

PRODUCER BENEFITS FROM INPUT MARKET AND TRADE LIBERALIZATION: THE CASE OF FERTILIZER IN CHINA

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In recent years, a number of researchers have documented the impact of China's trade and domestic market liberalization—both positive and negative—on the performance of the rural economy (Huang and Chen; Huang, Rozelle, and Chang). Most of the work, however, has focused on the agricultural output markets. Beyond the impacts that have occurred through output markets, liberalizing trade and domestic markets also can affect producers through the effects on agricultural inputs. To compete effectively with producers from other countries and benefit from trade liberalization, farmers in China need to have access to high-quality, modern inputs. The effects of input market and trade liberalization also can be significant; fertilizer accounts for around 40% of the cash outlays of farmers in China and chemical fertilizers are China's largest imported input in value terms.

Despite the potential benefits to farmers, few researchers have attempted to document either trade or domestic market reforms for inputs in China. Although national leaders announced efforts to relax restrictions on inputs during the early reform years, the attention given to the reform of markets for fertilizers, pesticides, and seeds lagged behind the reforms affecting output commodities (Stone, 1988; Crook). The challenges faced

by reformers in the case of inputs also have been greater than for farm output. Prior to the reforms, agricultural inputs almost exclusively were manufactured by state-owned enterprises and distributed through rigidly structured state-run sales networks. Given their starting point and that leaders have paid less attention to the reform of input markets (at least relative to output commodities), we have reason to believe that the input market reforms may not have made as much progress. If so, it is possible that returns to future market and trade liberalization for inputs could be substantial.

The overall goal of this paper is to assess how input trade liberalization induced by China's accession to the World Trade Organization (WTO), will affect producers in China. However, since the implementation of WTO has been so recent, and it is still too early to measure any impacts even if we had data from China's first postaccession year, we must look to the past for answers. Given that the primary impact of trade liberalization of inputs is through lower prices, we meet our overall goal by pursuing three specific objectives that focus mostly on fertilizer prices. First, we identify changes in domestic input marketing and trade policies over the past two decades in order to determine the sources of past input price changes. Second, we assess the degree to which producers have benefited from these price falls by examining the extent to which China's input markets can be considered integrated and characterized by low transaction costs. This will help us determine whether the gains from lower fertilizer prices that come as a result of domestic or trade policy reforms can benefit inland farmers away from port areas or domestic production sites. Finally, based on the observations from the experience of trade and marketing reform in the past, we conjecture about how the new trade liberalization measures will impact future fertilizer prices

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and benefit farmers in the post-WTO accession period.

Fertilizer Market and Trade Reform in China

Chemical fertilizers were not always readily available for farmers in China. In the prereform era, during the 1960s and 1970s, Socialist planners sought self-sufficiency in most industrial commodities and imported little fertilizer (Stone, 1988). During the 1980s, decollectivization coupled with the adoption of "Green Revolution" seed varieties led to a rapid increase in agricultural production that, in turn, triggered an unprecedented rise in the demand for fertilizer. Despite the efforts to boost domestic production, demand grew even faster and officials for the first time began to import. By 1991, China's fertilizer imports accounted for over 20% of world fertilizer trade.

Increasing fertilizer availability, however, did not come in tandem with the liberalization of domestic fertilizer markets in the 1980s. Planned fertilizer allocations dominated the national marketing and distribution system. Almost all fertilizer factories were state-owned and heavily subsidized (Xiao). Although implemented in a start and stop manner, reformers did not commit themselves to a program to liberalize domestic fertilizer markets until the early 1990s. After that, however, fertilizer wholesalers and retailers were commercialized and private trade was allowed. By 1995, half of China's fertilizer was sold by nonstate firms and in 1997 all trade limits were dropped.

During the pre-WTO years, China maintained strong central control of international fertilizer trade. Set up in the 1950s, Sinochem has imported all of China's fertilizer and only imported the quantities that were approved explicitly by the State Council (Stone, 1993).¹ Even throughout the 1990s, when the number of foreign trade companies expanded rapidly and began to increase imports of many types of commodities, Sinochem maintained its monopoly over fertilizer imports.

Similarly, little progress was made in tariff reductions for inputs. Estimates of the effects of trade liberalization on agricultural output are largely driven by tariff reductions occur-

ring over the reform period (Huang and Chen). During the 1980s and 1990s, however, the tariff rates of fertilizers changed little. Because of high tariffs and import restrictions, the nominal rate of protection of one of China's most common fertilizers, urea, was more than 150% in 1990 and 1991.

Having policies characterized by rigid tariffs and restrictions on imports, however, does not mean that the flow of fertilizer from the global economy into China's domestic market was low or stagnant. In the early reform years, when China was first beginning to implement its Open Door policy, fertilizer imports were one of the first beneficiaries. Between 1981 and 1990 fertilizer imports rose by more than 300% and during the 1990s rose by more than 70% (United Nations Food and Agriculture Organization). Although total fertilizer imports leveled off in the late 1990s for some types of fertilizer (e.g., urea), phosphorous, and potassium fertilizer imports more than doubled between the 1980s and 1990s.

