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Distortions at the Border; Integration Inland: Assessing the Effect of WTO Accession on China's Agriculture

JIKUN HUANG, SCOTT ROZELLE and YUPING XIE

ABSTRACT *The main goal of the paper is to address the impact of the WTO on China's agricultural sector. To accomplish this goal we address two sets of issues. First, we seek to provide measures of the distortions in China's agricultural sector at a time prior to the nation's accession to WTO. This is accomplished by estimating the nominal rates of protection (NPRs) of the agricultural sector's major commodities using a new methodology to account for grain quality differences within China and between China and the world market. Second, we seek to assess how well integrated China's markets are in order to understand which areas of the country and which segments of the farming population will likely be isolated from, or affected by, the changes that WTO will bring. We find that NPRs differ among commodities. Some of China's agricultural commodities are well above and others are well below world market prices. We also find that if increased imports or exports affect China's domestic price at the border, its own domestic markets are mostly integrated so that price shifts in one area will affect prices in most of the rest of China. Our analysis finds, however, that a number of policy and structural factors limit the overall size of the shock.*

Key words: WTO accession; Nominal rates of protection; Integration; Impacts; China.

1. Introduction

In the same way that the forces of development have been responsible for generating the progress that rural China has experienced during the past 20 years and

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exacerbating certain social and economic problems, the nation's efforts at pushing ambitious trade and investment liberalization policies will also have both positive and negative consequences. On the one hand, trade can bring rising efficiency, new technology and opportunities to increase the nation's economic growth (Lardy, 2001). On the other hand, trade, marketing and investment liberalization will also accentuate many of the negative trends in rural China, at least in the short run.

Surprisingly, despite the historic nature of China's move to join the World Trade Organization (WTO), little serious empirically based literature exists to answer some of the most basic questions about the expected effects of China's entry in the WTO.¹ For example, on balance, will the nation's accession to WTO help or hurt rural residents? How will the WTO affect rural incomes? Who in the rural economy will get hurt, or be most drastically affected? Are there some households in the rural economy that will be insulated from the effects of WTO?

Although many of the important effects of accession into the WTO (in December 2001), will occur in the off-farm labor markets (e.g. OECD, 2001; Zhao and Sicular, 2002), the food economy will also be affected in many complex ways and these effects will be difficult to identify fully. For example, consumers will gain from lower prices as tariffs and non-tariff barriers fall, allowing certain goods to enter the country that previously had been kept out by certain policies. Consumers, however, will also lose if prices rise for some commodities as the nation begins to export goods that have been excluded from markets around the world. The nature and magnitude of the effect, or even its existence, will also depend on how closely households are integrated into consumer markets (Taylor, 1998). For instance, subsistent households in remote areas might not be affected, while households in areas linked to international markets may enjoy a fall in the prices of important commodities from their daily consumption basket.

Despite the difficulties and complexities of analyzing the full impact of WTO on the domestic economy of China, the historic nature of China's accession into the WTO and the large potential effects on the welfare of rural residents, both positive and negative, demands that researchers examine these questions. We gladly undertake this, but in order to make the task more manageable, our attention is restricted to one subsector of the rural economy: agriculture. Therefore, the main goal of the paper is to address the impacts of the WTO on China's agricultural sector.

To accomplish this goal we feel that there are two sets of questions or areas that must be addressed. First, we seek to provide measures of the distortions in China's agricultural sector at a time prior to the nation's accession to WTO. This can be accomplished by estimating the nominal rates of protection (NPRs) of the agricultural sector's major commodities, or the gap between the price at which commodities are landed at China's borders and the price in domestic markets. Second, we seek to assess how well integrated China's markets are in order to understand which areas of the country and which segments of the farming population will likely be isolated from or affected by the changes that WTO will bring. Once the size of the 'shock' at the border is estimated, we can analyze how well price shocks are transmitted throughout the economy in order to understand the crop-specific and regional impacts of WTO's accession (as well as impacts on certain groups of rural residents, such as the poor). In areas that are isolated from coastal markets, where imports land, the impacts of WTO may be dramatically different from those areas that are fully integrated into the coastal markets and there will possibly be adverse impacts for the poor in these isolated areas. However, if markets

exist that provide links between distant regions and coastal markets, the price changes in one part of the economy can easily ripple through to another region's economy. This could occur even if imports are infused into (and exports flow out of) areas concentrated around a few large coastal cities, and the ramifications could be felt by poor households thousands of kilometers away. Ultimately, by addressing these two areas of research, we will better be able to understand how the policies that the WTO will impose on China will change the gap between the domestic and international price, affect imports and exports, and impact domestic production and incomes.

To meet our stated goal, the rest of the paper is organized as following. First, we will seek to provide a context for our analysis of the current distortions that affect China's agriculture. Second, we present measures of NPRs for a set of China's major agricultural commodities. In this section, we discuss how these distortions should be expected to change as China implements its WTO obligations and gains access (or not) to the promises that were made during negotiations. The third section analyzes the transmission of prices through the economy and seeks to make a guess on the size and scope of price impact as the nation's WTO commitments are implemented. The final section concludes.

2. Gradual Opening and Remaining Distortions

Although agriculture has been at the center of China's negotiations over its entry into the WTO, the likely shifts in China's future agricultural policy and its impacts are not well understood. Debates on the future of China's food security are increasing in intensity. Some argue that China's membership in the WTO will have substantial impacts on its agricultural sector (Li *et al.*, 1999; Carter and Estrin, 2001). Others believe that although there will be impacts; overall, the effects of accession on agriculture will be modest (Anderson and Peng, 1998; Martin, 2002). In part, some of the confusion can be attributed to the snapshot style of investigation by many studies of price gaps between international and domestic sources, instead of examining the general trend of changes in China's policies. In addition, the dearth in knowledge of previous trade reform measures and the role of WTO-induced policy in future reforms adds to the confusion.

As with all work on NPRs, it is difficult to choose the right set of prices – either inside or outside of the border – and the correct time frame. For this reason, different research efforts have generated different estimates of NPRs. For example, Tuan and Cheng (1999) estimated quite high and variable nominal rates of protection for agricultural commodities. Their estimates for wheat, maize and soybeans in 1997 were 62, 15 and 140% respectively. On the other hand, Carter and Estrin (2001) found generally negative price distortions. Such a wide range of measures makes one question the validity of all research.

