Trade Liberalization, Rising Imports and China's Food Economy:
The Case of Soybeans

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Executive Summary

In our report, our overall goal is to understand how soybean trade policy changes and changes in soybean trade flows that China has experienced between 1997 and 2003 have affected China's producers, consumers and users of soybeans. To do so, we will:

1. briefly analyze the nature of China's soybean markets; and understand the nature of the links between soybean trade, domestic market development, price, production, and consumption;

2. analyze the responses of households that are affected by soybean trade-related changes;

3. predict the magnitude and direction of responses to trade liberlalization-induced price shifts and suggest if policies are needed to offset adverse effects

In order to meet these objectives, we will describe in great detail using a number of data sets: the nature of soybean markets in China; the linkages between soybean producers, consumers and poverty; use our CAPSIM model to understand the impacts of trade changes on soybean producers, livestock producers and consumers; and finally discuss policy options.

The Integration of China's Domestic Soybean Markets

In the first part of our analysis, we need to analyze the nature of soybean markets in China for two reasons. First, we are interested in their development over time as a topic in and of itself. Traders and policy makers both have an interest in understanding how well they work. Second, and perhaps more saliently for our study, if we can establish that China's markets are integrated and are efficient, then when studying the effects of increased trade on producers and consumers, if we observe increases in imports, then we can know that all actors in China's food economy are affected.

According to our analysis, we find that over the past 10 years, China's soybean markets have become remarkably developed in many ways. As marketing and other policies have relaxed rules and regulations on marketing and pricing inside China, millions of private traders have entered the market and many government agencies have become commercialized. In an competitive environment such as this, we find that soybean prices begin to function much like prices would function in a market-oriented economy. Across space, the transportation gradient shows that prices across space are subject to lower aggregate transaction costs that even in the US. Over time pairs of prices in two markets, even those that are separated by thousands of kilometers, move together closely. Statistical

tests of inter-regional market integration show that whereas 10 or more years ago soybean markets in China were fairly fragmented, today they are almost completely integrated. Other analysis also shows that within regions, even more remote ones, soybean economies within village are integrated with marketing towns.   Given the behavior of soybean markets and the high level of measured integration, when we observe increased levels of imports, we can assume that producers and consumers and other users across China will all feel the price effects. Moreover, to determinate the benefits or costs for certain groups of farmers due to trade, one only needs to examine their production mixes and match them to the extent the prices of the products rose over the period or fell.

Soybean Trade Policy, Trade and Other Trends

Having established the integration of markets, we then shift our analysis to try to understand how much impact should be expected from changing trade measures and trade trends. And, by any account, to an extent greater than almost any other sector in China's food economy, there has been a systematic effort to reduce trade barriers for soybeans. Before the mid-1990s, there was little improvement in the opening of China's soybean economy. After 1997, the rate of change accelerated dramatically. Formal tariffs were reduced, non-tariff barriers eliminated and state-trading rule relaxed. Between 1997 and 2001 the nominal protection rate fell from near 50 percent to only 16 percent. Moreover, except of the 3% tariff and 13% value-added tax, there were almost no barriers to trade by 2001. Hence, most of the changes in trade policies came before China's accession to the WTO. In contrast, since the accession, if trade were to rise it would not be due to trade liberalization, but in a response to market forces.

In response to the falling barriers and rising market forces, China's soybean trade expanded rapidly since 1997. The import of soybeans surpassed in importance soybean oil trade in 1997. Between 1997 and 2001, soybean imports increased rapidly, reaching mor than 10 million tons. Between 2001 and 2003, after the liberalization was complete, trade even rose more, surpassing 20 million tons. Interestingly, despite the historic increases in trade flows, between 1997 and 2003 domestic production did not fall and prices after 2001 actually rose. Obviously many other factors, in addition to soybean trade, were affecting prices and production. In order to disentangle the effects of trade policy and trade from other effects more sophisticated analysis is needed.

