Agricultural Trade Reform and Rural Prosperity: Lessons from China

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30 August, 2007

Abstract

Tariffs on agricultural products fell sharply in China both prior to, and as a consequence of, China's accession to the WTO. The paper examines the nature of agricultural trade reform in China since 1981, and finds that protection was quite strongly negative for most commodities, and particularly for exported goods, at the beginning of the reforms. Since then, the taxation of agriculture has declined sharply, with the abolition of production quotas and procurement pricing, and reductions in trade distortions for both imported and exported goods. Rural well-being has improved partly because of these reforms, and also because of strengthening of markets, public investment in infrastructure, research and development, health and education, and reductions in barriers to mobility of labor out of agriculture. Much remains to be done to improve rural incomes and reduce rural poverty.

The views expressed in this paper are those of the authors alone and not those of the World Bank or any other individual or institution.

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More than 25 years have passed since the China launched its institutional and economic reforms. Since that time much has been written on the economic miracle of China. Perhaps more than any other area of inquiry, a tremendous amount of scholarship has focused on China's emergence as a trading nation; a target of foreign direct investment; the rise of its industrial power and the course of urbanization (Brandt and Rawski, forthcoming).

Although there has long been an interest in the agricultural economy (e.g., Lardy, 1983; Sicular, 1988b; Lin, 1992; Rosen et al., 2004), it is quite surprising to many that the agricultural sector of China actually has a record that is impressive in many dimensions. Growth rates of gross domestic product, agricultural gross value added and food per capita increased dramatically between the early 1980s and the mid-2000s. Indeed, China's performance in agriculture over the past two decades was more impressive than any other country in South and Southeast Asia. Markets have boomed. The structure of agriculture has fundamentally shifted. Despite having the largest population in the world and high income growth (which has created wrenching changes in the nation's consumption bundle), since the early 1980s China has been a net exporter of agricultural products in all but three years. A new report by the National Bureau of Statistics of China (NBSC, 2006) demonstrates that rural incomes grew robustly between 2002 and 2005 and did so in all income deciles and all provinces (see Table 1).

One of the even more surprising facts about the rapid growth of China's agriculture is that the positive and widespread growth in recent years occured at a time when the country was supposed to be implenting one of the most radical trade

liberalization efforts of any country in history (Huang and Chen, 1999; and Huang et al., 2004). This was especially true for the case of agriculture where China moved from a centrally-planned economy committed to self sufficiency and industry-first growth, through the Open Door Policy of the 1980s, to a much more market-oriented regime. Accession to the World Trade Organization that was allowed only after China's officials promised major institutional reforms and a virtually unprecedented degree of tariff reduction and liberalization of trade in services (Lardy, 2001; Bhattasali, Li and Martin 2004).

In response to the committment to reform trade as well as domestic markets, there were fears that such sharp liberalization would have dire consequences for the rural population. In poor countries, government officials know that agricultural price shifts can have important effects on domestic food production, farm household incomes, national poverty rates and overall rural stability. Many voices focused on the cuts in agricultural tariffs and warned that poverty in China would be exacerbated and rural incomes would fall if the nation were to follow through with their ambitious domestic market and trade liberalization policies (Carter and Estrin 2001; Li *et al.* 1999; Schmidhuber 2001, Ni 2007). Even in light of these concerns, policy makers have pushed ahead.

By the middle of the 2000s, the concerns about rural incomes of critics of trade policies have not been realized. Even scholars who have long worried about poor income growth in the rural areas are admitting the incomes and rural welfare are rising as never before. Although the gap in incomes between urban and rural people remains large conventional measuers of this gap are overstated because they do not take into account the lower costs of living in rural areas and by the exclusion of rural migrants living in

urban areas when calculating average urban incomes (Sicular, Ximing, Gustaffson and Li 2006; Chen and Ravallion 2007, NBSC 2007), rural incomes have grown steadily.

The overall goal of this paper is to address these questions using two specific approaches. The first is to present estimates of indicators of direct and indirect interventions of China's government in agriculture from 1981, when it first became possible to assess the stance of trade policies, to 2005, when almost all of China's WTO commitments had been phased in. In particular, we seek to understand the stance of agricultural policies before WTO accession, and then to assess whether the government carried through with its commitment to liberalize and integrate China's farm economy with the rest of the world. To achieve this objective, we examine the differences in prices between international prices and domestic prices at the border (Nominal Rates of Assistance or NRA at the market level and NRA_f at the farm level). Because inputrelated policies have generated few distortions in the case of China (OECD 2005), we focus on the transfers associated with changes in commodity prices. In most general terms, we find that China's economy shifted from an economy that was highly distorted with a generally taxed agricultural sector, to one that was highly integrated with the world economy.

Statistical profiles of the rural population show that throughout the early 2000s rural incomes have risen for all deciles and for all geographic regions of the country. In the second part of the paper, we seek to understand what allowed the rural economy to do as well as it has in the face of falling prices for some products. To do so, we examine four factors: investments in agricultural technology; the policy responses aimed at deregulating agricultural markets and promoting structural adjustment; the new set of

programs that have redirect resources towards rural infrastructure and services as well as relatively non-distorting transfer programs and tax cuts; and policies aimed at facilitating the movement of labor from agriculture to industry and from rural to urban.

The wide scope of the goals and objectives necessitate certain limitations. First, the absence of data precludes us from examining the entire agricultural sector. Instead, we examine commodities that account for nearly two-thirds of gross output value in all of the study years. Second, although we are able to judge from the price trends and an understanding of domestic marketing and pricing and trade policy reforms the broad sources of the shifts in the distortions of the agricultural economy, we can not identify the exact source of changes. Because of the complexity of agricultural trade instruments over this period—including state trading, quotas, licenses, tariffs and exchange rate distortions—we were forced to use price comparison approaches in a period where exchange rates were highly distorted for much of the time. To do this, we use an estimate of an equilibrium exchange rate to compare international prices with prices in China's domestic economy, an approach used in (Martin et al., 2006) to assess the impacts of exchange rate reform. At this point of our analysis, we can not identify the exact causes of the recent rises in income and assume they are linked to the agricultural R&D; market liberalization and rural infrastructure/services investments that are described. Earlier works by the authors and others have examined these causal linkages in more detail (Huang and Rozelle, 1996; deBrauw et al., 2004; Luo et al., 2007).

Before showing these results in the following section, we discuss our quantitative approach and sources of data. The results of the distortion analysis are presented and discussed in next section. The following section discusses three policy responses that are

likely part of the reason for the robust performance of China's rural sector. The final section concludes.

Methodology and data sources

In this paper, we have utilized the approach specified in Anderson, Martin, Sandri and Valenzuela (henceforth, Anderson et al., 2006). The approach is broadly based on comparisons between domestic and international prices. During the reform era these price comparisons provide indicators of the incentives for production, consumption and trade, and of the income transfers associated with interventions.

Our approach essentially creates four measures of distortions for each major commodity in the agricultural economy. The most basic measure in our analysis is the Nominal Rate of Assistance (NRA). NRAs are used to compare the prices of commodities in the domestic economy (at the port) with the international prices of commodities at the border (that is, cif in the port for importable goods; fob in the port for exportable ones). Conceptually, with the NRAs we are trying to measure the extent of the distortions due to tariffs, exchange rate distortions, and other non-tariff barriers—at the border.