The confusion about the ultimate impact of WTO can also be traced to a widespread lack of understanding of not only the policy changes that may be induced from China's WTO accession (Martin, 2002) but also that many of the current changes are really, in some sense, an extension of past trends. In examining previous work (e.g. Tuan and Cheng, 1999; CARD, 2001; OECD, 2001), we find that almost all of the discussion is directed at tariffs, quotas and licensing, state trading and traditional non-tariff barriers (NTBs). These four sets of trade policies have been the traditional focus of analysts and are frequently imposed by other countries to protect their agricultural sectors. It is implicitly assumed that the

WTO agreement is focused solely on these policies and that these policies are responsible for most if not all of the protection that China was enjoying prior to accession. In fact, although at one time these policies were highly distortive, after nearly two decades of reform in the external economy, some of the worst distortions caused by these policies have already disappeared. Instead, other measures, such as domestic and border taxes and subsidization policies, may be the source of some of the largest distortions on the eve of China's accession to the WTO.

Moreover, many of the changes that are being implemented in the name of the WTO are not actually new to China's trade policy. Over the past 20 years – not just recently as some of the WTO literature implicitly implies – China has steadily liberalized its international trading system. Lower tariffs and rising imports and exports of agricultural products began to affect domestic terms of trade. During the 1980s and early 1990s, most of the fall in protection came from a reduction in the commodities that were controlled by single desk state traders (Huang and Chen, 1999). In the case of many agricultural products, competition among non-state foreign trade corporations began to stimulate imports and exports (Martin, 2002). In addition, although many major agricultural commodities were not included in the move to decentralize trade, policy shifts in the early 1980s also contributed to changes in the behavior of state traders. More imports entered the nation in the 1980s and 1990s, even while there continued to be many year-to-year fluctuations for some commodities. After the fall of restrictions on imports and exports of many of China's agricultural commodities, a new effort was begun in the early 1990s, to reduce the level of formal protection. From 1992 to 1998, the simple average agricultural import tariff fell from 42.2% in 1992 to 23.6% in 1998 (MOFTEC 2001).

Although the WTO must indeed be thought of as a time in which China is entering a new phase in its external and domestic economy management, earlier achievements and policy shifts actually mean that China's level of protection at the border for its agricultural commodities had already been evolving for more than 20 years. For example, Figure 1 clearly shows the fall in NPR throughout the reform era. Protection for all crops has fallen uniformly since 1978. Huang (2001) shows that the protection for wheat has fallen from more than 90% in the early 1980s to around 20% in the late 1990s. Similar falls have occurred for rice, corn and soybeans.²

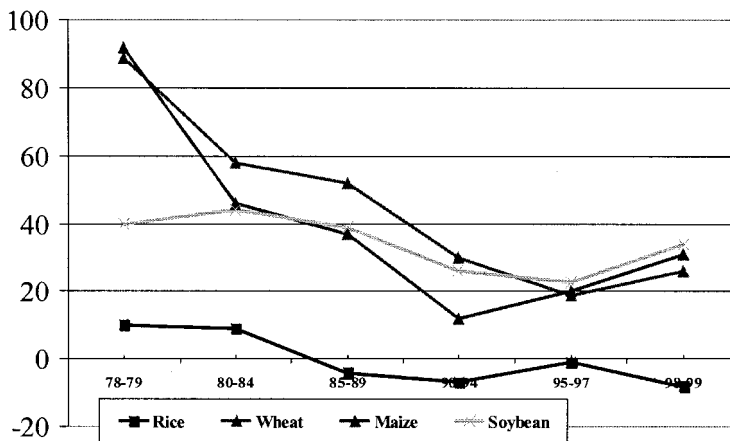


Figure 1. Nominal protection rates of major agricultural commodities, 1978–1999 (%), *Source:* Huang (2001).

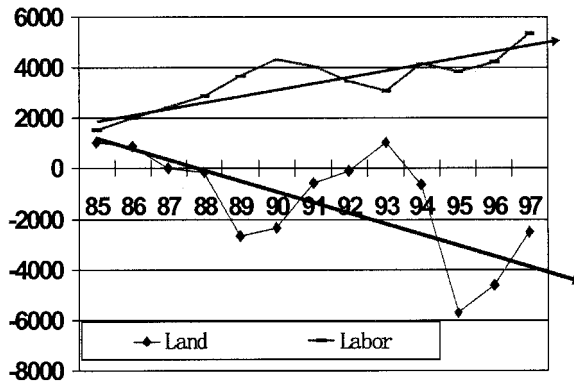


Figure 2. Agricultural trade balance by factor intensity (mil US\$), *Source:* Huang and Chen (1999).

Changes in trade and domestic marketing policies over the past 20 years have resulted in trade patterns that exhibit dramatic shifts in directions that are more consistent with China's comparative advantages. For example, the net exports of land-intensive bulk commodities, such as grains and oilseeds, have fallen; while exports of higher-valued, more labor-intensive products, such as horticultural and animal products, have risen. The proportion of grain exports, which was around 20% of total agricultural exports in the 1990s, is less than half of its early 1980s total. By the late 1990s, horticultural products and animal and aquatic products accounted for about 80% of agricultural exports (Huang and Chen, 1999).

The trends in trade patterns are even more evident upon reorganizing the trade data by groups on the basis of factor intensity (Figure 2), and two facts become clear (Figures 1 and 2). First, distortions have declined significantly in the past 20 years. This fact provides evidence that the current episode of policy reform that accompanied China's accession to the WTO should be considered an extension of past efforts. Second, the fall in protection measures emerges from decentralizing authority, relaxing licensing procedures for some crops (e.g. moving oil and oil seed imports away from state trading firms), reducing the scope of non-tariff barriers, relaxing of real tariff rates at the border, and the changing of quotas (Huang and Chen, 1999). It is perhaps for these reasons that much research on China's entry into the WTO focuses on the policies that were responsible for earlier progress and studying these policy tools is, of course, merited. Undoubtedly, changes in China's tariff regimes, state trading system and the matrix of NTBs will play a continuing role in creating or eliminating distortions in China's agriculture.

However, in part, because many of the gains from traditional trade reforms have already been experienced, there may exist less-discussed policies that also contribute to the gap between China's and the world's price. For example, policies of border and inland taxes may be sources of remaining distortions. As shown in Huang and Rozelle (2002), tax officials assess a 13 to 17% value added tax on China's agricultural commodity imports. The same domestic commodities are taxed at a rate of less than 5%. Prior to China's entry into WTO, local and central authorities subsidized the exports of several agricultural commodities, most conspicuously maize (providing exporters with rebates of up to 30% of the export price) and cotton (about 10%). Hence, even if traditional policies (e.g. tariffs or tariff rate quotas, (TRQs)) are still important, the gains from reforming non-traditional policies, such as taxes, may be as essential as those that can come from traditional trade reform.