Methodological Approach

Once we have established that China's soybean producers, consumers and other users are operating in such an environment (that is one with good markets, but which are affected by many other factors beyond trade), we then undertake our analysis on determining the impact of increased soybean trade on China's producers and consumers. In order to evaluate the impact of soybean trade liberalization on China's soybean and the rest of agriculture, a quantitative method has been developed based on CCAP's Agricultural Policy Simulation and Projection Model (CAPSiM). CAPSiM was developed out of need to have a framework for analyzing policies affecting agricultural production, consumption, price and trade at the national level. CAPSiM is a partial equilibrium model. It is the first

and most comprehensive model for examining the effects of policies on China's food demand, supply and trade. The commodities include 12 crops and 7 animal products. The crops included are rice, wheat, maize, sweet potato, potato, other coarse grains, soybean, cotton, all edible oils, sugar crops, vegetables and fruits. Farmers cultivate the 12 crops on more than 90 percent of China's total sown area. The animal products include pork, beef, mutton, poultry, eggs, milk, and fish. Ina addition to increased soybean trade, CAPSiM explicitly accounts for urbanization and market development of the demand side. In our supply side analysis we account for changes in technology, other agricultural investment, environmental trends and competition for labor and land use. Supply, demand and trade respond to changes in both producer and consumer prices.

Because the analysis based on the original CAPSiM framework can only be done at national level and was designed to be used to simulate the future effects of policy shifts, we have had to make a number of changes for this study in order to do *ex post* analysis (that is, in order to analyze the impact of trade shifts on soybean prices, production, consumption and income during the 1997 to 2003 period). We also had to modify the original model in order to allow us to disaggregate the national impacts into household production at the regional level and to assess the impact that soybean trade liberalization has had on household production and incomes of different income groups. In our analysis, we generate the production impacts of soybean trade on producers in EVERY province and present those for a subset of the most important provinces: Liaoning, Jilin, Heilongjiang, Inner Mongolia, Henan, Anhui, Hunan, Sichuan and Guangxi (which includes nine of the top 12 soybean producing provinces).

Among the many changes and new assumptions, work done for this project includes: a.) creation of a database on production, consumption, price and trade for the study period (1997-2003) at the national level; b.) generation of a database for household food production, farmgate prices of agricultural products and procurement prices of foods by income group and by province; c.) separating the impacts of soybean trade from other policy impacts; and d.) ensuring the results of CAPSiM's "backward projection or simulation" be largely consistent with the actual realizations of agricultural production, consumption, price and trade patterns during 1997-2003. In addition, we also break the study down by time periods.

Results of Soybean Imports on Price, Production and Consumption (Aggregate)

In summary of the analysis on the effects on prices, our analysis finds that increased soybean trade has had both important and broad reaching effects on prices in China's food economy. Rising imports have substantially reduced prices of soybeans and edible oils during both the entire study period, 1997 to 2003. For example, in the case of soybeans, without trade, the domestic price of soybeans would have risen dramatically to a level almost double its actual price. Rising soybean imports also have had effects on a broad range of commodities throughout the economy, including maize, the most direct competitor of soybeans, and livestock, one of the fastest growing sectors of China's agricultural economy. While important, in many cases, the effect of soybean trade policy is substantially less than other policies and economic forces affecting supply, demand and

prices. More importantly, it should be noted that although much of the change in prices in the early period, 1997 to 2001, was a direct consequence of trade liberalization measures, since the soybean trading regime was largely liberalized by 2001, the changes since 2001 were largely responses to surging market demand for soybeans, a demand that increased trade was instrumental in meeting.

Although it is difficult to come up with one summary measure of the effect of increased soybean trade on China's economy, many economists would favor expenditure-based measures. Our analysis shows for China as a whole—and for the rural and urban economies separately—the powerful effect of liberalizing soybean trade (during the 1997 to 2001 period) and allowing market forces to attract in large volumes of imports between 2001 and 2003. Prices of all major goods in the food economy, not just soybeans and soybean oil, fell as a result of increased trade. Although lower prices led to lower production of soybean and its direct competitors, other edible oilseeds and maize, it also stimulated production of food grains (marginally) and livestock activities. While certainly soybean producers would suffer falls in income, those in industries would only increase production if they were more profitable, so for many producers income (at least on part of their farming activities) would have risen. Finally, the consumption of all households rose. Since economic theory tells us that rising consumption leads to higher utility, trade policy in this dimension led to higher welfare from the consumer point of view.

Considering all of these effects, our expenditure analysis confirms the positive effects of increased imports. Despite the higher levels of consumption, our analysis demonstrates that households achieve the consumption levels with lower levels of expenditure. In fact, in the earlier period (1997 to 2001), because of lower prices rural consumers were able to achieve the higher levels of consumption on 15 yuan less expenditures. Such a lower level of expenditure represents a reduction in food expenditures of 1.83 percent and a reduction in overall expenditures of 0.87 percent. Moreover, despite the higher levels of consumption, even greater reductions in expenditures are achieved between 2001 and 2003. During the 1997 to 2003 period, rising imports allowed households to reduce their expenditures by 3.99, while consuming more.