Because of barriers within the domestic economy, the extent of protection (or disprotection) that is afforded by trade policies may not be the same as the real rate of protection to farmers. Since we have independent observations on the prices obtained by farmers in local markets we are able to estimate the *nominal rate of assistance at the farm level* taking into account *both* border distortions and domestic distortions affecting farmer returns (NRA_f's). NRA_f's are calculated after allowing for quality adjustment, tax or

subsidies, transport, storage and handling costs in moving commodities from the farm to the wholesale level. Differences between NRAs and NRA_f's arise from subsidy or transfer payments that cause the prices received by farmers to differ from what they would receive under competitive internal market conditions.

The data

In compiling our data we necessarily had to make choices on the coverage of the commodities included in the study. In the overall study, we included 11 commodities: rice, wheat, maize, soybeans, cotton, pork, milk, poultry, fruit (using apples as a representative product), vegetables (using tomatoes as a representative product) and sugar (both sugarbeet and sugarcane). Over the study period, these commodities accounted for between 75 percent (in the late 1980s) and 60 percent (during the early 2000s) of the total value of agricultural output in China. Because decisions on production and consumption to China's domestic market prices were only gradually being allowed to respond to domestic prices, and because we do not have access to reliable data on secondary market exchange rates prior to 1981, we focus on data for the period beginning in 1981.

When wholesale and retail prices for some commodities in some years were not available, price margins from farmgate to wholesale and retail are estimated. Much of the data on margins, transportation costs and other transaction costs are from an extensive set of surveys by Huang and Rozelle during the 1990s and the early 2000s, surveys which also served to establish which commodity price series provided appropriate bases for price comparisons. Some of this was previously reported in Rozelle et al. (2000) and Huang et al. (2004), which provided information on substantial quality differences

between some imported and domestic commodities and resulting biases in price comparisons as a measure of protection. For more recent years, survey teams from the Center for Chinese Agricultural Policy interviewed traders in 10 cities around China in 2006. The complete data series are in the appendices of Huang et al. (2007).

Results

The role of domestic price and marketing policy

Before examining the role of distortions at the border, it is useful (and necessary) to examine the relationship between the available domestic price series for farm and retail prices for two major grain crops (Figure 1, Panels A and B). The importance (and role) of China's domestic price and marketing policy for rice and wheat (the two largest crops in China—one an exportable and the other an importable) can be seen by comparing the state-set urban retail price and the state-set rural farm-gate procurement price with the rural retail price, a free market price. Until 1992 the urban retail price for rice was generally substantially below the price on the free market in rural areas, despite the costs associated with transferring rice to the urban area. This was a consequence of a procurement price system designed to provide urban residents with relatively inexpensive food. Only urban residents could buy rice at these low prices and only with ration coupons that were available in limited quantities.

In addition, the marketing and procurement system may have been the source of additional distortions. The relatively low selling price of grain at the farmgate by farmers shows that China's food system in the 1980s was set up to transfer income from rural to urban people (Figure 1, Panels A and B). The amount that farmers received for the

mandatory deliveries was far below the free market price. However, there is some question about the effects on incentives for production and consumption given the inframarginal nature of many of these transfers (Sicular 1988a). This is because after the mid-1980s farmers were able to sell additional amounts at higher market prices once they had met their obligation to deliver a fixed quota quantity at the low purchasing price. If a farmer sold more grain than was required by his/her delivery quota, and the above-quota price was determined by market forces, there may have been less of a distortion.

Ultimately, however, even such policies are not fully decoupled from incentives, with seemingly infra-marginal transfers away from rural households, for instance, giving their members an incentive to move out of agriculture. These linkages have been shown by Wang et al. (1999). Therefore, the distortions created by domestic marketing and procurement systems may have distorted incentives relative to international prices.

After 1992, however, changes to China's domestic marketing and procurement system appear to have eliminated this additional layer of taxation and regulation for producers of rice, and wheat (Figure 1, Panels A and B). In the early 1990s the urban price began to rise above the farm gate price; urban and rural retail prices also came much closer together. This reflects the phasing out of the implicit taxation of farmers through the grain procurement system. The gap between urban and rural retail prices essentially disappeared. And the gap between the rural retail price and the farm price declined, possibly suggesting an improvement in marketing efficiency (Park et al. 2002). With the disappearance of the distortions from the marketing and procurement system, the remaining distortions after the mid-1990s reflect only trade policies and not trade and domestic policies.

Nominal rates of assistance for China's main agricultural commodities

In this section we focus on the distortions faced by farmers in China between 1980 and 2005. To do so, we examine plots of NRAs and NRA $_{\rm f}$'s over time for an illustrative subsample of our 11 commodities. A more comprehensive analysis is contained in Huang et al. (2007).

Distortions to the grain economy before 1995. The distortions to the rice economy of China in the 1980s and early 1990s are characterized by two important features (Figure 2, Panel A). First, the NRA of rice, an exportable commodity, is negative in every year between 1980 and 1995. Ranging between -40 and -10, the negative NRAs show that China was highly competitive in international rice markets during these years. Trade policy, and particularly the state trading monopoly, kept exporters from shipping large quantities of rice onto world markets and kept the market price of rice in China's port cities below the world price. Even if there had been no other distortions in the rice economy, producers would have faced prices below world market prices.

The second feature demonstrates how domestic marketing and procurement placed a greater tax on farmers and insulated the domestic price of rice from the world market price even if trade policy had been liberalized (Figure 2, Panel A). Because of China's marketing policy through the mid-1990s, the state's artificially low procurement price kept the price received by farmers systematically below the free market price of rice as seen by the NRA_f's. Because of this the total tax on rice ranged from -70 in the early 1980s to -30 in the early 1990s. Rice producers were among the most heavily taxed farmers in China—given the large share of the crop's sown area and large negative rates

of disprotection. Importantly, our analysis shows how the state used trade and procurement policy to tax its rice farmers.

Unlike rice, the NRA measures show that trade policy offered high rates of protection for wheat in China between 1980 and the mid-1990s (Figure 2, Panel B). After 1980, during most years, the free market price of wheat in China's port cities was about 60 percent higher than the international price of wheat (cif, China's port cities), ranging between 50 and 70 percent. Unlike rice, which China produced competitively during the 1980s, wheat producers—who have been shown to produce at a higher cost than many other producers in other countries (Huang and Ma, 2000)—received high prices for their marginal output from trade policy. This policy on its own, unlike that for rice, would not be consistent with providing inexpensive food for consumers. It would, however, be consistent with a policy of food self-sufficiency since it would encourage greater production by keeping out imports and keeping domestic prices high.

The differences between rice and wheat illustrate that trade liberalization in China should not have been expected to hurt everyone and emphasizes the importance of looking at distortions on a commodity by commodity basis. If China's marketing and trade policies were creating the gap between the international and domestic prices were eliminated, in the case of rice, of course, producers should gain. Therefore, when considering rice areas in China, trade liberalization should not have been expected to cause producer incomes to fall. In fact, the opposite is true. By contrast, high protection rates for wheat were raising domestic market prices of wheat in the 1980s and early 1990s, a benefit that would disappear if trade policies were effectively implemented. Therefore, our analysis of why trade policy reform is accompanied by rural income rises

is most relevant for the case of crops, such as wheat, that were receiving positive protection in the 1980s and 1990s.