2.1. Protection on the Eve of WTO Accession

In fact, analysis using a data set that we collected on the eve of China's accession to the WTO shows that some of these non-traditional policies may be providing most of the protection from international competition.³ The survey recorded the characteristics of the commodities that were involved in trade in the immediate marketing area during the fall of 2001. We were particularly concerned with understanding the involvement and knowledge of interviewees related to imported or exported grains, fiber, meat and other goods. Enumerators asked the interviewees a series of questions about commodities about which the traders were most familiar. For imported commodities, interviewees first told the enumerators the international CIF price of the good. The interviewees then told enumerators what the good would sell for if auctioned off in a competitive auction. In other words, we elicited a series of price gaps for a defined set of goods. Since, on average, each interviewee had information about a number of commodities, we compiled several hundred observations. A similar set of questions was asked about exportable goods, including maize, rice, cotton, and meat products, etc.

Although there are differences among major varieties (e.g. high and low qualities varieties) of any individual agricultural commodity (e.g. wheat or rice), by weighting the NPRs of the different varieties by their sown area (for crops) and production shares (for meats), a set of crop aggregate NPRs can be created (Table 1). Wheat, for example, has an NPR of 12% (row 1). Since the value added tax (VAT) on wheat is typically not assessed at the border, the gap between China's domestic wheat price and that of the international market indicates that (assuming that wheat will continue to be exempt from the VAT) when wheat begins to fall under TRQ management, importers will have an incentive to import wheat. Rice, on the other hand, is implicitly taxed at a rate of 3%. Although there may still be some special types of rice that traders can profitably bring in after the commencement of TRQ management, the negative rates of protection mean that if China can get access to

Table 1. Average nominal protection rates for major imports and exports in China, October 2001

Major imports and exports	Domestic price (yuan per ton)	Nominal Protection Rate (%)
Imports		
Wheat ^a	1250	12
Maize	1150	32
Soybeans	1950	15
Cotton	9500	17
Sugar	2612	40
Exports		
Rice ^a	1954	-3
Pork ^a	11442	-30
Beef ^a	13743	-10
Poultry ^a	9904	-17
Fresh Fruits	5472	-4

Source: Authors' Survey; ^aAverage Nominal Protection Rates are created by summing the NPR rates of individual varieties weighting with the sown area (production) share.

international rice markets after its accession to WTO, traders should be able to export larger volumes of rice than in the past.

Beyond food crops, our findings also show that China should soon begin to increase its volume of imports of a number of crops, especially certain feed and fiber crops. For example, maize prices, according to exporters, were more than 30%, on average, above world prices. Hence, exporters in the north-east part of the country would have lost more than 30% of the value of their shipment, had the government not protected them with a subsidy. In other parts of the nation, protection rates, when considering maize as an import, differed. Traders in the north-east told our survey team that if they did not export, and foreign maize was imported into China, importers could earn 21% more than they could at domestic prices. Our interviews in south China found that the price gap between imported maize, CIF, and maize being traded in the domestic market in the region's largest port city, Guangzhou, was more than 35%. Aggregated across areas on the basis of their meat consumption shares, we estimate that China's maize NPR was 32% in 2001 (Table 1, row 2). Hence, as China implements its TRQ for maize, imports should rise and exports cease.

Interviewees also reported that, despite the large volume of increase in soybean imports in recent years, there is still a difference between the CIF and domestic price in the port (Table 1, row 3). The average difference between the domestic price and the international price was 15%. In one sense, the fact that there is a remaining price gap is remarkable given that China imported almost 15 million metric tons (MMTs) of soybeans in 2001, the official tariff is only 3%, and the commodity is freely traded without securing a license. On the other hand, the remaining price gap reminds us that there may be other reasons for distortions beyond tariffs and state trading, most likely the existence of the VAT. Hence, if China begins to comply with the 'national treatment' clauses that it promised to implement, an exploitable gap between the international price of soybeans and China's domestic price will appear and be likely to result in even greater imports (although the imports could also come in the form of soybean oil).⁴ Our results also find that cotton and sugar were highly protected in October 2001 (Table 1, rows 4 and 5).

On the other hand, in the same way that China's rice price was below that of the world market on the eve of its accession to WTO, the prices of most major livestock commodities – pork, beef and poultry – and that of many horticulture crops also were below international levels (Table 1, rows 7 to 10). Part of the reason that China's meat prices are below international ones is due to valid sanitary and phyto-sanitary restrictions and also in part the number of artificial barriers that other countries have erected against China's exports (Huang and Chen, 1999). Hence, to the extent that China can use the WTO to open up new commodity markets in which it has a comparative advantage, the producers of these commodities should be able to increase exports.

In summary, as China enters the WTO, there are still a number of challenges that officials interested in liberalizing China's trade will face. Alternatively, China has a number of instruments that it has been using and may continue to use (legally or not) in managing its domestic economy. In addition to traditional trade policies, tariffs, quotas and licensing, state trading and NTBs, we have shown that China has protected and/or has the potential of protecting its agriculture with a number of other policy measures. In particular, our analysis has shown that taxation policy may still be a tool that China could try to use to protect or further open its agricultural sector. It has also used export subsidies and rebates to create wedges between

the domestic and international prices of importable commodities and to decrease the domestic price relative to the world price of exportable goods.

3. WTO Effects at the Border

The magnitude of the effect of the WTO agreement on China's farmers depends on several factors. First, the magnitude will depend on the size of the true NPR as discussed in the previous section, which is a function of the distortions in the economy. The second factor is the size and nature of China's market. To compute a set of estimates of post-WTO supply, demand, trade and price effects, a complete assessment must include an analysis of both supply and demand behavior of producers and consumers of each commodity, not only inside China but also in the rest of the world. Such analysis, however, is beyond the scope of this paper. In other work done by the authors, when we use a partial equilibrium policy analysis framework to project the impact of completely liberalizing prices, we find that rice farmers and livestock producers benefit greatly; wheat, maize, and soybean producers suffer large falls in prices and income cuts (Huang and Chen, 1999).⁵ Given the sizeable gaps that our analysis has measured between domestic and international price for some crops, it would be plausible that if the nation were to undergo complete trade liberalization, the economy would experience wrenching changes. There would potentially be big winners and losers.