Even greater impacts are experienced by the urban sector, in part because there were no reductions in income due to falling production prices and so the rises in consumption levels were higher. Between 1997 and 2001, to buy a larger consumption bundle, urban consumers needed 36.40 yuan less. This represented 1.81 per cent of food expenditures and 0.69 of the entire expenditure outlay. The savings rose nearly proportionately when extending the study period by 2 years from 1997-2001 to 1997-2003. While many other factors have been helping increase the standard of living of China's rural and urban populations in the recent decade, clearly our results show how the increased trade of soybeans has contributed significantly.

Disaggregated Analysis on Production

In the preceding section, our analysis built a strong case for the idea that the liberalization of soybean trade and the rise in the import of soybeans has had a positive impact on the economy. Prices have fallen, many producers (especially livestock producers) have gained and all consumers, both rural and urban, have benefited. The only weakness of this analysis is raised in the first part of Section VI of this report: although households benefit, in general, the distribution of households across the economy that are engaged in soybean production is uneven. It is true that consumers and livestock producers benefit from lower trade-induced soybean prices. It also is true that food grain producers do not reduce their production when prices fall from increased imports. But, soybean producers do. Hence, the one remaining issue that we need to address is which producers get hurt, and by how much. If we know this, then policy makers that may favor trade liberalization and increased trade, in general, but who are concerned with the effect of increased trade liberalization on certain subsets of household, can use the information to devise measures to mitigate adverse effects on sub-groups of producers in the economy.

According to the disaggregated analysis, we can make the following summary and conclusions. For most households in China, the average effect on production is small, only about 90 kilograms or the equivalent of 1.3 percent of average household income. In poorer areas, in general, although the relative effect (that is as a fraction of household income) is larger, the total absolute amount of the impact is still small (only about 73 to 85 kilograms). But although the problem is not that bad in either the average or poor areas in general, the problem is much worse in the important soybean producing provinces. In fact, it is almost fair to say that ultimately the problem lies in several provinces, Heilongjiang, Jilin, Inner Mongolia and Anhui. Since the nation in general wins, and wins significantly, leaders in these provinces need to either make sure that their farmers are in some way compensated for the losses that they have suffered. Or, a program of investment is needed to help those that rely on soybeans, but that want to get out of production, switch to another farming enterprise or move off the farm all together. Because the concentration of farmers that are being adversely affected is high, it should be fairly easy to target those that deserve relief.

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I. Introduction

In the same way that the forces of development have been responsible for generating both the progress that rural China has experienced during the past 20 years as well as exacerbating certain social and economic problems, the nation's efforts at pushing ambitious market and trade liberalization policies has had both positive and negative consequences. On the one hand, trade can bring rising efficiency, new technology and opportunities to increase the nation's economic growth (Lardy, 2001). On the other hand, trade, marketing and investment liberalization may accentuate certain negative trends in rural China, at least in the short run (Yao, 2002).

Surprisingly, despite the historic nature of China's trade liberalization moves in the past and its current actions that it is undertaking to join the World Trade Organization (WTO), little serious empirically based literature exists to answer some of the most basic questions about the expected effects of China's past trade liberalization efforts and its current entry in the WTO, especially the effects on the poorer, farming sector. In our previous work (Huang et al., forthcoming), we have shown that, on balance, the nation's accession to WTO will help rural residents and improve incomes. However, we also show that some parts of the rural economy will be negatively affected by trade-related shocks. Huang et al. (2003) also demonstrate that since households in most parts of the China are fairly well integrated into national markets, the effects of trade liberalization that start at China's ports—both those that raise and lower domestic prices, are transmitted rapidly throughout the economy.

Unfortunately, in these modeling efforts, researchers almost never have tried to track closely the way that households suffer the negative or positive shocks. Seldom are the effects of trade liberalization analyzed on a commodity by commodity basis and matched to the different types of households in different regions of the country that produce them. If this analysis is not done, it is going to be difficult to assess household impacts, since some types of farmers (i.e., the poor or richer one) in some regions (i.e., those in the eastern, central or western regions) produce crops in which China is competitive and others produce crops in which China is not. We believe that the lack of such information has allowed many to misstate the effect of trade on the rural economy. It is often implicitly assumed that imports mean lower prices. With many things in the economy happening at the same time, it is possible that prices of commodities can rise as imports flow into a country. Imports can also increase the incomes of producers that use a commodity as an input to its production process. It also is often assumed that if a producer that earns a part of his income from a certain commodity suffers a fall in the price of the commodity that his household's income will fall by a substantial percentage (e.g., Chen and Ravallion, 2004). We know, however, that in almost all situations producers, in fact, will respond, shifting to less expensive resources, shifting cropping patterns and adjusting the household's consumption-side expenditures.

