Agricultural Trade Reform and Rural Prosperity: Lessons from China

Jikun Huang
Center for Chinese Agricultural Policy
jkhuang.ccap@igsnrr.ac.cn

Yu Liu
China Center for Agricultural Policy
liuy.04b@igsnrr.ac.cn

Will Martin
World Bank
wmartin1@worldbank.org

Scott Rozelle
Stanford University
rozelle@stanford.edu

3 April, 2008

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. Many challenges remain in improving rural incomes and reducing rural poverty.

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China's agriculture has grown rapidly in recent years, despite radical reductions in agricultural tariffs (Huang and Chen, 1999; and Huang et al., 2004). China's agriculture has moved from a focus on 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 was allowed only after China promised major institutional reforms and a virtually unprecedented degree of tariff reduction, the abolition of export subsidies, and introduction of constraints on domestic support (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 mid-2000s, the concerns about rural incomes of critics of trade policies had 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 measures of this gap are overstated by neglecting 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).

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 very impressive record. Growth rates of gross domestic product, agricultural 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 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 radically changed consumption patterns), China has remained a net exporter of agricultural products until very recently, with a recent switch to net import status due largely to increased cotton imports needed for burgeoning exports of textiles and clothing. 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).

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. 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 input-related policies were relatively small over most of our sample period, we focus on the transfers associated with changes in commodity prices, although we include the effects of input measures in our estimates of support to farmers. In the most general terms, we find that China shifted from an economy that was highly distorted with a generally taxed agricultural sector, to one that was highly integrated with the world economy.

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 has 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 our goals and objectives necessitate certain limitations. First, the absence of data precludes our examining the entire agricultural sector. Instead, we examine commodities that account for two-thirds or more of gross output value over our study period. Second, although we are able to judge from the price trends and our understanding of domestic marketing 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 and must rely on earlier work by the authors and others examining these causal linkages in more detail (Huang and Rozelle, 1996; deBrauw et al., 2004). Thirdly, because of the complexity of agricultural trade instruments during the period—including state trading, quotas, licenses, tariffs and exchange rate distortions—we were forced to

use price comparison approaches even though exchange rates were distorted by a two-tier exchange rate system up to 1994. During this period, we used an exchange rate adjusted for the two-tier exchange rate system to compare international prices with prices in China's domestic economy, an approach used in (Martin et al., 2006).

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 the 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., 2008). The approach is primarily 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 two main measures of distortions for each commodity. The basic measure in our analysis is the Nominal Rate of Assistance (NRA), 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 importables; *fob* in the port for exportables).

Because of barriers within the domestic economy, the extent of protection (or dis-protection) provided by trade policies may not be the same as the 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, taxes or subsidies, and transport, storage and handling costs in moving commodities from the farm to the wholesale level. Differences between NRAs and NRA_f's can 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.[1]

The data

In compiling our data we necessarily had to make choices on commodity coverage. 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 roughly 75 percent (in the late 1980s) and 60 percent (during the early 2000s) of the value of agricultural output in China. Because production and consumption decisions 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 the period from 1981.

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 methodologies for ensuring valid price comparisons. 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).

When calculating the rate of support to farmers, we took into account direct support measures using data from the Price Department of the National Development and Reform Commission. These measures included three applying since 2002—direct grain supports, the seed subsidy program, and agricultural machinery subsidies. We also took into account the negative assistance imposed by agricultural taxes on production of specific commodities. We did not take into account the input subsidy program that pays subsidies to state-owned-enterprises (SOEs) producing fertilizers, fertilizers and mulching film on the grounds that all or part of this may be a subsidy to the SOEs, rather than to the farmers. Nor did we include the "grain for green" payments made to convert fragile agricultural land to forest or pasture (see OECD 2008 for details of both of these measures).

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 farm-gate procurement price with the rural retail price, a free market price. Until 1992 the urban retail price for rice was generally well below the free-market price in rural areas, despite the costs associated with transferring rice to urban areas. Only urban residents could buy rice at these low prices and only with ration coupons that were available in limited quantities.

The relatively low selling price of grain at the farm gate 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 their mandatory deliveries was far below the free market price although, in the case of rice, it was above the urban retail price, suggesting urban prices were held down by a subsidy as well as by taxation of farmers. However, there is some question about the effects of the depressed rural prices on farmers' incentives given the infra-marginal nature of many of these transfers (Sicular 1988a). This is because from the mid-1980s farmers were able to sell additional amounts at higher market prices once they had met their obligation to deliver a quota at the low purchasing price. As shown by Sicular (1988a), the higher out-of-quota price is the relevant incentive for production at the margin. However, as shown by Wang et al. (1999), even such policies may not be fully decoupled from incentives, with seemingly infra-marginal transfers giving rural household members an incentive to move out of agriculture.

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. 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).