However, China's accession to the WTO is not a story of 'big bang' trade liberalization. In reality, China's entry into the WTO represents another gradual step in the opening of the external economy based on the aforementioned historical events. In fact, there are at least three factors, policy safeguards, household responses and high transaction costs (or isolated markets), that can serve as a buffer to the impacts of liberalization policies for those who live rural China.

3.1. Policy Safeguards and Household Responses

Even when China's producers will face the most liberalized conditions imposed on them by the WTO agreement (the peak year is currently specified as 2004) under which China will enter the WTO, there are provisions that will allow the nation to protect its rural sector – both under the letter of the agreement and by actions that it should be expected to take. Under the accession agreement, China's TRQ levels are set at modest enough levels that the quotas may not even bind. It is possible, for example, that after WTO, when TRQs are offered to private traders at such narrow price gaps between the international and domestic market (10% or less for the type of wheat the majority of China's consumers demand), importers will be faced with the predicament that the only worthwhile wheat to work with is of the highest quality and its market may not be large enough to fill the TRQ.

Moreover, even after China complies with all its obligations, the TRQs are low enough and quota tariff rates (or tariff bindings) are high enough that, even if the TRQs were filled, policy makers have the means to minimize damage suffered by producers and consumers. For example, after bringing in imports up to its TRQ level (e.g. 9.636 million tons for wheat), China's leaders can legally assess a tariff of 65% on any additional imports. At such high tariff levels, China's wheat producers would almost certainly be shielded from any competition from international producers for many years since, according to any conceivable set of predictions, there are no scenarios under which China's domestic price would rise by more

than 50% of the world price for a long period of time. This statement is especially true if China continues to commit itself to its ambitious set of 'green-light' investments in water control, rural roads, and agricultural research and extension. The same would be true for almost all other agricultural commodities, not just for wheat. Of course, there would be pressure to continue liberalization into the next round of world trade and investment liberalization negotiations. If the effects were damaging enough (or were perceived to be damaging enough); however, China's leaders would not agree to further concessions without at least obtaining agreement in other areas (e.g. allowing China to make higher decoupled producer payments) that would provide large enough gains such that the negative impact would be offset.

The case of soybeans before the WTO agreement, however, shows that when protection does come down and China allows more or less access to its markets (that is except for the official tariff and VAT), imports will surge. Before 2000, the import tariff for soybeans was as high as 114%, importers required licenses, and China's farmers grew most of the nation's soybeans. However, in anticipation of China's WTO accession, tariffs were lowered to 3% in 2000. After such a reduction, officials also phased out import quotas. Consequently, imports surged from 4.32 MMTs in 1999 to 10.42 MMTs in 2000. In 2001, most observers believed soybean imports exceeded 14 MMTs. Prices also fell and the nominal protection rates of soybean declined from 44% in the early 2000 to 15%, in October 2001. From this case it is possible to see that when the protection rates are high and there is high enough demand for a commodity, imports can move up sharply.

China's accession into the WTO will negatively impact households, especially in the short run, but when these households live in areas that are highly integrated into China's economy, they will have the ability to respond to the changes. Hence, even though households may experience large negative effects in the initial period, the costs may diminish over time, as farmers are responsive and flexible under the changing economic situations. For example, farmers in some areas may find that their soybean crop will be unprofitable in the first years after the onset of the implementation of the WTO agreement measures and thus their incomes will fall in response. These farmers, however, are not locked into soybeans by policy or regulation and rational producers will not continue to operate at a loss. Instead, they will undoubtedly respond by adoption of new technologies and investments that will allow them to take advantage of the positive opportunities that have arisen in the wake of the free trade agreement. However, there is no assurance that all farmers in the long run will benefit from the changes – in fact, some will ultimately be net losers. But, because of the ability of farmers to respond and be flexible, their losses in subsequent years can be substantially lower than in the initial year of policy changes.

Hence, in China, the magnitude and severity of the negative impact of WTO policies on agricultural production will depend, in part, on how well households are able to respond amidst change and how the government can help them be flexible. The rapidity and diverse ways with which the rural economy has historically evolved when facing changes in the external environment provides a source of optimism for a long run beneficial impact for China's rural economy. For example, the rural economy was responsive to the fiscal reforms in the 1980s that gave rise to China's rural industries. The market also responded positively to grain reforms in the early 1990s. In addition, the restructuring of ownership patterns was responsive to banking reforms in the late 1990s. However, while households and individuals have responded to policy changes in the past, households may respond and adjust to WTO policies even faster if officials simultaneously promote a more liberalized

rural credit and banking system, protect property rights, and foster wholesaling networks.

3.2. WTO Effects away from the Border: Market Integration in Rural China

To the extent that there are high transaction costs inside China and to the extent that certain domestic markets are isolated from others in the countries – it especially those inland areas that are isolated from the port regions where imports land – it could be that the impact of WTO policies will not be evenly distributed. In previous work on China's agricultural markets (e.g. Park *et al.*, 2002), it was found that, in general, China's markets were fairly integrated by the mid-1990s. However, this conclusion should be qualified. First, although there has been a large improvement, this previous work still found large parts of the country, especially poorer areas, were not completely integrated. Moreover, the work is dated, since the study was conducted over seven years ago and markets have had time to mature and leaders have taken a number of policy actions that could lead to greater market fragmentation. Surprisingly, given the fragile nature of reforming China's agricultural markets, there is almost no recent work that addresses these questions.

Why is it important to know if China's markets are integrated or not? If markets do not operate well and there is poor integration, the effects of WTO policies on producers in isolated areas will be greatly diminished. According to a study by Taylor (1998) of the impact of NAFTA on Mexican farmers in border regions and those in more remote regions that faced high transaction costs for marketing, their output and buying inputs varied dramatically. In fact, Taylor (1998) found that NAFTA has had little impact on those in the poorest areas mainly because they were insulated from the changes by high transaction costs. Before NAFTA, since most of their economic activities were all either within the household or with others in their own village or township, the prices that they were facing and selling for were determined locally and were not affected by what happened far away in the nation's coastal areas.⁶

Alternatively, if markets are well integrated, inland prices will fall in response to a sharp drop coastal area prices. If integrated markets do transmit price effects into inland areas there could be a substantial impact on incomes of those least able to cope with changes, since the majority of residents are some of the poorest farmers in China, who are dependent on the agricultural sector for income and are not as resilient to fluctuations in the agricultural sector, due to non-diversified production portfolios.