The rise of soybean imports and its effect on soybean farmers is an excellent case study to analyze the relationship in China between trade and its impact on the farming community. Soybeans have long been one of China's main crops. Indeed, soybeans are originally from China and have historically played an important role in the provision of feed to livestock producers and income for producers. Soybeans also have been a major good in the diets of China's consumers as an oil seed and food and as feed commodity. In the 1980s and early 1990s, most of China's soybeans were produced domestically. Although during this time the price of domestic soybeans were far above those on the world market, trade policy kept protection rates high and imports low. During the late 1990s, however, leaders lowered the rates of protection and trade began to rise. Between the late 1990s and now, imports rose from less than 1 MMTs to around 20 MMTs. Such a sharp rise in trade should provide a good case to study how rises in exports have affected China's farmers, livestock producers and consumers.

Goals and Objectives

In our report, our overall goal is to understand how soybean trade policy changes and changes in soybean trade flows that China has experienced between 1997 and 2003 have affected China's producers, consumers and users of soybeans. To meet this overall goal, we will pursue three specific objectives, which are to:

1. briefly analyze the nature of China's soybean markets; and understand the nature of the links between soybean trade, domestic market development, price, production, and consumption;

2. analyze the responses of households that are affected by soybean trade-related changes;

3. predict the magnitude and direction of responses to trade liberlalization-induced price shifts and suggest if policies are needed to offset adverse effects.

Approach

To meet these goals:

1.) we first seek to establish how well China's own domestic soybean markets function. To do so, we will seek to establish the ways prices are determined in China's domestic soybean markets and how integrated markets are. In addition to being of interest as a topic in its own right (for example, those engaged in foreign trade may be interested in knowing the nature of the domestic market of China once their soybeans enters the country), if China's markets are integrated, then we can compare China's domestic price of soybean in a single city (e.g., in Dalian or Guangdong) with prices in the international market. This is important to know because we want to know that if soybeans enter the market in any given place, whether or not the price effects will be felt by farmers—especially those in poor, remote (and far away soybean producing) areas.

Once we establish that China's soybean markets are integrated, we can then move on to the two key objectives of the report:

> 2. We will use a comprehensive set of data to map soybean production in China's agricultural economy to the income groups. We must see how many of the soybean producers are in areas that are poor. It is important also to see the cropping patterns, consumption patterns and livestock patterns of soybean farmers and to know the ways that they will be able to respond (in these different roles) if prices fall. In short, we need to understand the role in soybeans in China's economy and how it relates to poorer soybean farmers (or those that are in or close to poverty). We also will examine the role of livestock in China's agriculture. We also will track the importance of soybean and meat in the diets of people and in the feed mix of the economy.

> 3. We will build on our previous work that has used our CAPSIM modeling framework, a partial equilibrium policy analysis framework that has been used for a number of previous analyses (e.g., Huang, Rosegrant and Rozelle, 1999; Huang and Chen, 1999; etc.). We will use the approach to examine how WTO will affect the soybean producers, livestock producers and consumers. In addition to this traditional analysis, we will make one major change. Instead of looking at the average effect, we will decompose the production impacts of WTO on households in 9 representative provinces and 4 representative income categories. In this way we can examine in a very detailed way if any households will gain or lose.

Finally, to achieve our final objective for this paper, we need to make one more major change to the traditional approach used for macro-policy analysis. Instead of looking backward, we will use CAPSIM to examine how trade changes in the past several years have affected soybean producers. In this work, too, we will find the links between trade changes and households that have different levels of income. Our focus will be on those households that are under or near the poverty line, since this is the major concern of China's government. We will, however, also examine what happens to the average farmer and those near the top of the income hierarchy.

Finally, in the last part of the report:

> 4. we will briefly discuss the policy implications of our results. In the final analysis, we need to understand who gets hurt, who benefits, how households respond when prices change and how these actions attenuate the negative impact. Finally, if there are negative impacts, we discuss policy actions that might be taken to offset them.