Domestic marketing policies, however, were working in the opposite direction. The trends of the NRA_f's show how the forced deliveries of wheat quotas largely insulated farmers from the high rates of protection (Figure 2, Panel B). Although there was still positive protection for wheat in most years between 1980 and 1995, the average rates were lower (all below 50 percent except for in 1994 and 1995) and were zero and even slightly negative in 5 of the 16 years (1981; 1982; 1990; 1992; 1993). These figures suggest that policy for wheat was trying to increase production, through the higher market prices, but to transfer income from producers to consumers through the inframarginal transfers captured in the NRA_f. Huang et al. (2007) show that the story for maize is similar to that of wheat.

Distortions to the grain economy after 1995. After 1995 our distortions analysis shows that China's international trade and domestic marketing policies have changed strikingly (Figures 2—right hand sides of panels). It is apparent from the way the differences in the estimates of NRAs and NRA_f's narrow that China's reformers were able to eliminate the procurement policies that had been taxing rice and wheat (and maize) farmers (either by reducing the tax imposed by trade policy as in the case of rice or reducing the protection as in the case of wheat). In other work, Huang et al. (2004) show that the elimination of the procurement quota system contributed significantly to a reduction in the tax burden shouldered by farmers. In part, then, procurement policy reform itself was one of the ways that help increase rural incomes to farmers during the 1990s.

The liberalization of domestic markets in the mid-1990s was accompanied by a liberalization of trade policy, at least in the case of China's major food grains. After 1995 the taxation and subsidization of rice and wheat clearly were, indeed, as announced by officials, being phased out as the NRAs for rice steadily rose (became less negative) and the NRAs for wheat fell. Likely in part in preparation for its accession to the WTO, China's leaders liberalized trade for its main food grains to such an extent that between 1995 and 2001 most of the protection for these crops was eliminated. Since 2001, the NRAs for both rice and wheat have been almost zero. In a very real sense, it is the case of wheat that will interest us in the next section. Even though market prices of wheat fell during this time, why is it that rural incomes all over the country (including in wheat growing area) rose.

Edible oils, milk and sugar. Outside the grain economy, marketing and trade reform, as in the case of wheat, removed the positive protection from a number of key commodities. The source of liberalization, however, differs in the case of cash crops and processed goods. In particular, the biggest difference between the analysis of distortions of grain crops and cash crops (in our case, for soybeans) is that domestic marketing policy has historically played less of a role. Although in some counties in China there was a procurement delivery quota for soybean producers, it was not as widespread as for grain (in many counties soybeans were not procured by the state procurement system). In addition, the implicit tax on soybeans in places in which soybean quotas were collected was lower than that for the staple grain crops. Therefore, there is little difference between the graphs for NRAs and NRA_f's. In fact, because there was no state-mandated procurement of any non-grain crops, the same is true for all of the rest of the

commodities (livestock; horticulture and milk and sugar). As a result, the discussion in the rest of this section—for both the 1980s, 1990s and post 2000 period—focuses on trade policy.

Before 1995, our analysis shows that soybeans fluctuated between being taxed and protected (Figure 3). Although the average level of protection was roughly zero, protection varied from 30 percent to -20 percent. A paper by Rozelle and Huang (2004) shows that a lot of this fluctuation was due to domestic production policy that would first encourage soybeans, then discourage them, then encourage them while national planners allowed little trade.

The trends in the NRAs after 1995 show the strong commitment to trade liberalization for soybeans (Figure 3, right hand side of the graph). Beginning in the late 1990s and continuing through to 2005 the protection for soybeans fell from around 30 percent to almost zero. This falling protection, in fact, should not be a surprise given the integration of China into world soybean markets and the monotonic rise in imports (which exceeded 25 million tons in 2005). The story of soybeans after 1995 parallels that of wheat. In fact, because of the high level of imports, the case of soybean producers often raised in discussions about the adverse effects of trade policies on farmers (see Rozelle and Huang, 2004 for a complete description). In fact, Rozelle and Huang (2004) empirically show through their modeling effort using CAPSiM (a agricultural sector simulation that was developed by the authors that, in fact, soybean prices would have been considerably higher and the income of soybean producers also would have been higher in absence of trade reform. Therefore, in the case of soybeans the government carried through with its commitment to trade reform and, as such, it remains to be

explained why it is even when soybean prices were suppressed by trade liberalization and the rise of imports that rural incomes continued to rise.

The story for milk and sugar is similar to that for soybeans and, in fact, protection of these commodities began earlier and remained higher later. During the 1980s the NRAs for milk and sugar were positive and large (Figure 4, Panels A and B). Those for milk ranged from 50 to more than 200 percent between 1980 and 1987. Those for sugar were above 40 percent through the late 1990s. Although beginning earlier and falling further, by the late 1990s and after 2000 (in the early 1990s for milk), NRAs for milk and sugar were falling (to around 20 percent by 2003) and for milk were near zero. In other words, after 1995, the pattern for milk and sugar followed nearly the same contour as that for soybeans, and if rural incomes have risen as fast as NBSC data shows, this contributes to the apparent mystery about how rural incomes in the late 1990s and after 2000 have continued to rise.

Livestock and horticultural commodities. While there still is a mystery with wheat, soybean and livestock producers about the absence of a negative income effect that accompanied the trade liberalization-driven fall in protection, the case of livestock (Figure 5 for pork) and horticulture (not shown here—see Huang et al., 2007) shows that trade liberalization directly helped raise farm incomes in certain regions and sectors. In the cases of hogs in the early reform era there was heavy implicit taxation on livestock and horticultural commodities. In part, as noted by Huang et al. (2004), this situation was created by China's grain-first policy. Although China can competitively produce labor-intensive livestock and horticultural products, producers were neither encouraged to produce or export these commodities on a large scale. Part of this was due to China's

own barriers, such as the quotas on exports into Hong Kong. Another part of the price gap shown in these figures reflects trade barriers facing China in export markets. While there quite possibly were grounds for some of the barriers (for example, foot and mouth disease is widespread in China), even if a claim was blatantly false it could not be adjudicated effectively since China was not a WTO member. As a consequence, China's livestock and horticultural producers produced commodities far below the world market price yet were unable to increase exports into global markets.

Aggregate impacts. Aggregating the 11 commodities in our study together (and by importables and exportables) and assuming that our study commodities largely reflect the distortions to all of China, there is a striking pattern (Figure 6—left hand side of figure) that reinforces the positive relationship between trade liberalization and rural incomes. In the 1980s and through the mid-1990s, importables (such as wheat, soybeans, milk and sugar) were protected. On average, the protection rates were between 15 and 35 percent. The same was true for exportables, except the distortions show that commodities such as rice, livestock commodities and horticultural commodities were implicitly taxed. The implicit tax rates ranged from 40 to 50 percent. Overall, since the value of exportable agricultural products accounted for a greater part of the economy than importables throughout the early reform era, China's agricultural was highly distorted and on average the distortions were negative. In other words, China was taxing its agriculture—with both its international trade and domestic marketing policies.