To assess how integrated and developed markets in rural China are in the late 1990s and 2000, we proceed as follows. First, we will describe the data. Second, we examine how prices are determined and whether prices across China's marketing regions behave as if they are in an integrated, well-functioning market. If prices do behave as if markets are integrated, we should expect to see prices fall as market locations move away from the main consumption centers, which in the case of China are its main ports. We should also expect to see prices fall, as markets are located further away from main roads and railways. Finally, we will test for integration and conduct direct tests of how well prices in different markets move together.

4. Data

The data come from a unique price data set collected by China's State Market Administration Bureau (SMAB) in Beijing. Nearly 50 sample sites from 15 of

China's provinces report prices of different agricultural commodities every ten days. The prices are the average price of transactions that day in the local rural periodic or wet market. The Ministry of Agriculture's Research Center for Rural Economy (RCRE) assembles the information in Beijing, making the compiled data set available to researchers and policy makers.

We examine three main agricultural commodities, rice, maize, and soybean prices from 1996 to 2000 (except for maize that was only available through 1998). These three crops are produced and consumed in nearly every province in China. Rice price data are available for 31 markets. Because of quality differences among rice varieties in different regions of China, we look at price formation at the national level and within four regions, South China (South), the Yangtze Valley (YV), the North China Plain (and North-west China – NCP) and North-east China (NE). For the provinces included in the sample, rice prices are available for over 90% of the time periods.

Prices for maize and soybean data are available for 13 and 20 markets, respectively. Product homogeneity makes it possible to include a broader geographic range of buyers and sellers in a single analysis, and we are able to assess the integration of markets spread out over 1000s of kilometers. For example, the sample includes maize-producing regions in Shaanxi and Gansu Provinces and a maize-consuming region in Guangdong.

However, because trading patterns differ from those of rice, for the purposes of establishing distance from the major consumption region, China is divided into three maize and soybean marketing regions: coastal China (north of the Yangtze Valley between Beijing and Shanghai); the North–South coast–inland axis (a marketing region running between Guangzhou, Wuhan, Man and further north); and the NE (between the north-east provinces and Beijing).

Since the data set is temporal, prices were converted to a real basis. Nominal prices from our data set are deflated using monthly consumer price indices calculated and reported by the State Statistical Bureau (SSB, 1981–2001). Deflation facilitates transaction cost comparisons across time and allows us to disregard transaction cost increases within periods associated with inflation.

We also conducted extensive fieldwork, visiting nearly every major producing and consuming region in China over the past year to gain a better understanding of the institutions and policies affecting rice, maize, and soybean trade and to collect information on trade patterns. Interviews were conducted with national, provincial, and county grain officials, traders in buying and selling regions, transport officials (responsible for rail, trucking and shipping), futures and wholesale market staff, managers of grain retail outlets, and local private traders in rural periodic markets. Traders in major grain exchange centers and officials in provincial capitals provided estimates of the volume and direction of grain flows and transport, handling, and other transaction costs. Interview data are used to restrict the sample to pairs of provinces that actually trade rice and maize, where appropriate disaggregate results regionally validate our transaction cost estimates and assist in interpreting the empirical results.

We also have created a data set that provides several characteristics that theoretically should affect the price that traders and producers receive in an area if markets are functioning well and are integrated. We calculated the distance from each market by way of the shortest and most commonly used transportation route from the port (Guangzhou, Shanghai, Beijing and Dalian). This variable is called 'distance from the port.' We also determined the distance of a market from a national

highway and the distance to the nearest grain terminal via the rail system. Descriptive statistics are provided in Appendix Table A1.

5. Price Determination

Our first test of how well markets are functioning depends on the analysis of the behavior of prices of several of China's main commodities, maize, soybeans, and rice. If China's markets function well, then there is a greater likelihood that the price effects in one region of the country, in this case shocks caused at the border from increased imports or exports (or increased consumption in the coastal market), will affect producers (and consumers) in other parts of the country. If price formation does not appear to be consistent with the existence of adequately functioning markets, whereas the border effects may still be sharp (indeed, they may be sharper since demand curves would be more inelastic), large regions of the country should be shielded from the falling or rising prices that occur in coastal markets. Hence, the hypothesis to be tested is that price relations across China's regions exhibit characteristics that make it appear as if China's domestic producers, consumers and traders face price pressures created in part by market forces.

A simple plotting of the relationship between the price of rice in South China in 2000 and the distance from South China's main port city, Guangzhou (in Guangdong Province), shows a price contour that is consistent with the existence of well-functioning markets (Figure 3). Since the main demand center and point of export for varieties of rice produced and traded in south China is Guangzhou, one would expect that in an integrated marketing system, as a market became more remote, the price should fall. Indeed, the price in a market 1000 km away from Guangzhou (e.g. a market on the Yunnan Plateau), is, on average, about 0.20 yuan lower per kilogram (or about 11% of the average rice price in China – see Appendix Table A1).

The results of a multivariate analysis of the relationship between price and several factors, including distance from port and measures of the access of the market to the transportation infrastructure, finds similar results for maize, soybeans, and rice across China (Tables 2 and 3).⁷ Holding all other factors constant, as maize marketing sites move farther away from Guangzhou and Shanghai, the price falls (Table 2, row 1).

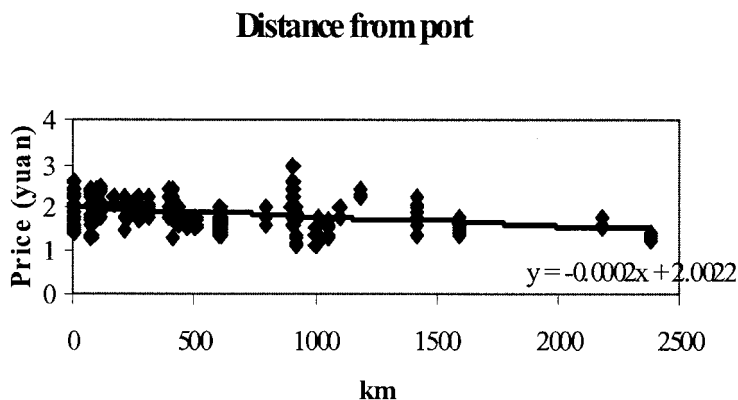


Figure 3. Changes in rice price across China as markets increase distance from port, 2000. *Note:* Graph of bivariate relationship between rice price and distance from port. Slope of line given by the simple linear regression of rice price on distance.