Nominal rates of assistance for China's main agricultural commodities

In this section we focus on the distortions faced by farmers in China between 1981 and 2005. To do so, we examine plots of NRAs and NRA_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 market prices of rice in China's port cities below world 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). 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.

Unlike rice, the NRA measures show that trade policy offered high rates of protection for wheat in China between 1981 and the mid-1990s (Figure 2, Panel B). In most years after 1980 the free market price of wheat in China's port cities was about 60 percent above international prices (cif, China's port cities). Unlike rice farmers, wheat producers—who have been shown to produce at a higher cost than producers in many other countries (Huang and Ma, 2000)—benefited from high market prices for their marginal output. 'By keeping out imports and keeping domestic prices high, trade policy appears to have been focused on food self-sufficiency, rather than on providing inexpensive food to urban consumers.

The differences between rice and wheat illustrate that trade liberalization in China should not have been expected to hurt everyone and emphasize the importance of looking at distortions on a commodity by commodity basis. Trade liberalization clearly had the potential to help rice producers, in particular. By contrast, the removal of the high protection rates for wheat observed in the 1980s and early 1990s, would have had the potential to hurt wheat producers. Our analysis of why trade policy reform has been accompanied by rural income rises seems 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 in NRA_f's show how the forced deliveries under wheat quotas largely insulated farmers from much of the benefit 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 infra-marginal 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). That China's reformers were able to eliminate the procurement policies that had been taxing rice and wheat (and maize) farmers is apparent from the way the differences between NRAs and NRA_f's narrow and disappear. In other work, Huang et al. (2004) show that elimination of the procurement quota system contributed significantly to a reduction in the tax burden on 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 policies in the mid-1990s was accompanied by 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 were 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.

Edible oils, milk and sugar. Outside the grain economy, marketing and trade reform, as in the case of wheat, removed positive protection from a number of key commodities. The biggest difference between the analysis of distortions for grain crops and cash crops (in our case, for soybeans) is that domestic marketing policy has historically played less of a role for cash crops. Although some counties had procurement delivery quotas for soybean producers, this was not as widespread as for grain and the implicit taxes on soybeans in counties with quotas were generally lower than for staple grains. There was, as a consequence, little difference between the graphs for NRAs and NRA_f's. The same applies for the remaining commodities (livestock; horticulture and milk and sugar), because there was no state-mandated procurement for these commodities, As a result, the discussion in the rest of this section 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, it varied from -20 percent up to 30 percent. A paper by Rozelle and Huang (2004) shows that much of this fluctuation was due to domestic policy cycles that switched between encouraging and discouraging production, while allowing little trade.

The trends in 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 2005 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 using CAPSiM (an agricultural simulation model developed by the authors) that soybean prices and the incomes of soybean producers would have been higher in the absence of trade reform. Therefore, in the case of soybeans the government carried through with its commitment to trade reform.

Protection of milk and sugar began earlier and remained higher than for soybeans. During the 1980s the NRAs for milk and sugar were large and positive (Figure 4, Panels A and B), with milk ranging between 50 and over 200 percent between 1980 and 1987, and sugar above 40 percent through the late 1990s. NRAs for milk fell dramatically in the late 1980s, and subsequently fluctuated between zero and 50 percent. Protection for sugar also fell in the late 1980s, but subsequently rose, with the average NRA fluctuating around 40 percent.

Livestock and horticultural commodities. The case of livestock (Figure 5 for pork) and horticulture (not shown here—see Huang et al., 2007) show that trade liberalization directly helped raise farm incomes in certain regions and sectors. During the early reform era there was heavy implicit taxation of livestock and horticultural commodities. Although China can competitively produce labor-intensive livestock and horticultural products, producers were not encouraged to produce or export these commodities on a large scale. Part of the resistance to exports was from China's own barriers, such as quotas on exports to 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 these barriers (for example, foot and mouth disease is widespread in China), even blatantly false claims could not be contested 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. We separated the commodities in our study into importable and exportable groups, and used production weights at undistorted prices to aggregate them. Assuming that our study commodities largely reflect the distortions to all commodities, 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, their 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 taxed at rates ranged from 40 to 50 percent. With exportable agricultural products accounting for a larger share of output than importables, China's average agricultural 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 fell 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 overall protection was between 0 and -5 percent. The combination of domestic marketing reforms and international trade liberalization has created an economy that 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. One key to this was the removal of agricultural taxation. Another was allowing farmers to produce the goods that would generate the greatest benefit at international prices.

When considering the impact of trade reform on the agricultural sector, it is not sufficient to consider only the instruments directly affecting the sector. The pathbreaking study of distortions to agricultural incentives in developing countries (Krueger, Schiff and Valdés 1991) showed that the indirect taxation of agriculture resulting from protection to other sectors was generally more important than direct agricultural distortions.