II. Data

In this study, we use three sets of data (datasets 1 to 3). The first two sets of data are used for the market analysis. The third is used for examining the impact of increased trade on soybean producers, users and consumers.

National Price Integration data (dataset 1)

The main data on China's domestic market to be used to examine national price integration of the soybean market come from a price data set collected by Prices taken from the Jilin Province Grain and Oil Information Center (henceforth, *dataset 1*). This data set was provided to us by the Beijing Office of the American Soybean Association. The website for the Jilin Province Grain and Oil Information Center (JGOIC) is http://www.jlgrain.com/grain /grainnews/soybean.jhtml. On a weekly basis between January 1, 1999 and March 2004, weekly prices are reported for 10 of China's main soybean production and consumption provinces, including Heilongjiang, Jilin, Tianjin, Hebei, Shandong, Henan, Shanghai, Jiangsu, Jiangxi and Guangdong (Meyer, 2002). These data are used in the analysis to understand the nature of China's soybean markets.

The choice of markets by JGOIC for the reporting of soybean prices will allow us to examine the relationship between producing and consuming areas. Our sample contains a number of the important producing provinces. As seen in Appendix Table 1, Heilongjiang and Jilin are by far two of the largest producing provinces. Shandong and Henan also produces substantial amounts of soybeans. The sample also contains a number of regions that consume a large share of soybeans. We have prices reported for Guangdong and Shanghai for all three soybean commodities—beans, oil and meal; and we have prices for some of the commodities for Tianjin, Beijing and Hebei.[1] Figures 1 and 2 show the location of China's major soybean crushing mills and their capacity. As can be seen, most of the crushing capacity are in areas in which we have price data—Beijing/Tianjin/Hebei; Shanghai; and Guangdong.

The data from the Jilin Grain and Oilseed Price Information Center appears to be high quality compared to other price series. Unlike other price data sets that are available in China, there are few missing observations. There are also relatively few inconsistencies in the data. In other data sets, corrections frequently need to be made to the data to account for missing observations and to adjust for prices when they are written down in price "per jin" even though the data category is supposed to be price "per kilogram." Unlike our previous analyses of prices using other data sets from China, we made *no* correction to the data after they were provided to us by the ASA.

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[1] Unfortunately, we do not have data for Dalian, the location in China with the largest crushing capacity. For some reason, however, that we could not assess, the Dalian market data were not available. Fortunately, this absence of data will not affect the generalizability since the flow of commodities, in general, will be the same between Heilongjiang/Jilin and Beijing/Tianjin and between Heilongjiang/Jilin and Dalian.

In our discussions with the Monitoring and Marketing Divisions (MMD) of the NGIOC (the division in charge of collecting the data) we discovered that the data were mostly from members of the marketing arms of local grain storage bureaus (that are making daily soybean sales), traders in major ports (e.g., Tianjin and Guangzhou) and end users (in the south). In its most common way a member of the MMD will make a call to the grain bureau personnel, trader or end user twice a week (Monday and Thursday). For example, in Dalian we were told that each week about 9 traders who are involved with shipping grain from Heilongjiang to South China are called. These traders tell the MMD official the average price at which soybeans are leaving Dalian at an FOB price. In the northeast (e.g., Jilin), we were told that MMD calls several grain bureaus in a region and has them provide unit value prices (value of shipments divided by volume) for the day. The MMD official averages the price in the district.

Regional/village Price Integration data (dataset 2)

The data for the part of the study that will examine how well China's villages are integrated into regional markets were collected in a randomly selected, nearly nationally representative sample of 60 villages in 6 provinces of rural China (henceforth, *dataset 2*). To accurately reflect varying income distributions within each province, one county was randomly selected from within each income quintile for the province, as measured by the gross value of industrial output. Two villages were randomly selected within each county. The survey teams used village rosters and our own counts to randomly choose twenty households, both those with their residency permits (*hukou*) in the village and those without. A total of 1199 households were surveyed. The CNRS project team gathered detailed information on both the production and marketing behavior of all of the farmers in the sample and the characteristics of each village and its relationship to the nearest regional market. From each individual respondent in the survey in each village, we know the price and timing of the sale for each commodity. From these data, we construct an average village price for each month in yuan per kilogram. In a community questionnaire, we know how far the village's center is from the nearest paved road and the distance to the county market both in kilometers. Finally, for each crop that the farmer cultivated, we know if the farmer's crop suffered a shock, recording both the incidence and the percentage by which the yield fell. We do not include any variable that controls for the presence of a community buffer stock system, primarily because such an institution is almost never observed in modern China. In addition, sales among farmers within a village are rare (according to our data, less than 5 percent of sales).