One of the main findings of this study is evident from the right hand side of Figure 6. After 1995, the NRAs of importables fall from around 20 percent to less than 10 percent. During this period, the NRAs of exportables rose, or the implicit taxes on them

fell, from about 40 percent to around 15 percent. When taken together, the distortions in China's agriculture fell to less than 10 percent. In many years the overall protection was between 0 and -5 percent. Clearly, the combination of domestic marketing reforms and international trade liberalization has generated an economy that, on average, is one of the least distorted in the world. It also helped China enjoy rising incomes (in the aggregate) at the same time that it was reforming trade policies. Thus, blanket statements that presuppose a negative relationship between trade liberalization and income are not always true. In part, the realization of a positive relationship depends on a pre-reform economy which is being taxed, being able to successfully implement trade policies and allowing producers to expand their production in the commodities in which they have an advantage.

When considering the impact of trade reform on the agricultural sector, it is not sufficient to consider just the direct effects of protection. In fact, Krueger, Schiff and Valdés (1991) concluded that the indirect taxation of agriculture resulting from protection to other sectors and exchange rate overvaluation was generally more important than direct distortions to agriculture in the overall incentives facing developing country agriculture. In the case of China, there has been an enormous amount of liberalization of non-agricultural barriers, including tariffs, exchange rate overvaluation through the two-tier system, quotas and licenses. We have combined our estimates of these distortions into a composite measure of the distortions facing non-agricultural tradeables into a single index depicted as NRA non-agricultural tradeables in Figure 7. In a simplified two-sector model what matters is the relative rate of assistance (RRA) also shown in this figure. This figure shows that during the period between the early 1980s and 1995, the

agricultural sector benefited from a progressive reduction in both direct and indirect taxation. The RRA was, as a consequence, always above the NRA for agriculture. In the period since 1995, when taxation through the procurement system was abolished, the RRA has become positive and continued to rise, albeit at a much slower rate than in the 1981-1995 period. The reduction in taxation of the agricultural sector evident in this diagram is consistent with the improvement in the terms of trade for agriculture relative to non-agriculture within China observed by Zhu and Hong (2007) using data on relative prices for agriculture and non-agricultural goods.

Distinguishing the impacts of WTO accession. One final issue that needs to be recognized when considering the impacts of reforms associated with WTO accession is the nature of commitments in the WTO. China's main WTO accession commitments on agricultural market access were in the form of commitments that tariffs would not rise above the bound levels agreed in China's WTO accession schedule. These commitments were negotiated through an intensive process that took into account the market access interests of existing members, and the previously prevailing applied tariff rates. Given the nature of China's trade regime, however, the relationship between these tariff rates and China's actual protection was weak. For many products, the relationship between domestic and world prices was determined more by state trading, quotas and licenses than by tariffs.

Table 4 shows the relationship estimated by Ianchovichina and Martin (2004) between applied protection prior to accession, the applied tariff, and the bound tariff associated with WTO accession. From the Table, it is clear that the applied tariffs for many commodities were strikingly above the protection actually applied. For rice, the

applied tariff of 114 percent was quite irrelevant, with the actual protection applied being negative. Similarly, the applied rates of protection on wheat and maize were far below the applied rates of 114 percent. For only a few commodities, such as soybeans, did the bound rate agreed at the WTO require reductions in the protection previously applied. This distinction between reductions in applied rates and reductions in actual agricultural protection is extremely important. Much of the concern about potential adverse impacts of WTO commitments expressed either in prospect by authors such as Schmidhuber (2001) or Carter and Estrin (2001) or retrospectively by authors such as Ni (2007) is based on the reductions in tariff rates required by WTO accession.

Creating a Package of Policies to Support Marketing and Trade Liberalization

Our analysis that empirically documents reductions in the distortions to China's agriculture helps us meet our first objective. China's commerce and trade policy makers, at least in agriculture, have successfully carried out their promises to liberalize markets and trade. In some sense the analysis also helps explain the second puzzle. Because of the rising share of livestock and horticulture in China's agricultural economy, and because trade liberalization actually eliminated negative protection (or reduced the implicated trade policy-induced tax protection) in these expanding sectors, the aggregate level of protection (combining the net effects of commodities that were having their positive protection removed AND the commodities that were being less taxed) was shown to be moving upwards towards zero. This means, of course, that in the aggregate trade policy was actually helping increase incomes. In this way then we are in part contributing to the explanation of how rural China avoided collapse during trade liberalizations.

However, the story needs more explanation. In part, the additional explanation is needed because rural incomes not only rose on average, they rose *in all provinces* (Table 1). The rise in income occurred in all provinces, including those in northern, northeastern and northwestern China. In these regions of China, farmers have been documented to produce many crops (wheat, maize, soybeans and cotton) that were still receiving positive protection during the late 1990s and early 2000s. If this set of crops account for most of the cropping area in northern, northeast and northwestern China, there is still a puzzle to explain. Why did incomes rise in those areas even though we know that the income of some producers would have suffered from trade liberalization-induced cuts in protection after the mid-1990s. Part of the explanation is presumably the reduction in the cost structure resulting from rapid liberalization in the rest of the economy. But this is surely not the whole answer. In the rest of this section we discuss three sets of policies that we believe in part (at least) have been instrumental in explaining why incomes could have risen even while protection fell.

Development and Dissemination of Agricultural Technology

Scientists and policy makers in the international community, in both developing and developed countries, recognize the importance that agricultural technology and its extension has played in promoting the expansion of supply and increased productivity in the world over the past 30 years. Much of the world's early economic growth has been shown to be tied closely with the productivity of the agricultural sector. In a country like China, where agriculture is dominated by small, poor farms, it is even more important.

During time of the reform era, it was not always clear if China was going to be able to maintain the pace of advance in technology needed to maintain farm incomes in a

dynamic economy. While in the early 1980s decollectivization played an important role in boosting productivity (getting more out of the same bundle of inputs due to more intense effort—Lin, 1992), after 1985 research has shown that technology has been the main engine of growth of productivity has been new agricultural technologies (Huang and Rozelle, 1996). China was one of the first nations to develop and extend Green Revolution technology in the 1960s, 1970s and 1980s. Hybrid rice was developed by China's scientists in the late 1970s and it was the only country in the world to have commercialized the new technology until the mid-1990s.

Despite these and other successes, China's system of agricultural research faced great challenges in the late 1980s (Pray et al., 1997). Research investment, almost totally publicly funded, was waning. Incentives were poor and funding was being allocated in a way that did not always reward excellence. The system was not responding to the demands for new technologies in many cases. And, the extension system was in shambles.

In part in response to the new demand to produce new technologies, a nationwide reform in research was launched in the mid-1980s (Pray et al., 1997). The reforms attempted to increase research productivity by shifting funding from institutional support to competitive grants, supporting research useful for economic development, and encouraging applied research institutes to support themselves by selling the technology they produce. In addition, in the late 1980s and early 1990s, imports of new horticultural seeds, genetics for improvement of the nation's livestock inventories (Rae et al., 2006) and new technologies for dairy (Ma et al., 2006).