In the case of China, this question requires particular attention since there have been enormous reductions in non-agricultural barriers, including tariffs, exchange rate overvaluation, quotas and licensing. We have combined estimates of these distortions into a composite measure of non-agricultural distortions depicted as an NRA for 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 the agricultural sector benefited from a rapid reduction in both direct and indirect taxation between the early 1980s and 1995. In the period since 1995, 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 agricultural 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 agriculture were 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 provided. 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.

Policies to Support Market and Trade Liberalization

Our analysis that documents reductions in the distortions to China's agriculture helps us meet our first objective. China's policy makers 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 in these sectors, the average level of protection (combining the net effects of commodities that were having their positive protection removed and the commodities that were being less taxed) moved towards zero. In this way, trade policy was helping to increase farm incomes. In the period since 1995, liberalization elsewhere in the economy reduced the taxation of the agricultural sector leading to the rise in the relative rate of assistance noted in Figure 7. In this way trade policy changes can contribute, in part, to the explanation of how rural China avoided declining during trade liberalizations.

However, the story needs more explanation. In part, the additional explanation is needed because rural incomes not only rose on average, but 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 produce many crops (wheat, maize, soybeans and cotton) that were still receiving positive protection during the late 1990s and early 2000s. With this set of crops accounting for a large share of the crop area

in northern, northeast and northwestern China, there remains a puzzle to explain. Why did incomes rise in those areas even though we know that incomes of some producers would have suffered from trade liberalization-induced cuts in protection. Part of the explanation is presumably the reduction in the cost structure resulting from rapid liberalization in the rest of the economy. In the rest of this section we discuss several key policy reforms that we believe contributed to rural incomes rising even while agricultural protection fell.

Development and Dissemination of Agricultural Technology

The importance of agricultural research and extension in increasing agricultural productivity in developing countries is now widely recognized. Successful development has been shown to be tied closely to productivity growth in the agricultural sector (World Bank 2008). In a country like China, where agriculture is dominated by small, poor farms, it is even more important.

During the reform era, it was not always clear whether China would be able to maintain the pace of technological advance needed to maintain farm incomes in a dynamic economy. While decollectivization played the key role in boosting productivity (Lin, 1992) in the early stages of reform, this provided only a one-off boost to productivity. After 1985, the evidence suggests that technological advance has been the main engine of productivity growth (Huang and Rozelle, 1996). China was one of the first countries 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, until

the mid-1990s, it was the only country in the world to have commercialized this new technology.

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

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 produced. In addition, in the late 1980s and early 1990s, new horticultural seeds, improved breeding livestock (Rae et al., 2006) and new technologies for dairy were all imported (Ma et al., 2006).

After declining between the early 1980s and the mid-1990s (Pray et al., 1997), investment in R&D also began to rise. Funding was greatly increased for plant biotechnology, although only only Bt cotton has been commercialized in a major way to date (Huang et al., 2002). China now 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 and, according to some projections, it will soon outspend the US government on plant biotechnology research. Investment in government-sponsored R&D increased by 5.5 percent annually between 1995 and 2000

and by over 15 percent per year after 2000 (Hu et al., 2007). During the past decade, the increase in investment in rural research and development has been the most rapid of any large nation.

The investment in R&D has been paying off. During China's early reform period the yields of major food crops rose steadily (Table 2, column 1). Although some of that yield increase came from greater efficiency in input use, technological improvements appear to have accounted for some of this 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).

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 growth of output continued to outpace that for 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. Such rises, which occurred in all provinces and with all crops, could not have helped but increase incomes—of all farmers—regardless of whether the crop was being protected or taxed.

Policies to Encourage Market Integration and Efficiency

Price and marketing reforms have been key components of China's transition strategy from a centrally-planned to a market-oriented economy. These policies were implemented in a gradual way (Sicular, 1995). 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 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 businesses. Finally, except for a short period in the late 1990s, government officials 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 assessing the health of the rural economy, it is important to understand how 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.

According to price data from private reporting stations and information firms, it appears that China's markets function relatively well. For example, maize prices in for different cities 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 and between 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).

The improvement in markets has allowed individual producers to specialize as never 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 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 a 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 beneficiaries of new demands for horticultural commodities.

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. Even where market and trade liberalization has reduced protection and necessarily adversely affected income, the rising productivity and efficiency effects have at least partly offset these negative impacts. This interpretation is supported by the modeling work in Huang et al. (2005) which finds when

trade policy positively affects some prices (e.g., horticultural crops), but negatively affects others (e.g., wheat), farmers mitigate the downside effects by transferring production into the commodities with rising prices.

Public Investment, Services and Subsidies

Any visitor to most parts of rural China is struck by one thing: Agriculture is still being carried out in many environments 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 infrastructure in 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.

Although the stock of infrastructure is poor there have been improvements in recent years. Research has shown that on average each village in China had about one infrastructure project during the late 1990s (Luo et al. 2007). This is far higher than in most other developing nations in Asia. In recent years, the level of investment activity has risen sharply (to almost one project per year). Most of these projects are public goods (and not activities, such as orchards, in which governments frequently invested during the 1980s). In addition, research suggests that this investment is being targeted fairly well, with increasing amounts going to poor, minority and remote parts of China.