When assessing the effect of China's external economic policies on fertilizer availability and prices, assigning impact should be done carefully. Increased imports during reform did not come as a result of trade liberalization. Instead, rising imports were the result of administratively determined actions. Planners, not markets, guided the interface between world and domestic fertilizer markets. Hence it should be the administrative decision to increase imports that is given credit for increasing the availability of fertilizer for China's producers.

Trade and Marketing Liberalization and Effects on Producers

In this section, we examine the effects that trade policy changes and domestic market reforms have had on rural producers. Since the main linkage between trade liberalization and rural welfare is the price of fertilizer, we frame our discussion in terms of the effect of trade reform and domestic market liberalization on fertilizer prices. We assume the size and distribution of the benefits will depend on how much change occurs at the border (and in China's own plants) and the nature of markets that allow falling prices to be transmitted inland.

At least in the late 1990s, China has experienced steadily falling fertilizer prices. Between the 1997 and 2002, domestic prices of two of

¹ China's accession to WTO in December, 2001, formally ended Sinochem's monopoly on fertilizer imports.

China's most common potassium and phosphate fertilizers, potassium chloride (KCL) and diammonium phosphate (DAP), fell continuously. The price of urea, China's most common fertilizer, fell 15% from 1997 to 2000, and remained at that level through 2002.

While trade liberalization did not occur, the rise in imports almost certainly has increased the welfare of China's producers during the past two decades (including the late 1990s). For some types of fertilizers, such as KCL, availability on the domestic markets almost completely depends on imports. In the case of other types, for example, DAP, more than 50% is from imports. With these types of fertilizer, there is little doubt that most, if not all, of the price changes in recent years have taken place due to state *decisions* to increase *planned* import volumes.

If trade liberalization has contributed so little to date to farmer welfare, outside the impact of rising import volumes, the rest of the fall in domestic fertilizer prices must be due to changes in domestic supply. With the monotonic rise of domestic production during the 1990s, there is little doubt that domestic supply has played an important role. With the elimination of factory subsidies in the early 1990s and the promotion of ownership reform for the small and medium-sized fertilizer factories (as well as managerial reforms in the larger state-owned enterprises), domestic reforms have benefited the rural sector greatly in terms of the increased fertilizer supply and lower input prices.

Effects of Improving Domestic Markets

While reforms in the distribution system served to break down the system of planned allocation and interprovincial movement, it is not clear whether efficient markets have replaced the system. If markets have developed, then inland farmers will be able to enjoy the benefits of future price falls that occur in other parts of the country (e.g., at the border). Farmers also will benefit from access to modern inputs.

In the remainder of this paper, we explore whether input markets have emerged to spread the benefits of increased production and more open access to international sources of fertilizer. To do so, we analyze the extent to which fertilizer prices are burdened by transaction costs and the extent of price integration in fer-

tilizer markets. We use monthly average retail prices from 160 sample sites in 31 provinces collected by China's State Economic Development and Planning Commission in this analysis.

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 fertilizer types, urea, KCL, and DAP. The hypothesis to be tested is that price relations across China's regions exhibit characteristics that make them appear as if China's domestic producers and traders face price pressures created in part by market forces. To show this we undertake a multivariate analysis of the relationship between price and several factors, including the distance from China's main ports and dummy variables that hold the cities and time periods of analysis constant.

The results of this analysis indicate that transportation costs are, in general, statistically significant but not large (table 1). The magnitudes of the coefficient on the distance from port variable vary, but their sizes still fall in a fairly narrow range. In the regressions in columns 1 and 2 (in which the dependent variable is the log of the price of urea) the results suggest that when the distance of a market from the port increased by 1,000 km, the price of urea increased from 1.1 to 3.8% (from 0.02 to 0.06 yuan per kg). Similar results are found for DAP (from 0.05 to 0.07 yuan per kg) and KCL (from 0.06 to 0.11 yuan per kg) fertilizer. When compared to the transaction costs experienced in the grain economy, an economy that is thought to be fairly well integrated, it should be noted that transaction costs for fertilizers are significantly lower.²

Integration Tests

In this section we test for market integration. To do so, we apply the Engle-Granger cointegration approach. Two or more price series are cointegrated (even if each is individually nonstationary) if a linear combination of the variables (i.e., the differences of the prices) is stationary. Following Engle and Granger,

² The lower transaction costs for fertilizer are not due to policies such as subsidies for fertilizer transportation. They are likely due to the relative ease of transporting fertilizer, by weight and value, when compared to grain.