Table 2. Ordinary least squares regression explaining soybean and maize price variation in China and selected marketing regions in China, 1998 and 1999 (dependent variable: real price of maize or soybeans)

Explanatory Variable	Maize price, 1998		Soybean price, 1999		Soybean price, 1998	
	(1)	(2)	(3)	(4)	(5)	(6)
Distance from Guangdong:	-9.3E-05 (9.32)**	-0.00029 (12.4)**	-0.00039 (-17.72)**	-0.00021 (8.01)**	-0.0004 (8.40)**	-0.00019 (3.24)**
Distance from road ^a	-	0.005319 (13.1)**	-	-0.00828 (9.91)**	-	-0.00928 (4.84)**
Distance from rail	-	-0.00103 (6.15)**	-	0.005106 (8.29)**	-	0.001669 (1.18)
Marketing region dummies:						
East (or inland)	-	-0.34 (6.09)**	-	0.245 (4.82)**	-	0.23 (1.98)**
West (or coast)	-	-0.039 (1.03)	-	0.46 (8.69)**	-	1.08 (8.89)**
Period dummies ^b	Included	Included	Included	Included	Included	Included
Adjusted R-square	0.1401	0.525	0.3121	0.4069	0.1321	0.2992
No. of observations	318	318	648	648	648	648

Note: T-ratios in parentheses. Coefficients marked with * and ** were statistically significant from zero at the 10 and 5% level, respectively; ^aDistance of market from road was measured as distance in kilometers from nearest 'national-level' road; ^bDummy variables were included for each sampling period throughout the year. Survey was conducted every 10 days. Therefore, we included 35 period dummies. The one for the first 10-day period of January was dropped.

Although the magnitudes of the coefficient on the 'distance from part' variable change from year to year, their sizes still fall in a fairly narrow range (from 0.16 yuan/kg to 0.39 yuan/kg). This is what one would expect from markets for commodities for which traders use fairly similar transportation routes, equipment and infrastructure to get their products to markets. Since the values of the commodities on a per kilogram basis differ, the transportation/transaction cost in percentage terms varies from commodity to commodity. Soybean is lowest (about 5% average in 1999 and 2000); rice is second (8.7% in 2000 and 6.6% in 1998); and maize is the highest (22% in 1998). Interestingly, the magnitudes of the transportation/transaction costs are similar, although lower, than those reported in Park *et al.* (2002). This result, however, should not be surprising, since China's infrastructure has improved rapidly in recent years, as has the nation's transportation sector (Luo, 1998).

The case of rice is somewhat more complicated. Although the simple relationship between rice price and distance from the port (from Guangzhou, Shanghai, Qinhuangdao or Dalian) is negative (Table 3, column 1), when other variables are added (using a specification similar to those used for maize and soybeans), the coefficient on the distance from port variable becomes positive (Table 3, column 2). The coefficient for this relationship only becomes negative again after either a squared distance term or a set of two locational dummy variables is added to the regression (Table 3, columns 3 and 4). Both changes to the specifications suggest that, in the 2000 rice market, there was a non-linear relationship between distance to port and

Table 3. Ordinary least squares regression explaining rice price variation in China and selected marketing regions, 1999

Explanatory Variable	(1)	(2)	(3)	(4)
	Full Sample ^c	South China Region	Yangtze River Region	Yellow River Region
Distance from port:				
Linear term	-0.00016 (-7.14)	-0.0003787 (-4.35)	0.0000184 (0.26)	-0.0000361 (-1.29)
Squared	5.17e-08 (8.41)	2.47e-07 (5.57)	-1.09e-07 (-3.24)	2.40e-08 (3.48)
Distance from road ^a	-0.00378 (-12.04)	-0.0034828 (-5.95)	-0.0097497 (-5.70)	-0.0046768 (-5.16)
Distance from rail	-0.00025 (-1.66)	-0.0004541 (-2.75)	0.0058257 (2.92)	-0.0023546 (-3.75)
Marketing region dummies:				
South	0.23573 (9.35)			
Yangtze	-0.05628 (-2.83)			
North-east	-0.17794 (-5.37)			
Income	Not included			
Period dummies ^b	Included	Included	Included	Included
Adjusted R-square	0.3088	0.4167	0.2239	0.1582
No. of observations	1170	307	343	520

Note: T-ratios in parentheses. Coefficients marked with * and ** were statistically significant from zero at the 10 and 5% level, respectively; ^a Distance of market from road was measured as distance in kilometers from nearest 'national-level' road; ^b Dummy variables were included for each sampling period throughout the year. Survey was conducted every 10 days. Therefore, we included 35 period dummies and the one for the first 10-day period of January was dropped; ^cNorth-east marketing region has too few observations.

rice price. In other words, in 2000 the rice price begins to fall as markets move away from the port. However, after the rice price hits a certain point (in this case about 1600 km from the port), the price begins to rise. Interviews with traders in Guangzhou, Kunming and Beijing provide an explanation for the finding. In some years (e.g. in 2000, the year we find this price non-linearity), production in the surplus regions of the Yunnan Plateau was lower than normal. If so, it is possible that the regional rice price rose high enough so traders could not earn a profit shipping rice to the Guangzhou market after paying for transportation and procurement costs. In fact, during interviews with traders we found that most of the rice produced and sold in Yunnan markets that year stayed inside the province. Hence, in this year, we should not expect to see a linear relationship between price and the distance from the coastal port. Analysis of the determinants of price in other years supports such an explanation. For example, in a more normal production year (e.g. 1996), the coefficient on the distance to port variable is negative and significant, using the same specification as in Table 3, column 2.

Our findings in the rice market therefore suggest that, in some years, some inland markets are isolated from coastal and international markets. In other years, however, the links are re-established. To the extent that it is local supply and demand characteristics that determine the participation and not a policy intervention (or infrastructure failure) that artificially isolates a region, the findings are consistent with China having well functioning, although emerging markets.⁸

6. Integration Tests

In this section, we use more formal tests of market integration. Cointegration statistics measure the proportion of movement in one price that is transmitted to another price during the period of observation. The coefficient on the ‘causing’ price is bounded between 0 and 1, where 0 indicates that there is no impact on the ‘affected’ price variable (and markets are not integrated), and where 1 indicates that markets completely adjust within the analysis period. A coefficient inside the 0–1 interval indicates that prices adjust only partially within the period of observation (or that markets are integrated but frictions slow down price transmission). Two markets are cointegrated if the coefficient is not different than one at a 5% level of significance.