Disaggregated Impact of Trade Analysis data (dataset 3)

The baseline for examining the effect of increased trade of soybeans is constructed from the 2003 China National Statistics Bureau's (CNSB) national household income and expenditure survey (*dataset 3*). Based on the sample of more than 80,000 rural households from all of China's provinces, these data form the core of the government's statistical database on rural China. The data include information on each

household's key economic indicators (e.g., income, demographics, education); livestock production, cropping output and sown area for each major crop, including soybeans, and expenditures on a commodity by commodity basis, including soybean and edible oil. With such data, we are able to create a production and consumption profile for the typical household in China and in each province (we will focus on nine of them—Heilongjiang; Jilin; Liaoning; Inner Mongolia; Henan; Anhui; Sichuan; Hunan; and Guangxi) and within each region at the typical household in four different income categories (the poorest of the poor; the poor; the median; and those in the richest decile). Since we want to study the impact of soybean trade liberalization, we analyze the time period since 1997 and study two periods: between 1997 and 2001 (the year before the implementation of WTO) and between 1997 and 2003, which also will capture the WTO effect.

III. Domestic Markets for Soybean

In this section, we examine the nature of China's domestic soybean markets during the post-accession period. This analysis is needed for two reasons. First, it is of interest for its own sake. Second, and more importantly, to study China's behavior at the border, we need to establish that the nation has a nation-wide, well-functioning market for soybeans. If the market for soybeans in China functions well, and price shifts in one part of the country are reflected in shifts in prices in other parts of the country, then we can use prices in one place as a standard for what is happening across China. Moreover, if markets are integrated, we know that when there is a price shock in one part of China (for example, due to increased trade in a commodity), then we know that it is felt by farmers throughout the country.

While it may come as a surprise to some that China's markets are found to function remarkably well, the current state of the nation's soybean markets are a result of 20 years of policy change, institutional transformation and infrastructure development. In this section we see the result of these fundamental changes in marketing structures. During the past 20 years, China's centrally-planned and bureaucratically-run grain system has been replaced almost completely by a domestic market that is dominated by thousands of private and commercialized state traders. Private and profit-oriented quasi commercial trade is the rule in rural areas, regional markets and interprovincial trade. Whereas trade once moved slowly through a planned system on overcrowded trains and small, slow-moving ocean-going junks, today there is a national network of soybean trade that moves by train, truck and the most modern of ships and port facilities. Soybean deals that used to be made during annual trade conferences set up by central bureaucrats in Beijing are now made daily among traders and users in the opposite ends of China through one of the world's most comprehensive cellular telephone system and rapidly expanding internet network. While documenting this transformation is beyond the scope of this report, we include a brief account of some of the major international and domestic trade policy and institutional changes in Appendix B.

In the rest of this section to examine China's soybean markets during the time period in which China is emerging as a major soybean importer. To do so, first, we

examine price relations among the major producing and using areas over time. This is mostly done with graphical analysis and while causality and the exact nature of the markets are not analytically determined with this description, we believe it is important to see visually that prices appear to move closely together. Second, we look at price determination in nation by examining the spatial relationship of prices across China between major ports (which also are the locations of major crushing facilities) and inland markets. We do this and compare our results to similar findings in the US in order to show that price relations from the ports to China's major producing areas throughout China operate in a way not too different than what is observed in the Mississippi Valley between New Orleans and the US's main producing areas. Finally, we do two tests of price integration, one looking at the integration of prices among some of China's major soybean producing and consumer markets; and the other examining the relationship of prices between regional markets and China's villages.

Anticipating (and summarizing) our results, we find that China's soybean markets during the post-accession period function well. Prices in key markets appear to move together, despite long distances between them. Across space between China's main ports (and crushing plants) China's prices look remarkably like those in the US. They also appear to be falling over time, meaning the markets are improving in recent years. Prices also are shown to be integrated statistically among all pairs of key producing and consumer markets. We also show villagers in soybean producing regions are tied into national marketing networks. In short, we believe our analysis convincingly shows that China has a well-integrated market for soybean. If this result is accepted, in the rest of our analysis, when we see increased trade flows, and assume that rising supplies from international markets affect the price in the port into which the shipments arrive, then we can be fairly confident that the price effects (both positive and negative) reflect price relations across much broader regions of China.