After declining for more than a decade (between the early 1980s and mid-1990s—Pray et al., 1997), investment in R&D also began to rise. Funding was greatly increased for plant biotechnology, although only Bt cotton has been commercialized in a major way (Huang et al., 2002). China ranks among the global leaders in agricultural biotechnology. In the late 1990s China invested more in agricultural biotechnology research than all other developing countries combined. Its public spending on agricultural biotechnology was second only to the US; according to some projections it will soon outspend the US government in plant biotechnology research. Including investment into agricultural biotechnology, since 1995 investment by the government into R&D increased by 5.5 percent annually between 1995 and 2000 and by more than 15 percent annually after 2000 (Hu et al., 2007). The rise in spending was the largest of any large nation in the world during the past decade.

The investment in R&D—before the reforms and the recent reform and resurge of investment apparently has been paying off—in both the early and late reform period. According to our analysis during cost of production data, during China's early reform period the yields of major food rose steadily (Table 2, column 1). Although a significant portion of that gain arises from the mobilization of inputs, not all of it has; in fact, the technological improvements appear to account for some of the growth, since indices of aggregated inputs (that is, measures of land, labor and material inputs) for rice, wheat, and maize actually fell for all the crops during the early 1980s (column 2). The drop in inputs, while output has been rising, mean the productivity has risen in China (Table 3, column 2).

Although there was concern about the effect of the slowdown in R&D spending during the 1980s and early 1990s, the analysis shows that the level of output continued to outpace inputs (Table 2, columns 3 and 4). And, productivity trends continued to rise (Table 3, column 2). During this time—and during the early reform period—China's TFP has been rising at the healthy rate of about 2 percent per year during the early reform era. Such rises, which occurred in all provinces and with all crops, could not have helped but increase incomes—of all farmers—regardless of the whether the crop was one receiving protection or being taxed.

Policies to Encourage Market Integration and Efficiency

Price and market reforms have been key components of China's transition strategy in the nation's effort to shift from a centrally-planned to a market-oriented economy. The policies have only been implemented, however, in a gradual way (Sicular, 1995). For example, the initial price and market reforms initiated in the late 1970s were modest in scope. At that time the initial reforms were aimed only at raising farm level procurement prices and allowing a small amount of local trade. These specific reform policies included gradual increases in agricultural procurement prices toward market prices, reductions in procurement quota levels, the introduction of above quota bonuses for cotton, tobacco and other cash crops, negotiated procurement of surplus production of rice, wheat, maize, soybean, edible oils, livestock, and most other commodities at price levels higher than those for quota procurement, and flexibility in marketing of surplus production of all categories of agricultural products by private traders. It is interesting that in the initial years there was little effort to move the economy to one in which most all resources and factors were allocated according market price signals. Over time the

government's position on market reform has gradually evolved. As officials in charge of the overall economic reforms began to be committed to use markets as the primary means to allocate resources for the economy, the commitment to allowing markets in agriculture also deepened (Sicular, 1995).

As markets began to emerge, China's leaders both took steps to encourage the efficiency of markets and, perhaps more importantly, stepped aside and allowed them to expand in an environment with minimal distortions. Above all national and regional governments invested in the hardware—roads, landline telephones and cellular technology—that reduced transaction costs and accelerated the flow of information and goods (Park et al., 2002). Many regional and local governments invested in marketing sites and tried to attract commercial interests to set up business in their localities. Finally, except for a short period in the late 1990s, government officials, in fact, have stepped back and allowed the entry of private traders and private transport and done little to interfere with markets. Licensing fees and taxes are low or non-existent. Markets were encouraged for both agricultural outputs and inputs.

In making an assessment of the health of the rural economy, it is important to understand how well China's markets are functioning. Markets—whether classic competitive ones or some workable substitute—increase efficiency by facilitating transactions among agents to allow specialization and trade and by providing information through a pricing mechanism to producers and consumers about the relative scarcity of resources. With better markets, producers can begin to specialize, become more efficient and increase their incomes.

There is much evidence that China's markets have improved markedly over time.

According to price data that are reported through a string of private reporting stations and information firms, it appears that China's markets function relatively well. For example, maize prices in Northeast China track each other closely (Rozelle and Huang, 2003). Soybean prices in markets in different regions of the country move almost in perfect concert with one another (Rozelle and Huang, 2004). Rice markets also have been shown to function as well as or better than those in the United States in terms of the efficiency of moving commodities around China's producing and consuming regions (Huang et al., 2004). Horticultural, dairy and livestock markets are all dominated by millions of small traders who are operating in extremely competitive environments (Wang et al., 2007; Wu et al., 2007; Bi et al., 2007). Huang et al. (2003) argue and provide empirical evidence that the improvement in the quality of China's markets have made prices behave across the nation's provinces in a way that is almost identical to the way prices behave across the United States.

The improvement in markets has allowed individual producers to specialize as they never have before. According to one national survey, the number of villages that have become specialized producers of a single commodity rose from less than 20 percent in 1995 to nearly 40 percent in 2004 (Rosen et al., 2004). Such integration also has allowed relatively small and poor farmers to participate in emerging markets and to accrue the substantial income gains associated with moving from subsistence to market orientatin (Wang et al., 2007; Bi et al., 2007; Balat and Porto 2006). In fact, in a recent survey of the greater metropolitan Beijing area, it was found that poor farmers living in poor villages were the main beneficiary of the new demand for horticultural commodities. Since poorer farmers tend to live in more remote, less accessible regions, their participation could only be facilitated if markets worked.

Most importantly, according to deBrauw et al. (2004), when markets in China have begun to become more competitive and efficient, they have led to rising productivity and efficiency. The link between improved markets and rising incomes is important because it is consistent with our puzzle. Although market and trade liberalization in some cropping sectors have reduced protection and necessarily adversely affected income, the rising productivity and efficiency effects may have partly offset the negative impacts. This interpretation is supported by the modeling work in Huang et al. (2005) which finds when trade policy negatively affects the price of some commodities (e.g., wheat), but positively affects others (e.g., horticultural crops), farmers reduce the downside effects by shifting part of their cultivated area into the commodity with the rising prices. When markets work well, such shifts necessarily are facilitated.

Public Investment, Services and Subsidies

Any visitor to most parts of rural China is struck to one thing: Agriculture is still being carried out in an environment that can only be described as backward. Except in a few suburban and coastal regions, the infrastructure in rural China is extremely poor.

Roads and bridges, irrigation and drainage, drinking water, schools and health facilities are far from modern and decades behind the level of infrastructure that characterizes China's cities. Yet development economists know that for a country to modernize, its infrastructure has to be able to support the production and marketing activities of a complex economy. Public goods also provide services that give utility outside of work to those living in the region.

Although the stock of infrastructure is poor, this is not to say that there has not been an improvement in recent years. Research has shown that on average each village in

China had about one infrastructure project during the late 1990s. This is far higher than most other developing nations in Asia. In addition, in the past two years, the level of investment activity rose sharply (to almost one project per year—Luo et al. 2007). Most of the projects are public goods (and not activities, such as orchards, that the government used to invest in during the 1980s). In addition, it can be shown by research that the investment is being targeted fairly well—increasing amounts are going to poor, minority and remote parts of China. Clearly, this is a record for which the new government should be commended.

