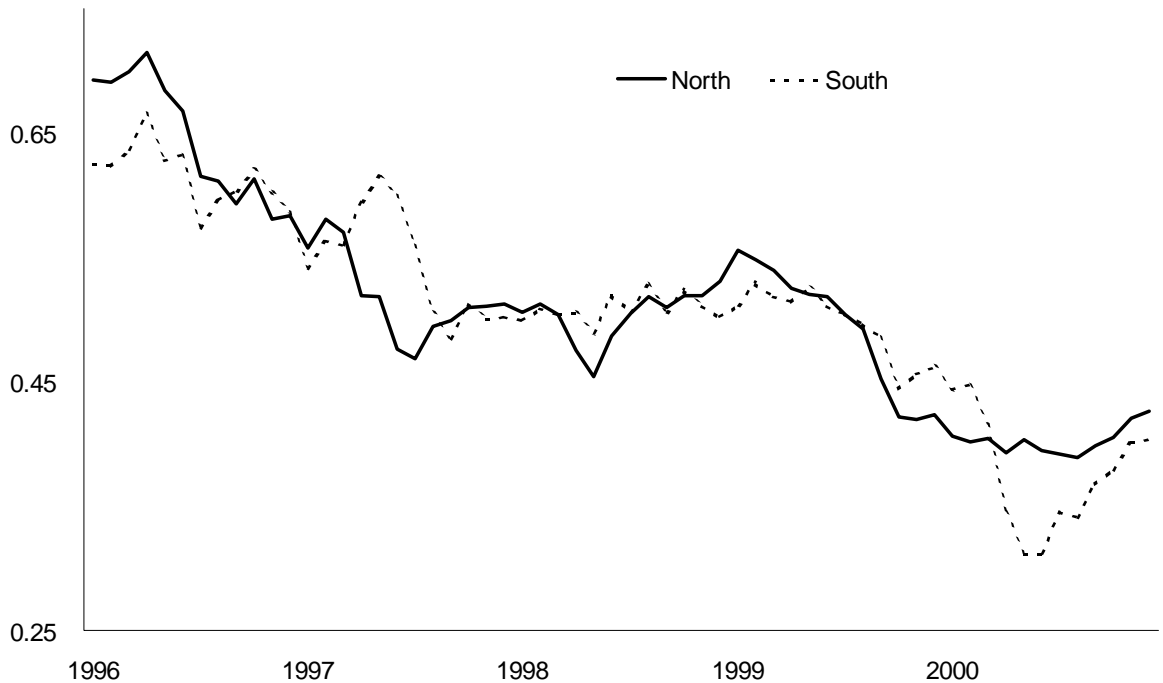


**Figure 7    Ratios of wholesale to retail wheat prices, 1996–2000**

per cent of wheat flour prices, with 60 per cent going to retailers to cover transportation, processing and related costs, and profit. Though we cannot estimate exactly how much of final product price goes to farmers, Figures 3 and 4 show that farmers do get higher prices than wholesalers. Most of the final value, however, is taken by retailers.

**Corn.** Unlike rice and wheat, corn is used mainly as feed, and so its consumption is influenced not only by households' income but also—and perhaps decisively—by feed, animal and aquatic product markets. Corn is used in more different forms than rice and wheat, making the study of its marketing and consumption rather complicated. Hence, because the data are so limited, we compare only corn farm gate, corn wholesale and corn flour retail/consumer prices.

Figures 8 and 9 show the basic trends of the corn marketing margin. From farm gate to wholesale markets, in both the north and the south, price ratios fluctuated around 0.9, with a wide range, especially prior to mid 1998. At the end of 2000, they tended to 0.9, so the wholesalers' profit was not big. From wholesale to retail markets, however, revenues of corn flour retailers have increased since 1996—their shares increased from 40–50 per cent to about 65 per cent. Though transportation, processing and related marketing costs also increased, retailers' profits still increased faster than those of wholesalers and farmers.

On the whole, at the end of 2000, wholesalers got less than 40 per cent of corn flour prices. More than 60 per cent went to retailers. Of the wholesalers' share, about 30 per cent (less than 40% x 90%) transferred to farmers, so that in the end less than 10 per cent was left to wholesalers.