Price Relationships Among Key Soybean Domestic Markets in China

Using dataset 1, we can see how closely prices in within and between certain key soybean, oil and meal markets move together. For example, when we plot our price data from 1999 to 2004, for markets that are in the same region, we find prices track each other closely (Figure 3). In Northeast China, soybean prices in Heilongjiang and Jilin follow each other closely for the entire period (Panel A). Interestingly, since 2000, the price of Heilongjiang consistently stays marginally below that (about 3 to 5%) of Jilin, a reflection of the fact, no doubt, that it is more expensive to ship soybeans from Heilongjiang into the main consuming areas, such as Dalian or Beijing/Tianjin. The prices are track each other closely within other regions—both between Hebei and Shandong in North China (Panel B); and among Shanghai, Jiangsu and Jiangxi in Eastern China (Panel C). In fact, in these markets that are separated by relatively short distances and which have fairly good transportation and communication infrastructure, the prices within the region are almost identical.

Using dataset 1, the patterns of movement across further points of China display similar patterns of close movements of prices (Figure 4,). For example, our data show clearly the prices in Heilongjiang and Hebei (a proxy for Beijing/Tianjin) move together during the entire sample period (Panel A). The prices in Jilin and Henan, likewise move closely together (Panel B). Interestingly, if anything, the prices appear to actually becoming slightly closer together in the later period, 2002 and 2003 when compared to the earlier period, 1999 and 2000. Prices between markets in the south, such as Guangdong and Jiangsu, are almost the same and have been so for the entire period (Panel C). The close linkages between prices in the Pearl River Delta and the Lower Yangtze River Delta almost certainly are influenced by the fact that much of the stock for the oil crushing mills are imported and the cost of transport between foreign ports and either Guangdong or Jiangsu mills is negligible.

The integration of China's markets, according to our data, goes beyond the bean market and includes both oil and meal markets. When plotting data for oil, with the exception of the trend of the prices in all of the markets over time (a topic discussed below), the close price linkages among markets within and between regions is as close for oil as they are for soybeans (Figure 5). For example, the prices of oil in the soybean producing areas, Heilingjiang and Jilin track each other almost perfectly (Panel A). The same close linkages are found between more distant markets, between Heilongjiang and Hebei (Panel B), and among some of the main markets in the Northeast (Heilongjiang and Jilin) and Eastern China (Shanghai—Panel C); and between the Northeast and Guangdong (Panel D). Meal markets, both within and between regions, also move together (Figure 6, Panels A to C).

While prices for all of the commodities clearly are moving together both within regions and among them, when prices of different commodities are plotted against one another, there are differences among periods, especially between soybean and oil and between meal and oil (Figure 7). Specifically, it is clear that in the early part of our sample period, 1999 and 2000, the price of oil is falling while the prices of soybeans and meal are staying relatively the same (Panel A). After 2000, however, the prices of oil, soybean and meal all follow similar paths. When plotting the differences between the prices (measured as the ratio of the price of oil to soybeans/meal), the ratio (in all of the major areas) moves from the early period from 3 to 2 to a constant rate (about 1.25) in the later period (Panel B). The closing of the gap likely shows the increasing integration between the markets of the different soybean complexes, since in most other places of the world, the gap is around 1 to 1.5.

Price Determination Across Space

We also can use statistical analyses to analyze of the behavior of prices of soybeans in another dimension. In this subsection we examine price behavior across space, holding time constant. If China's markets function well, then there is a greater likelihood that when a price changes in one region of the country (e.g., there is a price shock arising in Shanghai or Guangdong that occurs from increased demand for exports

or shipments to elsewhere in China), that prices will change throughout the rest of China. If price formation does not appear to be consistent with the existence of adequately functioning markets, price shifts at the border (e.g., in Shanghai or Guandong) may not be experienced elsewhere in China. Indeed, if markets in China are fragmented, shifts of prices in the coastal areas near the border could be sharper (for a given shift in demand), while in large regions of the country away from the border, producers could be shielded from them. Hence, the hypothesis to be tested is that price relations across China's regions exhibit characteristics that make it appear as if China's domestic producers, consumers and traders face price pressures created in part by market forces. As a standard, we compare our results from northwest China with those from the Mississippi Valley in the US.