Table 1. Ordinary Least Squares Regression of Fertilizer Price in China, 1997–2002

Dependent Variables	Urea						Diammonium Phosphate (DAP)			Potassium Chloride (KCL)		
	Log of Real Price	Real Price	Log of Real Price	Real Price	Log of Real Price	Real Price	Log of Real Price	Real Price	Log of Real Price	Real Price	Log of Real Price	Real Price
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Distance from port (100 km)	0.0038 (4.22) ^a	0.0011 (3.20) ^a	0.0049 (1.58)	0.0022 (1.37)	0.0037 (1.88)	0.0026 (2.37) ^b	0.0367 (3.38) ^a	0.004 (0.05)	0.0073 (11.0) ^a	0.0043 (11.2) ^a	-0.0106 (3.60) ^a	-0.0006 (0.36)
Distance square			2e-6 (0.01)	-5e-5 (0.56)			-0.0022 (3.79) ^a	0.0003 (0.70)			0.0008 (5.97) ^a	0.0004 (4.38) ^a
Time dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City dummy	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Constant	0.26 (16.4) ^a	0.31 (17.7) ^a	1.29 (54.7) ^a	1.36 (52.5) ^a	0.66 (25.4) ^a	0.59 (18.3) ^a	1.90 (36.0) ^a	1.83 (27.8) ^a	0.21 (14.6) ^a	0.27 (18.7) ^a	1.33 (72.3) ^a	1.33 (61.3) ^a
Observations	1670	1670	1670	1670	829	829	829	829	1424	1424	1424	1424
R ²	0.79	0.66	0.79	0.68	0.67	0.11	0.66	0.13	0.60	0.29	0.60	0.31

^aSignificant at 1%; ^bSignificant at 5%; coefficients for time and city dummy variables are not shown.

we apply the two-step estimation process and perform Dicky-Fuller tests on the regression residuals to determine whether price series from any two markets are cointegrated.

The results of the cointegration analysis support the conclusions of the determinants of price analysis (table 2). Between the early part of our study period (1997–1999) and the later part (2000–2002), fertilizer markets have become more integrated (much like markets in the grain economy). For example, in the case of urea fertilizer in South China (first row), in the first time period (1997–1999), the estimated results show that only 57% of markets showed signs that prices were moving together, while the number increased to 67% for the second time period (2000–2002).

Despite the emergence of functioning fertilizer markets shown by the integration analysis, our results also show that there are pairs of markets during different years that are not integrated. For example, in the DAP fertilizer market in South China, in about 60% of the cases prices moved in one market but did not in another. The case of KCL is even more notable. In 75% of the market pairs, prices do not move together in KCL markets in South China in both periods. One explanation for such a result is that there is some kind of institutional breakdown that is creating fragmented markets in China. However, many provinces in China have fertilizer plants or large stores of fertilizer held by traders and distributors. These local supplies may be sufficient to meet local demand in certain times and places so that the price differentials between regions stay within a band that is less than shipping fertilizer from other regions. When this happens, moderate price movements in one area may not necessarily induce price-equilibrating trade flows.

WTO and Effects of Future Changes

Increased trade and domestic market liberalization for inputs has provided positive benefits to producers through lower input prices. In this way, rising imports and improved domestic markets have helped attenuate some of the adverse effects of trade liberalization. Falling prices for inputs, including fertilizer, have increased profits and provided incentives to increase production. The falling input prices, however, have not occurred due to trade liberalization. At least in the case of fertilizer, prior to WTO there was little trade liberalization.

Table 2. Percentage of Market Pairs That Test Positive for Price Integration Base on Engle-Granger Cointegration Analysis: 1997–2002

Fertilizer Type	South China		Yangtse River Valley		North China	
	1997–1999	2000–2002	1997–1999	2000–2002	1997–1999	2000–2002
Nitrogen (urea) (%)	57	67	42	53	73	63
Diammonium phosphate (%)	27	40	50	63	20	43
Potassium chloride (%)	25	25	36	40	40	50

Breaking sharply with the past, China's accession to WTO greatly increases the nation's commitment to liberalize trade for agricultural inputs. For example, the agreement replaces the monopolized fertilizer trade regime with what is expected to become a more open system of tariff-rate quotas (TRQs). As with other TRQs, fertilizer imports within the quota will be levied at 4%, while imports beyond the TRQ face a much higher tariff, 50%. The TRQs for various fertilizers also increase each year throughout the implementation period. In the first year of China's WTO accession (2002), the TRQs are set at 1.3 mmts of urea, 5.4 mmts for DAP and 2.7 mmt for compound nitrogen-phosphorous-potassium fertilizer (NPK). These quotas rise to 3.3 mmts for urea and 6.9 mmts for DAP by 2008. For NPK, the implementation period will be longer (8 years) and the quota will grow by 5% per year. In addition, at least 50% of these TRQs will be allocated to nonstate trading enterprises, undermining the monopoly power of Sinochem in China's fertilizer trade.

With this agreement, given current world market prices, rural producers should benefit from WTO. Because the world-China price gap for many types of fertilizer is sizeable, even if imports are assessed as a 13% value added tax, it still should be profitable for importers to expand the volume of trade over previous years. From this point of view, rising trade will mean falling prices and with China's robust markets, rural producers across China should benefit.

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