**Soybeans.** Figures 10 and 11 show the basic trends of the soybean marketing margin. For soybeans, farm gate-to-wholesale price ratios fluctuated around 0.85. Three large fluctuations occurred—in mid 1997, at the beginning of 2000 and in mid 2000. From wholesale to retail, during the period 1996–99, wholesalers' shares decreased greatly, to about 60 per cent, with little fluctuation. Meanwhile, since 1997, soybean prices have declined, from about 4,500 yuan per tonne at the beginning of 1997 to 3,500 yuan per tonne at the end of 2000. Thus, farmers' income from selling soybeans continued to decrease for several years.

On the whole, at the end of 2000, wholesale prices in northern areas were about 50 per cent of retail prices, while farm gate prices were about 90 per cent of wholesale prices. Thus, retailers got about 50 per cent of final product value, farmers 45 per cent (50% x 90%) and wholesalers 5 per cent (50% x 10%). In southern areas, wholesale prices at the end of 2000 were about 60 per cent of retail prices, while farm gate prices were about 80 per cent of wholesale prices. Thus, retailers got about 40 per cent of final product value, farmers 50 per cent (60% x 80%) and wholesalers 10 per cent (60% x 20%).

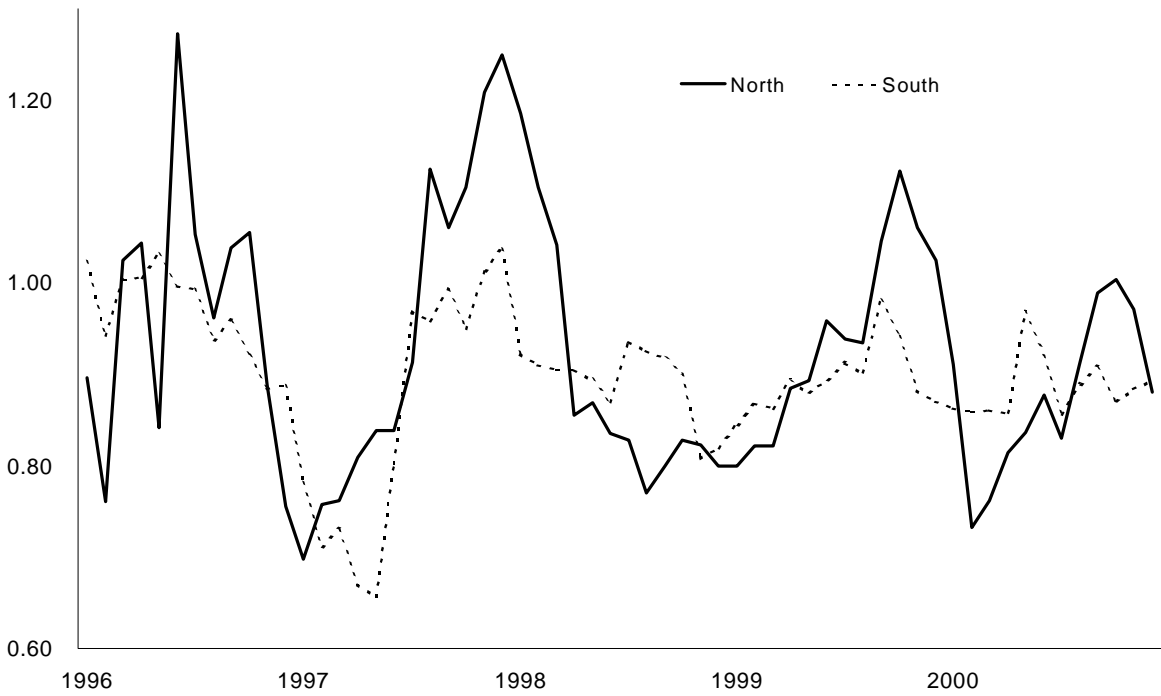**Figure 8    Ratios of farm gate to wholesale corn prices, 1996–2000**