Despite the progress, however, rural China is still far from becoming a modern economy. Although the level of public goods investment per capita rose from about 40 to 100 US dollars (in PPP terms), it is still far below the levels that were enjoyed by rural residents in Japan during the 1950s and South Korea during the 1970s (Luo et al., 2007). Although most farmers in China admit that their living environment and public goods infrastructure has improved in recent years, very few say that they are satisfied. Quality, while rising, is still low in many villages (Liu et al., 2007). In fact, it often is the case that a small improvement appears to whet the appetite of rural residents and leads to greater demand. This means that to make progress and move towards an economy in which rural and urban residents both have sufficient infrastructure, China is just beginning and it will take an enormous and sustained effort to transform the rural economy.

Education and Health Programs

Rural services—in particular education and health—are perhaps that weakest part of the rural economy, despite the recognition by development economists of their importance. Rural education by any metric is abysmal. Fees—until recently—were high,

even for elementary school. Buildings and equipment are outdated and poor. Teaching quality is poor. Because of poor education, there is evidence that even as the nation accelerates its drive towards industrialization and urbanization, and even during a time that agriculture is becoming more complex and demanding, retention rates for farm children remain very low beyond the compulsory nine years of schooling. Partly because tuition and associated fees are so high—an estimated one-quarter of total expenditure for many poor households— participation rates in high school (grades 10-12) are less than 15 percent for the rural population. A national survey found that nearly half of rural residents believe education has not been improved in recent years (Liu et al., 2007).

While many feel that the current efforts are still too little and too late, in response to the problems, there has been an new surge of interest by the government in improving rural education and reduce the cost of education—especially in poor, rural areas. In 2005, fees for elementary schools were eliminated in poor areas. In 2006, this was expanded to the entire rural economy. By 2007 all compulsory education (grades 1-9) is supposed to be free. The income effects of such policies—especially for those families—are enormous. In fact, it was shown in Huang et al. (2004) that the elimination of government tuition fees provided a benefit more than twice as large as the losses resulting from tariff reductions for China's protected crops.

The national and regional governments have also begun to build a rural health care program. In its initial years, while funding was scarce, it is in high demand. By 2007 the government was investing up to 30 yuan per capita into the program.

Farm Subsidies and Taxes

The government has launched a massive program of direct subsidies in 2004 and the program is planned to expand further in the coming years. Designed in part to boost production of grain (for national food security) and in part as rural income transfer, the national Grain Subsidy and national new technology program have in a very short time become fixtures in the rural economy. Nearly 80 percent of farm households received subsidies. Participation in the program is as high in poor areas as is it is in higher-income areas (Tan et al., 2006). Although they were relatively small in the first year of the program, by the second year, between the two programs, many farmers were receiving about 10 to 15 yuan per mu, which is more than 70 yuan per acre. There is discussion about increasing the amount.

While farmers were obviously predisposed to favoring the program (who does not like direct subsidies), there are several issues that China must weigh in considering the long term benefit and sustainability of the program. First, is whether or not payments of Grain Subsidies should be counted towards the nation's Aggregate Measure of Support (AMS) at the WTO. In its accession to WTO, China agreed to keep its distorting payments in agriculture below 8.5 percent of Agricultural Gross Domestic Product.

Obviously, if these payments were counted against the AMS, China would be rapidly approaching its maximum level of payments. But there is a question about whether the payments are "distorting or not." In 2004, a survey by RCRE found that more than 70 percent of the payments were decoupled. In other words, farmers received the payment whether they planted grain or any other crop. If this were the case, then such payments arguably could be counted as pure, unlinked transfers and not counted. However, during

the second year of the program there was more of an effort to target those households that produced grain. If the receipt of the payment were connected to the type of crop that was planted, obviously this would be a distorting subsidy and a careful accounting would have to be done to figure out the maximum possible amount of subsidies that China could give, given its WTO commitments.

In addition to subsidies, the national government also has eliminated almost all taxes and fees in rural villages. In 2001 and 2002, all fees were converted to a single agricultural tax that was not to exceed 8.5 percent of a household's (village's) gross value of agricultural output. However, no sooner had this policy been implemented across China than the national leadership decided to eliminate the tax altogether. By 2007, surveys have shown that farmers are paying almost no taxes.

When added together—rural infrastructure, free rural schools tuition, grain and other agricultural subsidies, tax reductions and health insurance subsidies—total to a large amount. In fact, between 2004 and 2006 these programs added significantly to the increase in rural incomes. These programs were quite widespread, being enjoyed by more households in rural China. Therefore, it is easy to see how even when some farmers suffered falling receipts due to trade liberalization, other government programs have stepped in and injected enough funds through enough programs that almost everyone has ended up with higher incomes.

Improving Mobility of Labor out of Agriculture

China began the period under study with around 50 percent of its workforce in agriculture and will reduce this fraction to just a few percent by the time she reaches high income status. The rate of migration out of agriculture consistent with China's growth

path is one of the most rapid ever observed. The slow pace of this adjustment, particularly due to sector and region-specific investments in human capital is frequently seen as the source of the typical "farm problem" where farm incomes fall below incomes in the rest of the economy.

The usual resistances to labor out-migration are compounded by a number of Chinaspecific factors. One is the *hukou* residence permit system, which has restricted mobility of labor into urban areas (see Sicular and Zhao 2004). Another is the land tenure system, where households leaving the agricultural sector completely must relinquish their land without compensation (Zhao 1999). Other China-specific resistances have come from factors such as the low quality of educational opportunities in rural areas discussed above. Unless these structural rigidities to mobility of labor out of agriculture are reduced, the effectiveness of other reforms, such as tax cuts or price supports, is likely to be diminished greatly, as excess labor remains bottled up in agriculture, earning low returns.

During the period we consider, the *hukou* system has been relaxed considerably, to the point where it is regarded by some, but not all, labor economists working on the issue as a relatively minor source of resistance to overall labor mobility out of agriculture. Relatively little appears, so far, to have been done to change the land tenure system to reduce this barrier to mobility. The improvements in rural education discussed above seem likely to play a key role in enhancing mobility, both by increasing returns from work outside agriculture, and by lowering the costs of adjusting (Fan and Hertel 2004).

Conclusions and Implications

The main finding of our paper is that the nature of policy intervention in China's agriculture has changed dramatically over the past 25 years, transforming the agricultural sector from one characterized by high distortions to one that is relatively liberal. In the 1980s and early 1990s (or the early reform period) there were distortions in both external and domestic policies that isolated domestic producers and consumers from international markets. Importantly during the early reform period domestic marketing and pricing policies actually served to make the prices that domestic producers and consumers faced almost independent from the effects of trade policy. Because of this even in the case of a exportable commodity (e.g., rice), a commodity that had already been taxed heavily due to the distortions at the border, domestic pricing and marketing policies further prevented producers to reap the profits from international-level prices and instead forced farmers to sell much of their surplus to the state at an artificially low price. Hence, domestic policies levied a tax on farmers even though there was little protection at the border. Similar dynamics characterized importable commodities such as wheat and soybeans where, despite fairly high rates of protection from trade policies, producers were receiving much less protection than they would have had their been a free domestic market for the importable, while consumers were being implicitly taxed.