Although the level of public goods investment per capita has risen 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).

Quality, while rising, is still low in many villages (Liu et al., 2007). China is just beginning the process of narrowing the gap between rural and urban infrastructure 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 the 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 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 improved in recent years (Liu et al., 2007).

There has been a new surge of interest by the government in improving rural education and reducing 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) was supposed to be free. The income effects of such policies are potentially enormous. Huang et al. (2004)

show 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 launched a massive program of direct subsidies in 2004 and this program is projected to expand further in the coming years. Designed in part to boost production of grain (for national food self-sufficiency) and in part as a rural income transfer, the national Grain Subsidy and the national new technology program have in a very short time become fixtures in the rural economy. Nearly 80 percent of farm households receive 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.

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 under the 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 could rapidly

approach its maximum level of payments. But there is a question about whether these payments are "distorting or not." In 2004, a survey by RCRE found that more than 70 percent of the payments were decoupled, with farmers receiving 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 households that produced grain. If the payment is linked to the type of crop planted, it is likely to be classified as a distorting subsidy with careful accounting needed to ensure it does not violate the restriction on distorting subsidies under China's WTO commitments.

In addition to subsidies, the national government 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 been implemented than the tax was eliminated altogether. By 2007, surveys showed that farmers were paying almost no taxes.

When added together, the recent policy innovations in rural infrastructure, free rural school tuition, grain and other agricultural subsidies, tax reductions and health insurance subsidies are substantial. These government programs have likely injected enough funds to contribute importantly to the observed improvements in household incomes in rural areas.

Improving Mobility of Labor out of Agriculture

China began the period under study with around half 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. In almost all rapidly-growing economies, the resistance to this adjustment, particularly due to sector and region-specific investments in human capital, is frequently seen as the source of a "farm problem" in which farm incomes fall below incomes in the rest of the economy.

The usual resistances to labor out-migration are compounded by a number of China-specific 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. Where out-migration is feasible, de Brauw and Giles (2008) show that it increases the living standards of the family members remaining, and tends to increase their land holdings, although not necessarily their investment in other assets.

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 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 this 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 and variable 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.

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. In the case of rice and other exportable commodities, heavy border distortions that reduced domestic prices were compounded by a domestic procurement system that depressed farm prices and the prices paid by urban consumers.. Similar dynamics characterized importable commodities such as wheat and soybeans where, despite fairly high rates of protection from trade policies, producer prices were relatively low.

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 for farmers' 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 protection to the agricultural tariffs that they produce—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 returns to 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 to have generated wide-ranging, positive income effects in rural China.

The implications of these findings are that, although trade policies may have had negative effects on incomes in 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 frequently been overstated is that the agricultural sector as a whole was negatively protected at the beginning of the period, and most of this taxation has been eliminated. Another important source of gains was the reduction in protection to some less-efficient import-competing sectors, which allowed farmers to increase the value of their output. There were also important dynamic benefits as new export activities emerged, and the cost to burden on agriculture of protection to nonagricultural sectors was reduced.

The reforms undertaken in China have included both trade policy reforms and complementary domestic reforms that have helped to create greater opportunities for rural people—a combination of policies widely seen as necessary if the greatest benefits are to be achieved. China's experience over the past quarter century appears to provide some important lessons both for the future, and for policy makers grappling with similar challenges in other countries.

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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

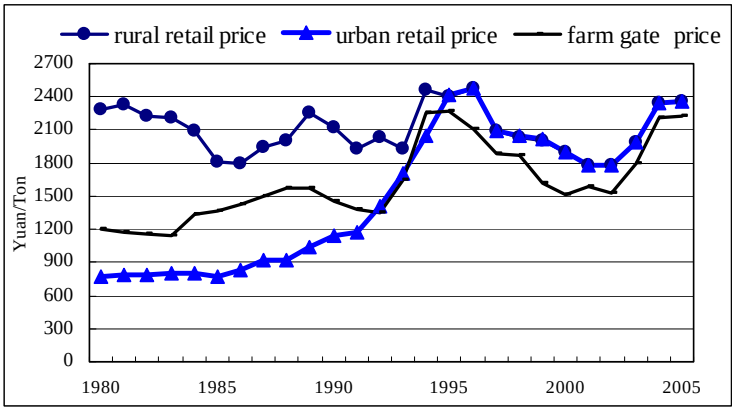
Data source: Jin et al., 2007.