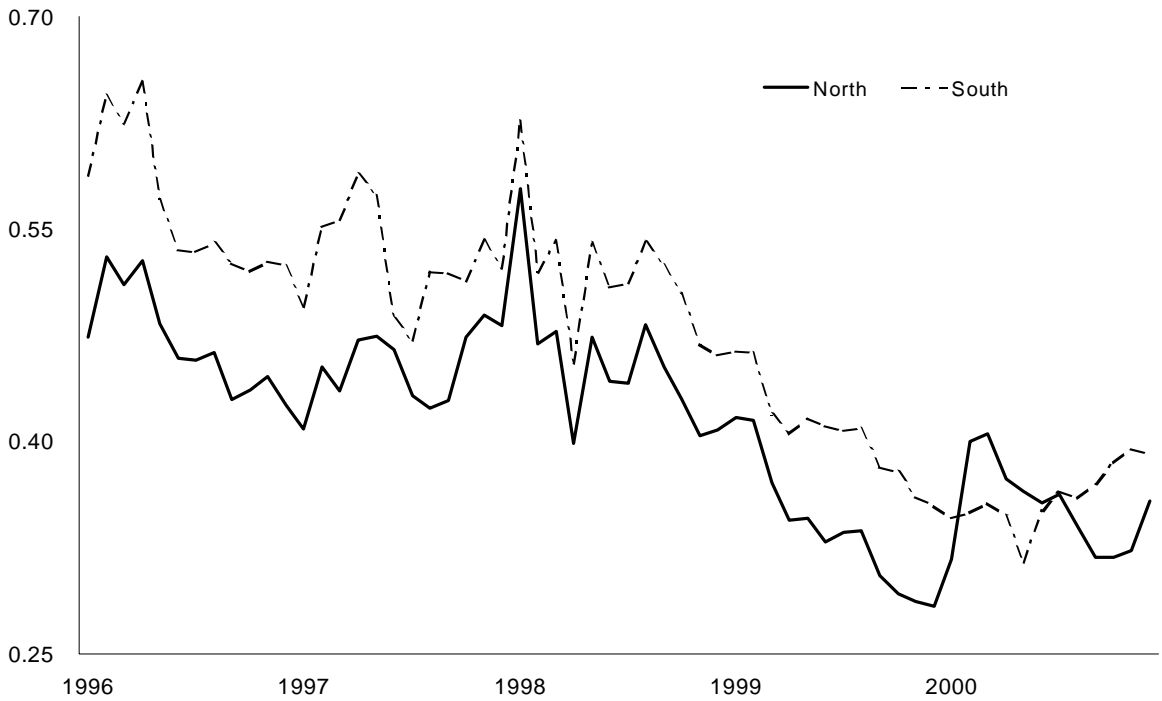**Figure 9    Ratios of wholesale to retail corn prices, 1996–2000**