In contrast, since the late 1980s and early 1990s (the *late reform period*), the liberalization of domestic markets has reduced the distortions from domestic policies (as the market gradually has replaced the state as the primary mechanism for allocating resources and has became the basis of farmer production and marketing decisions). At the

same time, especially in the case of importable commodities, trade policy has been liberalized, with distortions from border measures falling substantially. As a result, we find that in recent years (that is, by the end of the late reform period), China's agriculture is much less distorted in two ways. First, the differences between international and domestic market prices have narrowed considerably for many commodities due to trade policy liberalization. Second, the elimination of domestic policy distortions increased farm prices for many commodities. Reductions in protection to non-agricultural tradables—a major element of the WTO accession negotiations—also appear to have reduced the costs imposed on the agricultural sector.

The main question, once the trade liberalization is established, then, shifts gear and the focus of our analysis begins to try to understand how it could be—when there are many places in China that have experienced large falls in positive protection that rural incomes still rose almost nationwide. In trying to explain this puzzle, we examine three sources of income increases that might help offset the fall in income brought on by trade liberalization. We explored the role of agricultural technology, the rise of markets and the emergence of new subsidy and support policies.

In our analysis we find that at the same time that trade liberalization policy was reducing income for some products that had been receiving positive protection, a number of other elements were working to offset these effects. One was the reductions in taxation of other important commodities, such as rice. At the same time, investments in R&D, the fostering of markets and the new investment and subsidy programs appear likely to have had wide-ranging, positive income effects. In addition to other sets of factors, these three

factors are likely to have been responsible for helping increase rural incomes across wide areas of China.

The implications of such findings are that although trade policies may have had negative income effects on certain parts of the agricultural community, the magnitude of these adverse impacts appears to have been widely overstated. This is partly because the usual way of assessing the impact of WTO commitments—comparisons of bound tariffs with prior applied tariffs—widely overstates the extent of liberalization required in China. Another reason that these adverse impacts have been overstated throughout the reform period is that the agricultural sector as a whole was negatively protected at the beginning of the period, and the taxation of these products was eliminated, or at least substantially reduced, in many cases. There are also positive impacts of trade reform as new export activities emerge, and the costs imposed by protection to other sectors are reduced.. To minimize any negative effects of trade reform on the rural population, there needs to be a package of policies that can work together with trade liberalization to remove distortions without and create greater opportunities for rural people. The combination of trade reform and supporting policies in China provides some important lessons in how to do this.

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Table 1: Real Per Capita Net Income of Rural Households by Province in China, 2000-2005 (in Real 2005 Yuan).

Province	2000	2005	Growth (%) in 2005 over 2000	Annual growth rate (%)
Beijing	4790	7346	53.36	8.93
Tianjin	3830	5580	45.68	7.82
Hebei	2711	3482	28.41	5.13
Shanxi	2127	2891	35.90	6.33
Inner Mongolia	2318	2989	28.97	5.22
Liaoning	2671	3690	38.18	6.68
Jilin	2215	3264	47.37	8.06
Heilongjiang	2339	3221	37.75	6.61
Shanghai	5809	8248	41.97	7.26
Jiangsu	3960	5276	33.25	5.91
Zhejiang	4603	6660	44.70	7.67
Anhui	2095	2641	26.08	4.74
Fujian	3467	4450	28.36	5.12
Jiangxi	2255	3129	38.77	6.77
Shangdong	2960	3931	32.80	5.84
Henan	2195	2871	30.80	5.52
Hubei	2526	3099	22.68	4.17
Hunan	2452	3118	27.17	4.92
Guangdong	3838	4690	22.22	4.10
Guangxi	1991	2495	25.32	4.62
Hainan	2346	3004	28.06	5.07
Chongqing	2015	2809	39.39	6.87
Sichuan	2109	2803	32.90	5.85
Guizhou	1513	1877	24.02	4.40
Yunnan	1615	2042	26.40	4.80
Tibet	1414	2078	46.99	8.01
Shanxi	1620	2053	26.68	4.84
Gansu	1656	1980	19.53	3.63
Qinghai	1729	2151	24.40	4.46
Ningxia	1891	2509	32.64	5.81
Xinjiang	1796	2482	38.24	6.69
National Average	2462	3255	32.21	5.74

Note: values are in real 2005 Yuan using rural consumer price index by province.

Data source: NBSC, Statistical Yearbook of China, 2001-2006.

Table 2. Annual growth rate (%) of yield and total cost of main grain crop in China, 1985 to 2004.

Crop	1985-1994		1995-2004	
	Output	Input	Output	Input
Early Indica	0.05	1.72	0.08	-2.31
Late Indica	1.37	2.12	0.80	-1.16
Japonica	1.79	3.99	0.17	-1.99
Wheat	2.84	2.58	1.38	-0.22
Maize	3.66	1.87	1.04	-0.63
Soybean	0.71	2.24	1.06	-1.36

Data source: Jin et al., 2007.

Table 3. Annual Growth Rate (%) of Main Grain Crops's Total Factor Productivity (TFP) and Decomposition into Technical Efficiency (TE) and Technical Change (TC) in China, 1985 to 2004.

	1985-1994			1995-2004		
	TFP	TE	TC	TFP	TE	TC
Early Indica	1.84	-0.03	1.88	2.82	0	2.82
Late Indica	1.85	0.26	1.59	2.92	0.21	2.71
Japonica	-0.12	-0.37	0.26	2.52	0.15	2.37
Wheat	0.25	1.08	-0.83	2.16	1.06	1.10
Maize	1.03	0.61	0.42	1.70	-0.23	1.94
Soybean	0.11	0.19	-0.09	2.27	-0.08	2.35

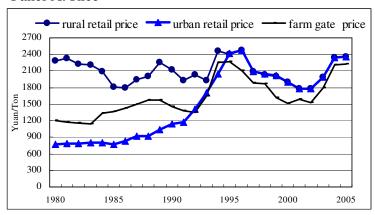
Data source: Jin et al., 2007.

Table 4. Actual protection, applied tariffs and out-of-quota tariff bindings.

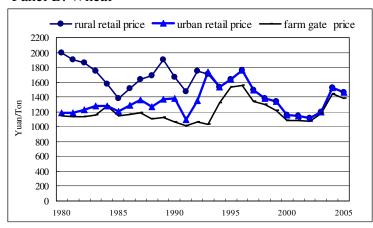
	Actual Protection 1995	Applied tariff	Out-of-quota tariff bindings
	%	%	%
Rice	-5	114	65
Wheat	25	114	65
Corn	20	114	65
Soybean	30	22	3
Sugar	44	114	50
Cotton	20	30	40

Figure 1. Rural Retail Price (free market price), Urban Retail Price and Farm-gate Sales Price in China, 1980 to 2005 (Real 2005 Yuan).