The results of the cointegration analysis support both our descriptive findings and the conclusions of the determinants of commodity price analysis in the previous page, especially when they are compared with the findings of research on market integration in the late 1980s and early 1990s (Table 4). In the middle part of the reform era (1988 to 1995), a time when markets were starting to emerge, a study using the same data as used in our present study found that between 20 and 25% of markets showed signs that prices were moving together during the study periods and sub-periods (Park *et al.*, 2002). According to Park *et al.* (2002), 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 Park *et al.* (2002) study as a base line, our current analysis shows that, during the late 1990s, China’s markets have not only continued along their previous path of maturation, but in particular those markets for maize and soybeans are remarkably

Table 4. Percentage of market pairs that test positive for being integrated based on Dickey–Fuller test in rural China, 1988–2000

Commodity	(Percentage of market pairs)	
	1989–1995	1996–2000
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 from same data set. 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.

integrated. In the late 1990s, examining the co-movement of prices between pairs of markets in our sample, we see a large increase in the number of integrated markets. In the case of maize, for example, in 89% 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% of the time in the early 1990s. The number of pairs of markets for soybeans, japonica and indica rice show similar increases (Table 4, rows 2 to 4).

Moreover, in many cases these markets were separated by more than a 1000 km. For example, we frequently found prices to be integrated between markets in Shaanxi and Guangdong provinces and between those in Sichuan province and southern Jiangsu. Interviews with traders in remote parts of China support our findings. In one case, we were interviewing traders in northern Shaanxi, more than 200 km north of Xian, the provincial capital. We found that, on a daily basis, purchasing agents of a large trading network originating in Guangdong would phone their regional headquarters nearly everyday, receiving price guidelines for procurement. The regional coordinators, in turn, stayed in nearly constant contact with those in South China, the destination of much of their purchases. To the extent that there are many such networks (and indeed one cannot help but run into grain buyers many times in any given day when working in villages in rural China), it is unsurprising that price data from the local markets in a remote inland location would more or less move with data collected from markets in the coastal regions.

Based on each of the market performance analyses, the impacts of the WTO on China's agriculture will be experienced across wide regions of the nation, a finding that has both positive and negative implications for China's rural residents. First, to the extent that the WTO will lead to price falls at the border (see the previous section for a discussion of the complicated set of factors that the realization will depend on), farmers of certain crops – most likely maize, cotton, wheat and soybean – will suffer a cut in revenue. However, if prices rise due to the China's accession, because agricultural traders are able to increase their exports, integration will allow some of China's farmers to benefit.

Moreover, if China's markets are broadly linked across large regions of the country, the mere size and number of people who will be affected actually may help attenuate the effect of negative impacts, at least as long as China's TRQ commitments are relatively low. The main reason for this attenuation is that the larger the region over which the price effect of a given quantity of increased imports is spread, the smaller the price effect will be (on the region it affects). To illustrate this point, assume an extreme case. If markets in China were completely isolated (in other words between the local areas around a major port and inland regions), one would expect the prices in coastal cities to fall immediately from the current price to the international price level, making any price gap disappear completely. Inland areas (which have been shown to be above the world market price), however, would not be affected and the price received in the inland area would depend on its own supply and demand. Even if prices in the inland region were higher, the price gap between that region and the world market would persist. At the other extreme, if markets were perfectly integrated, the fall in the price gap would be somewhere between zero and the full fall, depending on the quantity that was imported. Since China's TRQs are relatively small and since markets appear to be fairly well integrated during most years, it is plausible to expect that the price fall will also be relatively small. Of course, if the price fall were small, it would be more likely that the entire amount of the TRQ would be imported.

7. Conclusions

In this paper, which centers its attention on the agricultural sector, we show that in the cases of some commodities in some regions of the country, farmers will be negatively affected. In particular, in the cases of maize, soybeans, sugar and cotton, the price gaps that exist between the prices of China and the world will mean that imports should flow into the nation as WTO is implemented. However, even if the short run negative effects on agriculture are substantial, there will be many other indirect effects of WTO. To the extent that it positively affects the efficiency of the rural economy, the longer run economy should be stronger and have broad positive effects. Moreover, improving the ability of households to respond to market changes in both their production and investment decisions can mitigate the negative effects. Hence, as China enters the 21st century, it should combine trade and investment liberalization policy with a number of other transition and rural development policies in order to push for as rapid an evolution as possible towards a modern economy.

Moreover, our study's focus on the agricultural sector showed that even in agriculture, the overall impact would not be negative. Our findings, based on new methods to collect data and create NPRs, show that there are also commodities in which China has considerable comparative advantage – e.g. rice, meats (in some parts), and horticulture products (in other parts) – hence, the WTO could provide benefits to those engaged in these activities. China needs to pursue policies that will encourage the export of these commodities.

The extent to which prices fall (from rising imports) or rise (from rising exports) depends in part on how China's executes its WTO obligations. Although there may be room for foot dragging (which could delay the negative effects), it is more important to note that the nature of the agreement itself also provides many means to limit the downside effects. Likewise, China's benefits are going to depend on how well its trading partners honor their commitments and provide China with better access to global markets. We suggest that, rather than foot dragging, China would benefit from using its political capital and goodwill to fight the unfair measures used by some trading partners, such as Japan's safeguards against mushrooms. Here, China has already had a huge, unheralded win by getting Japan to move from its original proposed use of blatantly WTO-illegal non-tariff barrier measures to safeguards that are transparent and temporary. Complainants against foreign trade barriers in the WTO tend to have a high success rate. To gain the most in the long run from the agreement, both China and its partners need to make an attempt to live up to their agreements.

We have also found that, unlike the case of Mexico, it appears as if many of China's markets may be fairly well integrated into the rest of the economy. This is good news and bad news for poor farmers in inland areas. The good news is that they can benefit from falling input prices and rising export opportunities. The bad news is that, unlike a large number of maize farmers in Mexico who were not affected by NAFTA's reduction in maize import restriction, our results show that, for large parts of China, its rural farmers will be affected. The problem, although perceivably only for the short run, may be that this group of households is the least flexible and most dependent on agricultural for its income and subsistence. Consequently, our findings point to an important developmental and social problem for China's rural economies and this should be taken as a warning to government leaders as they need to be concerned about the welfare of these susceptible groups.