**Figure 10    Ratios of farm gate to wholesale soybean prices, 1996–2000**
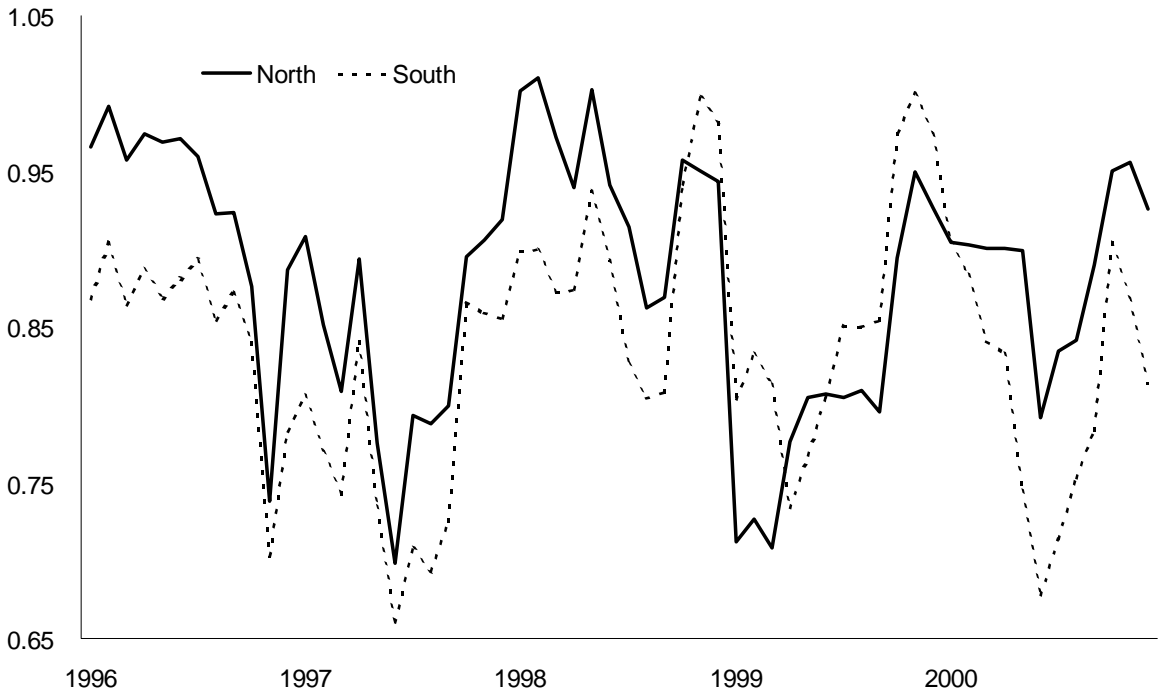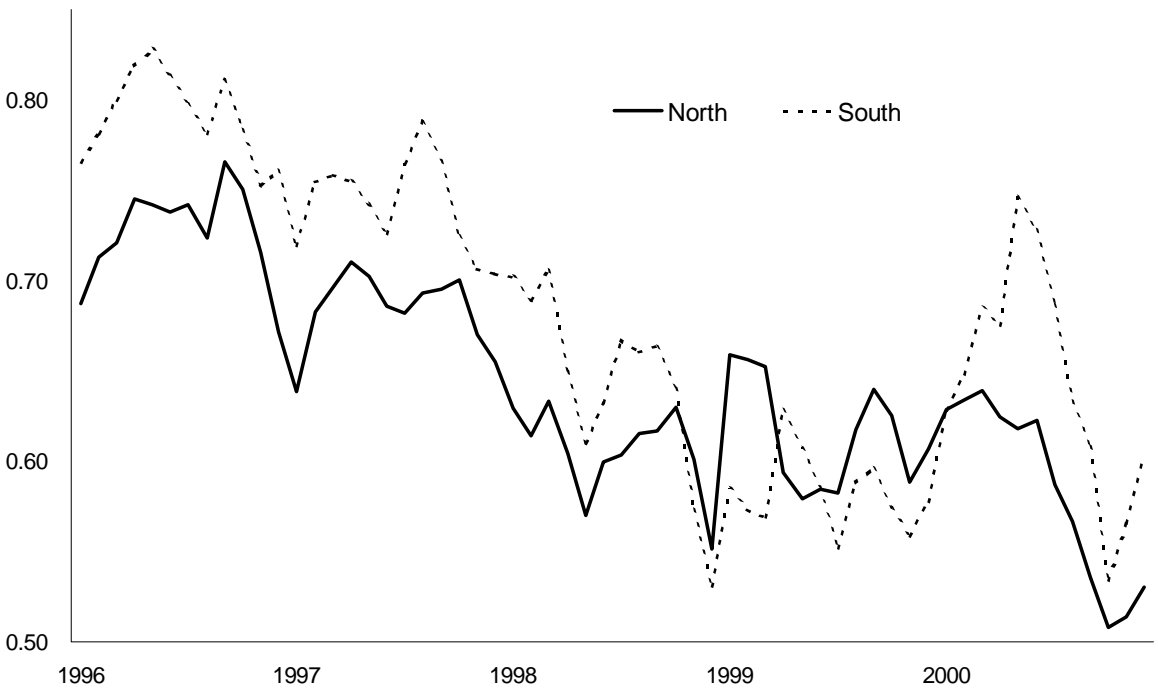


**Figure 11    Ratios of wholesale to retail soybean prices, 1996–2000**

# Conclusions

This paper has examined vertical relationships from farm gate to retail markets. A co-integration model was used to test vertical market integration, and it was found that, with the exception of three pairs of corn markets, wheat, rice, corn and soybeans are all vertically integrated, which means that marketing relationships are stable.