Panel A. Rice



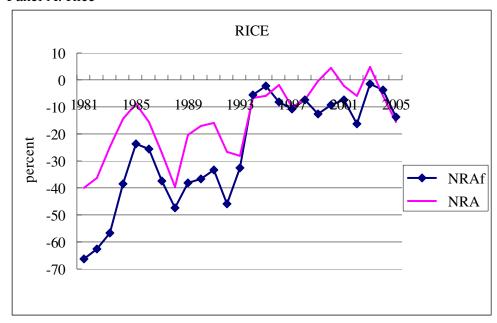
Panel B. Wheat



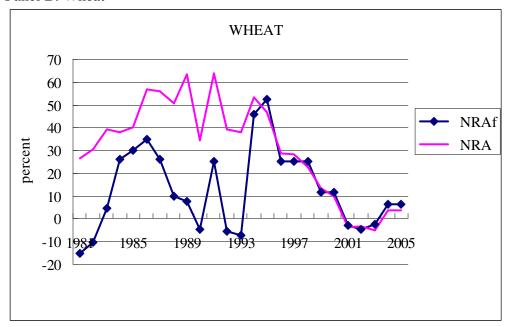
Data Source: China Price Yearbook, 2005

Figure 2: Nominal Rates of Assistance (NRAs) and Nominal Rates of Assistance for Farmers (NRA_fs) for rice and wheat in China, 1981-2005

Panel A. Rice

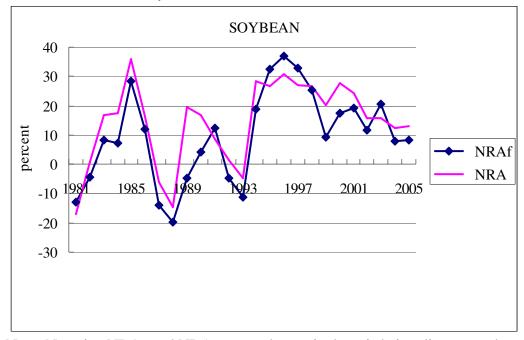


Panel B. Wheat



Note: Negative NRAs and NRA_fs mean that agriculture is being disprotected or taxed; positive NRAs and NRAfs mean agriculture is being protected.

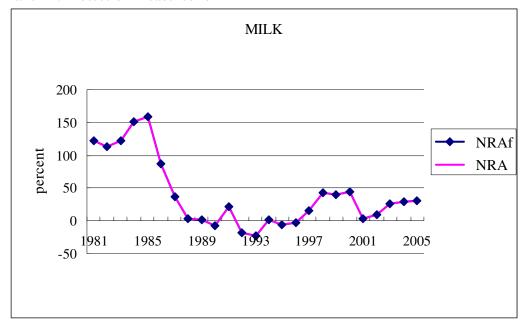
Figure 3. Nominal Rates of Assistance (NRAs) and Nominal Rates of Assistance for Farmers (NRA $_{\rm f}$ s) for soybean in China, 1981-2005



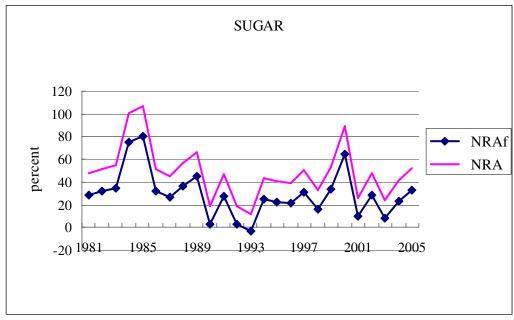
Note: Negative NRAs and NRA $_f$ s mean that agriculture is being disprotected or taxed; positive NRAs and NRA $_f$ s mean agriculture is being protected.

Figure 4. Nominal Rates of Assistance (NRAs) and Nominal Rates of Assistance for Farmers (NRA $_f$ s) for industrial processed goods (milk and sugar production) in China, 1981-2005

Panel A. Protection measures for milk

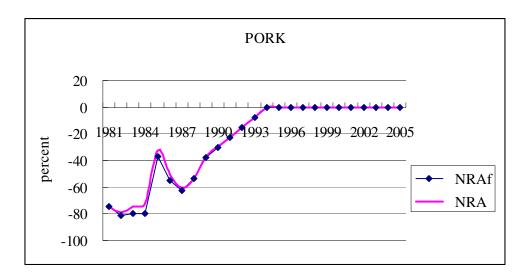


Panel B. Protection measures for sugar



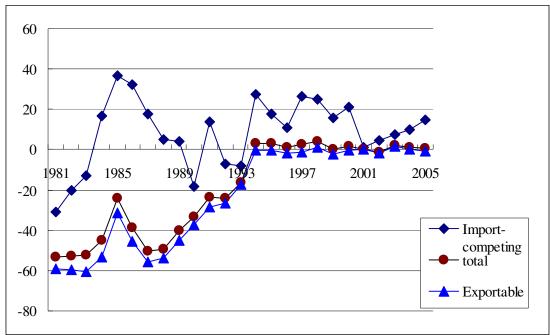
Note: Negative NRAs and NRA_fs mean that agriculture is being disprotected or taxed; positive NRAs and NRA_fs mean agriculture is being protected.

Figure 5. Nominal Rates of Assistance (NRAs) and Nominal Rates of Assistance for Farmers (NRA_fs) for pork in China, 1981-2005



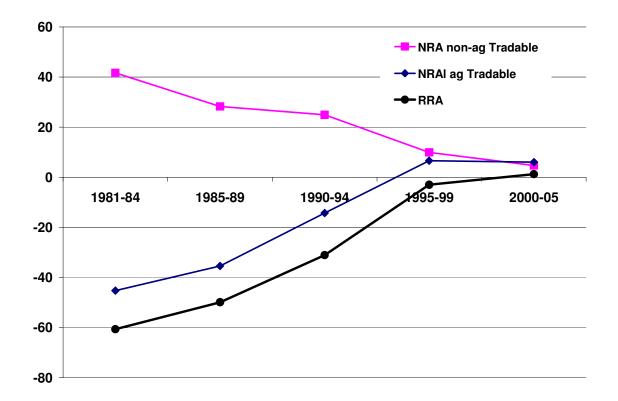
Note: These measures are calculated in the same way as NRAs and NRA_fs reported for other commodities. However, the true NRAs for these commodities become zero after 1994 because China has no policies holding their prices below world levels.

Figure 6. Rates of Assistance (including subsidy/taxes on inputs) for farmers that Produce Importable Commodities, Exportable Commodities and for All of Agriculture (11 commodities) in China, 1981-2005



Source: Authors' spreadsheet using methodology from Anderson et al. (2006) Note: Negative DRAs mean that agriculture is being disprotected or taxed; positive DRAs mean agriculture is being protected. Since the distortions to inputs are so small, the graphs for NRA_fs are essentially the same.

Figure 7. Agricultural and non-agricultural protection and the relative rate of assistance to agriculture



Endnotes

In addition, exchange rate distortions present particular measurement problems and require detailed analysis if price-comparison-based measures are not to be misleading. The assumption and methods that were used to generate our exchange rate series are in Martin et al. (2006).

ⁱ While NRAs (and NRA_f's) only measure differences in output prices, there may also be distortions on the input side. To capture these, it is possible to provide measures taking into account direct subsidies and differences between the international prices of inputs and the prices that farmers pay for these inputs. While these forms of protection (or taxation) are important in many countries—and particularly in OECD countries—we find that they are generally relatively small and so we mainly focus on the NRA and NRA_f measures when examining distortions to producers.