Notes

1. A number of good analytical papers exist that identify the conditions under which China will enter the WTO, the possible sources of gain and losses, as well as what the effects might be on aggregate trade. (See, for example, Tuan and Cheng, 1999; Johnson, 2000; Carter and Estrin, 2001; CARD, 2001; OECD, 2001 etc). Little of this work, however, tries to track the regional, sectoral or other specific effects with empirically based methods.
2. Jikum: please include a one to two paragraph explanation of the calculations of these NPR's...
3. In Table 3, we estimate a new set of NPRs on the eve of China's accession to the WTO. These estimates will attempt to overcome some of the previous problems of researchers. In particular, we try to understand in a more disaggregated way, the part of certain markets (in terms of varieties or commodity type) that China is protecting. Such an analysis, should help us more accurately assess what the impacts will be after China implements its WTO obligations. To overcome previous shortcomings of NPR studies, we primarily rely on a new data set, collected from interviews and surveys with more than 100 importers and exporters, domestic traders and grain officials, with the stated goal of precisely identifying the differences in prices at a precise point of time and a particular location between an imported good on one side of the border (outside China) and a domestic good of identical quality on the other side (inside China). Likewise, we also wanted to identify the same price gap between exportable domestic goods as they leave the country and the same goods from other countries that are being traded in international markets. Such information provides the raw data that we used to estimate NPRs on a highly disaggregated basis. While such information is of interest in its own right (which we analyze in more detail in Huang and Rozelle, 2002), it also can be used to construct more aggregate NPRs (for the entire crop) by making certain assumptions about the structure of the distribution of quality of the commodity in the domestic economy.

Conducted in 2001, the enumeration team was in the field more than 3 months, from August to November. The team visited seven port cities – Guangzhou, Shenzhen, Ningbo, Shanghai, Lianyungang, Qinghuangdao and Dalian – and two other more inland cities, Beijing and Changchun. In each port, a number of 'sampling frames' were used to select a sample of domestic traders, importers and exporters, wholesalers, grain and oilseed users, trade regulators, agents, and other grain and fiber officials. Because of the absence of a single central authority that manages grain flows, the enumeration team chose their sample in a number of ways. In each location, we first visited the local grain bureau and obtained access to a list of all grain bureaus, the firms that they were running on a commercial basis, and their subsidiaries. We interviewed an official in the grain marketing division and transportation division. We also chose three firms that were owned directly by the grain bureau and three that were affiliated with the grain bureau. In several cities, the grain bureau had a list of large grain-trading and grain-using firms (e.g. mills and feed lots). In others, this was obtained from the market administration bureau. Five firms were chosen on the basis that they were private and had yearly sales that exceeded 1 million yuan. We interviewed at least two flour or rice mills and feed mills in each location. Finally, we visited the wholesale market and randomly chose five stalls to interview. The team also visited a number of other entities, such as the grain reserve, the local COFCO agency (China's state grain trading corporation), and supermarket chains. In some cases, the managers of these entities knew the grain trade business well enough to answer our questions, in other cases they did not. In total, more than 100 people were interviewed. Only a small fraction (less than 10%) of those contacted refused to be interviewed.

4. National treatment is a clause in China's WTO agreement under which it promises to treat internationally produced goods in a way that is identical to the way it treats domestically produced goods.
5. Without considering the political-economy factors that affect how fast and how complete the distortions are removed, traditional supply, demand and trade analysis, such as with the use of a CGE or partial equilibrium modeling framework, is needed to project the changes in output, consumption, prices and income.
6. Moreover, because farm households in poorer areas are operating in economies that are characterized by poor, incomplete or absent markets for many factors, such as land and on-farm labor, even when these households do interact with commodity or input markets, if there are changes in these prices, some of the impact of the prices are 'absorbed' by changes in the shadow value of the un-marketed household resources, such as land or labor. For example, part of the fall in agricultural prices could affect the shadow value of land, which while 'real' is unrealized since the household is not able (or is not willing) to sell or rent the land in any case. Such impacts, rather than having their full effect fall on family nutrition or consumption, often end up mainly affecting the farmer's valuation of leisure or un-marketed land. That is not to say that WTO policies do not affect welfare in these

- areas; they do. However, the complicated ways in which farmers in these economies respond to changes in prices and marketing opportunities usually mean the effects are much smaller than they would be on households that live and work in completely commercialized economies.
7. The cases of maize and soybeans might be expected to provide the strongest cases since, unlike rice (China's main food grain), feed grains are inherently more homogeneous in nature, quality-wise. In addition, maize and soybean markets should be more robust from year to year in any given region, since a larger fraction of the output of feed grains is typically marketed, and less is used for the own consumption needs of the farm family – a feature that may make it so that local growing conditions (i.e. if there was a drought or flood that reduces on-farm output, but would not reduce the family's consumption needs) will be more likely to affect the participation of food grain farmers in output sales markets.
 8. Maize, soybeans and rice prices also vary in most cases in most years with the development of the regional infrastructure (Tables 3 and 4, rows 2 and 3). In most regressions, the signs of the coefficients on the variables distance from the nearest national road and distance to the nearest rail are negative and significant in many of those cases. As one would expect, when a market is on a major road or rail link, the cost of getting that grain into the national marketing network and to the consumption center is lower and so the price of procurement would be higher. The further away the market, the lower the price (in most cases). Such a finding is also consistent with competitive and integrated markets.

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Appendix

Table A1. A summary of price data and key determinants for rice, maize and soybeans in China, 1996–2000

	1996	1997	1998	1999	2000
Rice					
Price (average annual price)	3.01	2.32	2.27	2.15	1.81
Average distance from the port ^a	–	–	–	–	882.22
Average distance from the railway ^a	–	–	–	–	39.70
Average distance from the national hwy ^a	–	–	–	–	11.97
Corn					
Price (average annual price)	1.56	1.22	1.32	N/A	N/A
Average distance from the port ^a	–	–	–	–	1125.91
Average distance from the railway ^a	–	–	–	–	34.54
Average distance from the national hwy ^a	–	–	–	–	13.17
Soybean					
Price (average annual price)	3.64	3.96	3.54	2.83	2.81
Average distance from the port ^a	–	–	–	–	638.15
Average distance from the railway ^a	–	–	–	–	18.93
Average distance from the national hwy ^a	–	–	–	–	10.98

Source: Authors' Survey; ^aData from SSB, 2000.