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

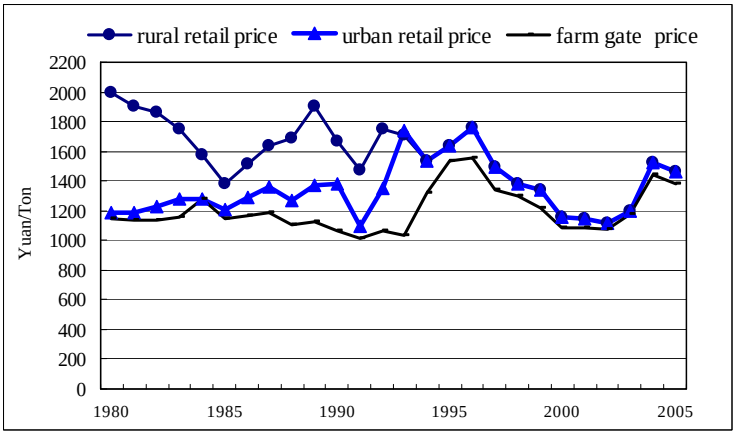
	Actual Protection 1995	Applied tariff	Out-of-quota tariff bindings
	%	%	%
Rice	–5	114	65
Wheat	25	114	65
Corn	20	114	65
Soybean	30	22	3
Sugar	44	114	50
Cotton	20	30	40

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



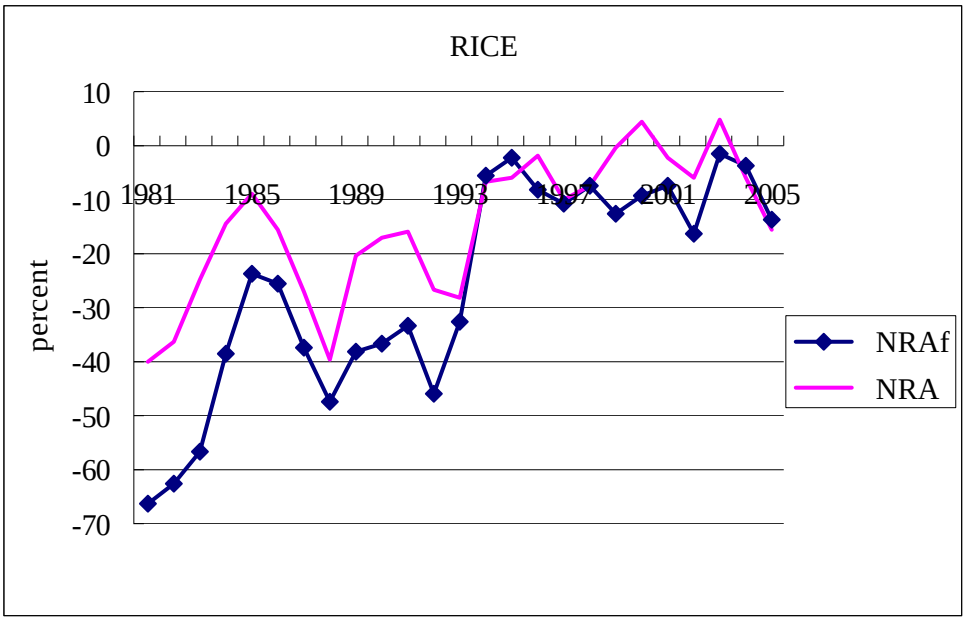
Panel B. Wheat



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

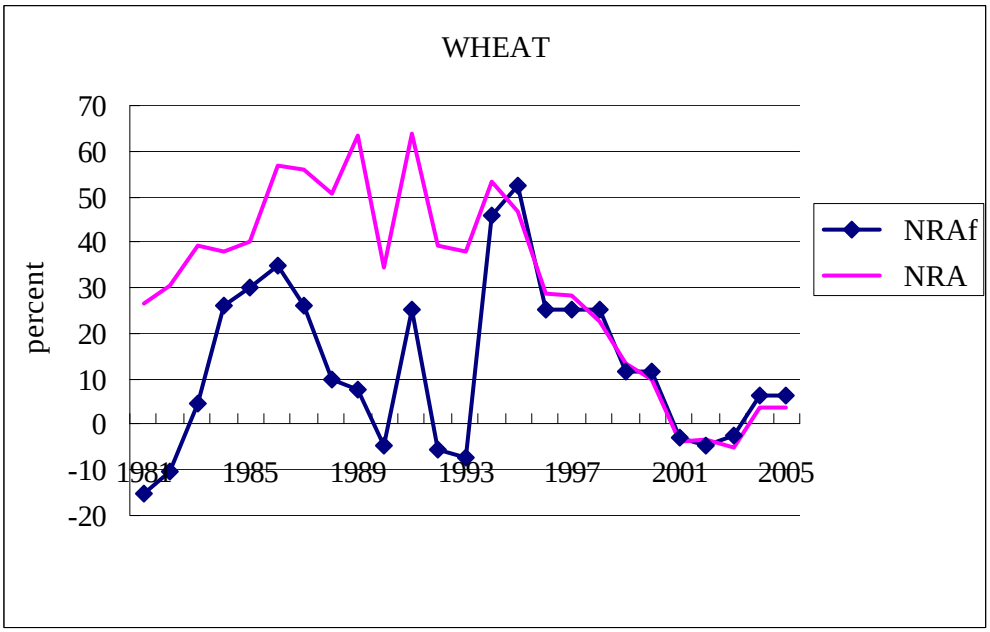


Figure 3. Nominal Rates of Assistance (NRAs) and Nominal Rates of Assistance for Farmers (NRA_fs) for soybean in China, 1981-2005