Subsequently, for integrated markets, a Granger Causality test was used to determine causality patterns among farm gate, wholesale and retail prices. It was found that the causality between wholesale and retail prices is mainly from wholesale to retail, while the causality between farm gate and retail prices is from farm gate to retail. This means that retail prices are mainly influenced by wholesale or farm gate prices.

As for the relationship between farm gate and wholesale markets, in southern areas, in the main producing areas, wholesale prices are mainly influenced by farm gate prices. The exception is prices for soybeans. In the main producing areas in the north, except for rice prices, the causalities are from wholesale to farm gate, meaning wheat, corn and soybean farm gate prices are led by wholesale prices.

Finally, a marketing-margin analysis was performed, using the end of 2000 as the reference point. For rice, farmers could get 50 per cent of the retail price in both the north and the south, wholesalers could get 10 per cent in the south and 20 per cent in the north, and retailers' revenues came to about 40 per cent in the south and 20 per cent in the north. For wheat, wholesalers and farmers could get about 40 per cent of wheat flour prices in both the north and the south, while retailers got 60 per cent to cover their transportation, processing and related costs, and profit. For corn, farmers got 30 per cent of corn flour prices, wholesalers about 10 per cent and retailers more than 60 per cent. Finally, for soybeans, in northern areas, farmers got about 45 per cent of final product value, wholesalers 5 per cent and retailers 50 per cent. In southern areas, farmers got about 50 per cent of final product value, wholesalers 10 per cent and retailers 40 per cent.

These findings have important implications for domestic grain marketing reform policy. First, future reform policies should focus on wholesale markets and futures markets. Theoretically, futures/wholesale markets should lead or determine rural and urban free markets. In China, however, the futures and wholesale markets are still undeveloped, farm gate prices can be higher than wholesale prices, and causalities between farm gate and retail prices tend to be irregular. These factors all support the argument that wholesale and futures markets need to become the focus of future grain marketing reform policy.

Second, farmers' shares in final product values tend to be small, while retailers' tend to be much larger. The government should take measures to reallocate revenues among farmers, wholesalers and retailers, for example, by supporting industrial organisations and encouraging farmers to establish marketing organisations themselves.

Third, the government should release its hold on grain procurement, phase out the quota policy and allow grain to be traded in rural free markets. The government can use

support prices to protect farmers from market risks, and the state grain reserve should be purchased in wholesale markets or from international markets. These measures will greatly increase vertical integration.

Finally, the government should facilitate the construction of information systems, market infrastructure and transportation systems—a difficult but very important task.