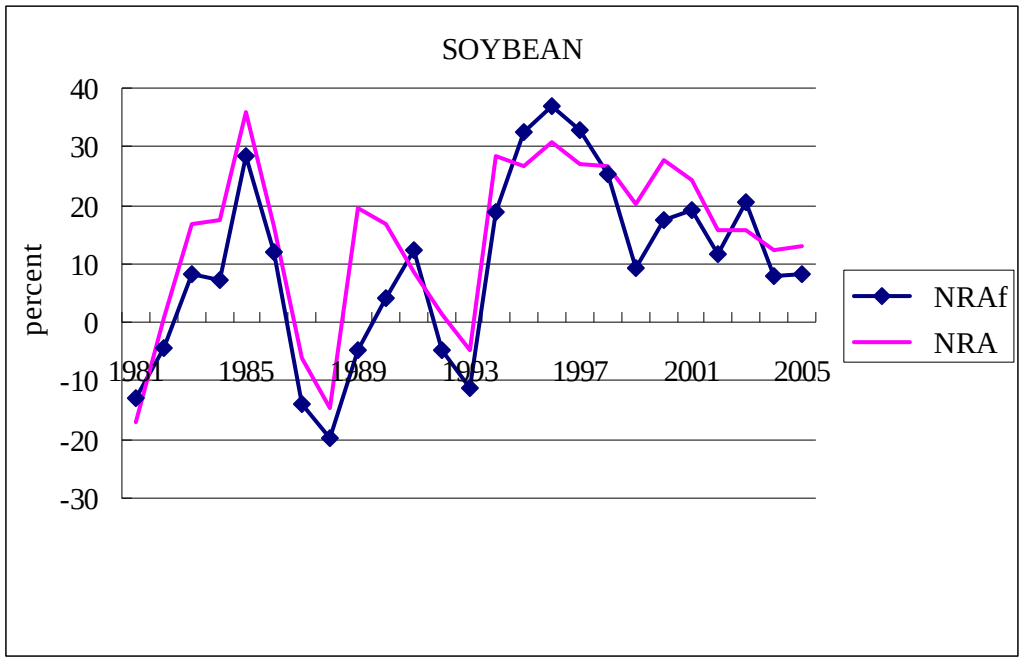
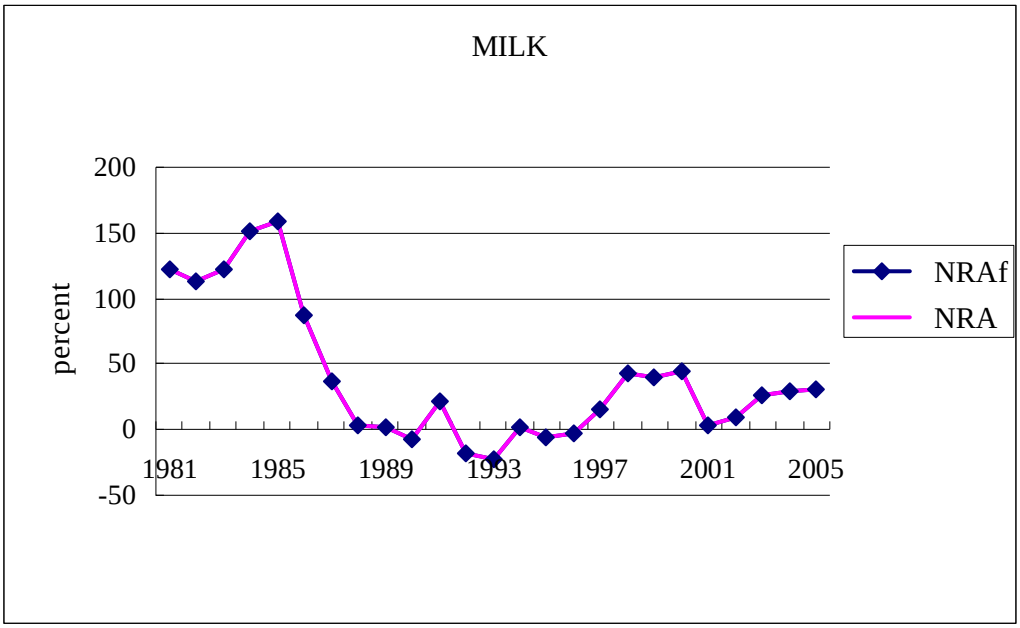