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# Appendix

## Table A1  Ratios of average producer prices to average consumer prices, 1996–2000

| Time | Wheat/ flour | Rice/ flour | Corn/ flour | Soybean/ soybean | Time | Wheat/ flour | Rice/ flour | Corn/ flour | Soybean/ soybean |
|---|---|---|---|---|---|---|---|---|---|
| Jan 1996 | 0.680 | 0.596 | 0.424 | 0.664 | Jul 1998 | 0.454 | 0.557 | 0.365 | 0.552 |
| Feb 1996 | 0.691 | 0.606 | 0.403 | 0.707 | Aug 1998 | 0.464 | 0.545 | 0.372 | 0.531 |
| Mar 1996 | 0.706 | 0.589 | 0.523 | 0.690 | Sep 1998 | 0.455 | 0.489 | 0.362 | 0.536 |
| Apr 1996 | 0.695 | 0.594 | 0.551 | 0.726 | Oct 1998 | 0.457 | 0.476 | 0.356 | 0.603 |
| May 1996 | 0.634 | 0.594 | 0.407 | 0.719 | Nov 1998 | 0.459 | 0.498 | 0.332 | 0.571 |
| Jun 1996 | 0.612 | 0.600 | 0.584 | 0.716 | Dec 1998 | 0.465 | 0.507 | 0.326 | 0.520 |
| Jul 1996 | 0.581 | 0.604 | 0.482 | 0.712 | Jan 1999 | 0.467 | 0.515 | 0.333 | 0.469 |
| Aug 1996 | 0.518 | 0.558 | 0.445 | 0.667 | Feb 1999 | 0.460 | 0.508 | 0.341 | 0.477 |
| Sep 1996 | 0.537 | 0.591 | 0.446 | 0.707 | Mar 1999 | 0.453 | 0.514 | 0.305 | 0.462 |
| Oct 1996 | 0.493 | 0.587 | 0.461 | 0.658 | Apr 1999 | 0.453 | 0.530 | 0.305 | 0.461 |
| Nov 1996 | 0.513 | 0.574 | 0.396 | 0.528 | May 1999 | 0.453 | 0.528 | 0.309 | 0.466 |
| Dec 1996 | 0.549 | 0.583 | 0.321 | 0.595 | Jun 1999 | 0.456 | 0.532 | 0.315 | 0.471 |
| Jan 1997 | 0.492 | 0.483 | 0.285 | 0.580 | Jul 1999 | 0.438 | 0.532 | 0.315 | 0.469 |
| Feb 1997 | 0.533 | 0.494 | 0.343 | 0.581 | Aug 1999 | 0.441 | 0.526 | 0.315 | 0.500 |
| Mar 1997 | 0.512 | 0.503 | 0.332 | 0.563 | Sep 1999 | 0.459 | 0.529 | 0.319 | 0.509 |
| Apr 1997 | 0.495 | 0.498 | 0.661 | 0.635 | Oct 1999 | 0.462 | 0.532 | 0.329 | 0.559 |
| May 1997 | 0.470 | 0.465 | 0.398 | 0.545 | Nov 1999 | 0.470 | 0.474 | 0.305 | 0.559 |
| Jun 1997 | 0.445 | 0.455 | 0.389 | 0.479 | Dec 1999 | 0.474 | 0.491 | 0.291 | 0.562 |
| Jul 1997 | 0.434 | 0.412 | 0.395 | 0.541 | Jan 2000 | 0.466 | 0.481 | 0.289 | 0.569 |
| Aug 1997 | 0.452 | 0.343 | 0.476 | 0.546 | Feb 2000 | 0.470 | 0.487 | 0.293 | 0.572 |
| Sep 1997 | 0.481 | 0.422 | 0.455 | 0.556 | Mar 2000 | 0.477 | 0.499 | 0.309 | 0.576 |
| Oct 1997 | 0.488 | 0.427 | 0.610 | 0.627 | Apr 2000 | 0.477 | 0.500 | 0.304 | 0.562 |
| Nov 1997 | 0.483 | 0.357 | 0.713 | 0.607 | May 2000 | 0.481 | 0.511 | 0.305 | 0.556 |
| Dec 1997 | 0.491 | 0.517 | 0.643 | 0.602 | Jun 2000 | 0.473 | 0.516 | 0.313 | 0.493 |
| Jan 1998 | 0.491 | 0.525 | 0.379 | 0.630 | Jul 2000 | 0.445 | 0.516 | 0.301 | 0.490 |
| Feb 1998 | 0.470 | 0.541 | 0.326 | 0.620 | Aug 2000 | 0.443 | 0.511 | 0.310 | 0.476 |
| Mar 1998 | 0.484 | 0.544 | 0.366 | 0.616 | Sep 2000 | 0.447 | 0.514 | 0.315 | 0.476 |
| Apr 1998 | 0.444 | 0.551 | 0.341 | 0.568 | Oct 2000 | 0.447 | 0.514 | 0.320 | 0.483 |
| May 1998 | 0.392 | 0.529 | 0.412 | 0.571 | Nov 2000 | 0.450 | 0.507 | 0.313 | 0.491 |
| June 1998 | 0.434 | 0.549 | 0.370 | 0.564 | Dec 2000 | 0.443 | 0.511 | 0.315 | 0.491 |

**Note:** 'Wheat/flour' means wheat prices divided by wheat flour prices, and so on.