Figure 4. Nominal Rates of Assistance (NRAs) and Nominal Rates of Assistance for Farmers (NRA_fs) for industrial processed goods (milk and sugar production) in China, 1981-2005

Panel A. Protection measures for milk



Panel B. Protection measures for sugar

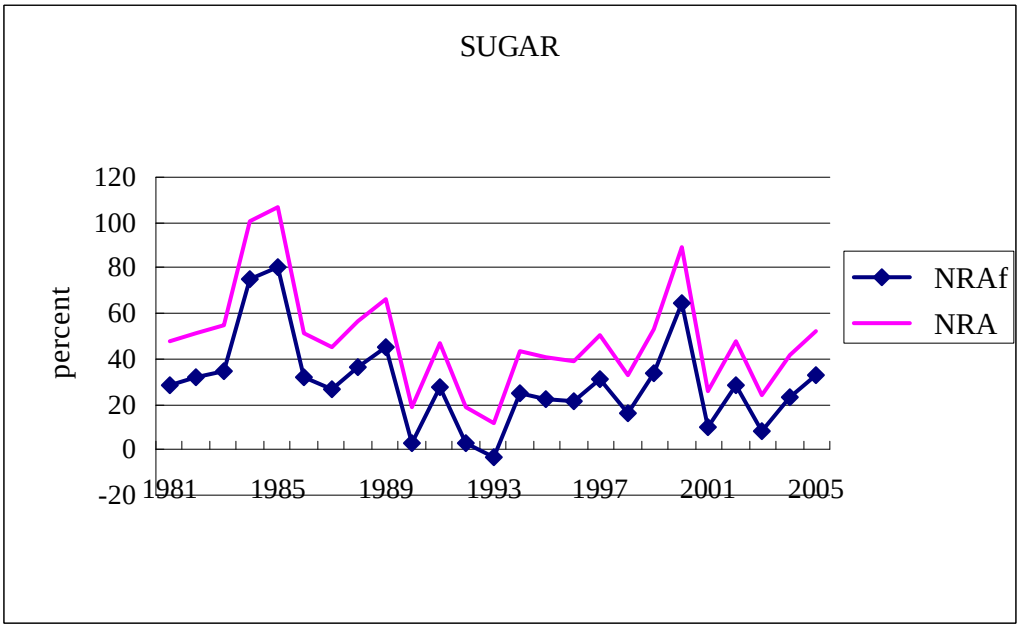
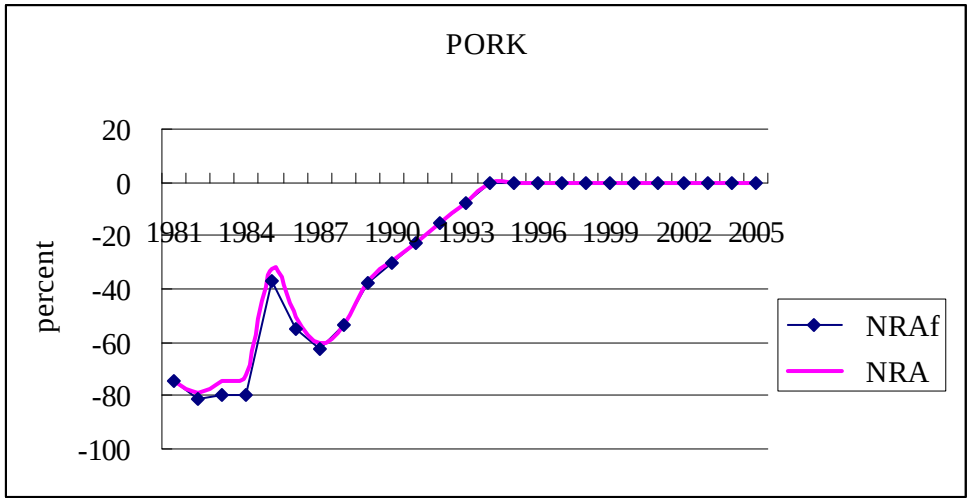
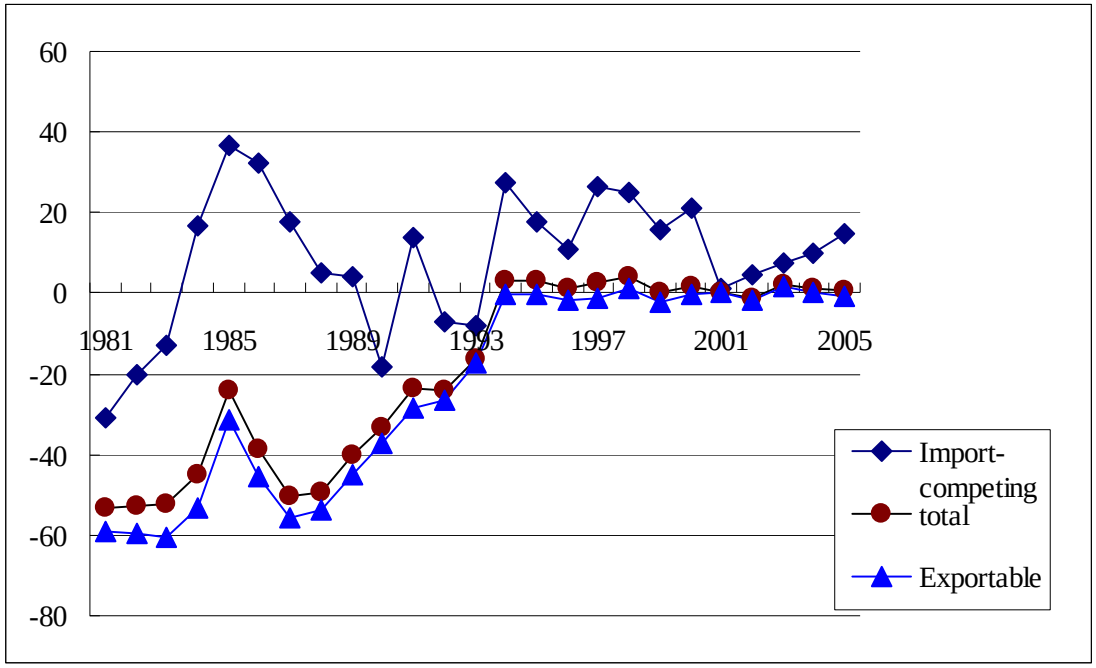


Figure 5. Nominal Rates of Assistance (NRAs) and Nominal Rates of Assistance for Farmers (NRA_fs) for pork in China, 1981-2005



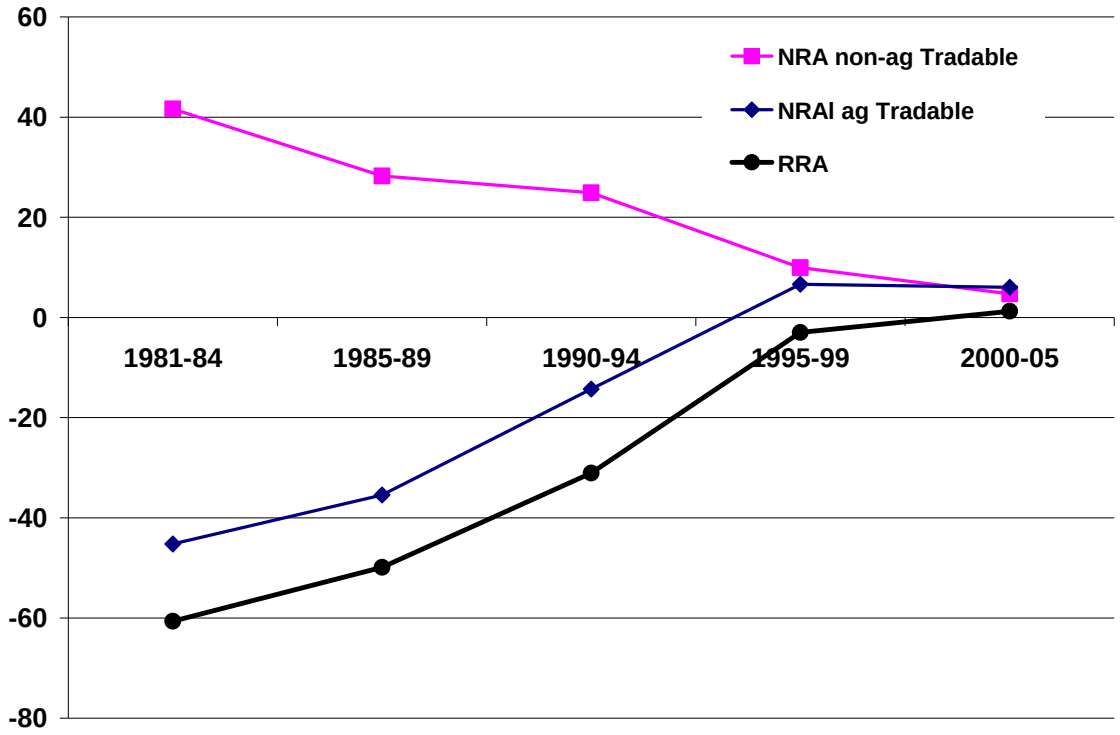
Note: These measures are calculated in the same way as NRAs and NRA_fs reported for other commodities. However, the true NRAs for these commodities become zero after 1994 because China has no policies holding their prices below world levels.

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)

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



Endnotes

[1] While NRAs only measure differences in output prices, there may also be distortions on the input side, our NRA_f measures include a number of budget support and tax measures.. The assumption and methods that were used to generate our exchange rate series are in Martin et al. (2006).