A simple plotting of the relationship between the price of soybeans in China's ports (Beijing/Tianjin/Hebei; Shanghai or Guangdong) and those in the inland producing and consuming areas (e.g., Heilongjiang, Jilin, Henan, Shandong or Jiangxi) during study period (1999 to 2003) illustrates a price contour that is consistent with the existence of well-functioning markets (Figure 8).[2] Since the main demand centers are in the vicinities of the ports, one would expect that in an integrated marketing system, as a market became more remote from the ports, the price should fall. Indeed, the average price in a market in the port (2250—say, Hebei/Beijing/Tianjin) and one that is a 1000 kilometers away from port (2100—say, Jilin) is, on average, about RMB 150/mt different. In percentage terms, this means the price of Jilin soybean is about 6 to 7 percent lower than the price of soybean in the Beijing area.

The results of regression analysis of the relationship between prices (entering the equation either in linear or log form) in the local market and the distance from port and a series of time period dummies (one for each time period of analysis—that is, one for every ½ week in the sample and an interaction term) find a similar result (and, in fact, one that shows closer integration) soybeans in China (Tables 1). Holding all other factors constant, as soybean marketing sites move farther away from the ports (either Guangdong; Shanghai or Beijing/Tianjin/Hebei), the price falls (row 1). The magnitudes of the coefficient on the distance from the ports show that for for each 1000 kilometers, the price of soybean falls by RMB 76..26/mt (column 1). In log form, our results show that for each 1000 kilometers, the price falls by 3.5 percent (column 2).

Similar results are found when we look at each region of China's soybean market separately (Table 2). When looking at the distance from Beijing/Tianjin/Hebei the price falls by RMB 86.55/mt or by 4.2 percent (columns 1 and 2). While varying somewhat (7.12 percent for Shanghai and 2.6 percent for Guangdong), similar spatial price relations hold (columns 3 to 6).

Interestingly, the magnitudes of the transportation/transaction costs are similar to those reported in Park et al. (2002). They also are similar to those found in the US. When plotting similar data and running similar regression on soybeans in the Mississippi

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[2] The spatial relationships between the prices at the port and the prices in the more remote areas hold for all parts of China's soybean market (see Appendix Figures 1).

valley we find pattern of spatial price spread similar to those in China. According to our analysis, in the US, when soybeans move from the Upper Mississippi Valley towards New Orleans, the price (depending on the year) falls at about 5% per 1000 kilometers. In other words, the graphical and statistical findings of the spatial analysis are consistent with China having well functioning, though emerging, soybean markets.

Correlations and Integration tests

In this section we use more formal tests of market integration. To do so, we first examine the two-way correlations (measures of price co-movements) between prices in different markets (Table 3). The results of the analysis confirm the previous exercises. The correlations among the various markets are all very high. In the 45 pairs of markets in our sample (n*(n-1)/2, where n=10=the number of markets), 37 of them are above 0.9. The remaining 8 pairs of markets still have correlations between 0.85 and 0.9, also very high. Hence, according to these simple correlation measures, market prices appear to move together.

In a more rigorous analysis, we apply the Engle-Granger cointegration approach to test for the integration of China's grain markets. Two or more price series are cointegrated (even if each is individually non-stationary) if a linear combination of the variables (i.e., the differences of the prices) is stationary. We apply a two-step residual-based test. The first step uses the OLS regression of one price series on another:

$$P_t^i = a + l\,t + bP_t^j + e_t,$$ **(1)**

where t is the common trend of the two price series and where e_t is the error term. The main reason for running the first step is that it provides the residuals, e_t, for the second step.[3] When we run the first step with our sample, all of the series are non-stationary to a degree of AR(1)—Table 4. In other words, this means that our price series can be tested for cointegration in the second step.

The second step then tests for the stationarity of the residuals from equation (1) using the augmented Dickey Fuller test:

$$\Delta e_t = d e_{t-1} + \sum_{j=2}^{N} g \Delta e_{t-j} + x_t$$ **(2)**

If the test statistic on the δ coefficient is less (i.e. more negative) than the relevant critical value from the Dickey Fuller (D-F) table, the null hypothesis maybe rejected and the two series are said to be cointegrated of order (1,1). According to Engles and Granger, this implies that the two markets from which the price series come are integrated. The absolute value of the test statistics should be greater than 3 at 10% significant level. In

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[3] The lags from the analysis using equation (1) do not play a direct role in the analysis. Intuitively, they tell the analysts the number of time periods (1/2 week to week long periods) over which the prices in the two markets have some kind of relationship. The second stage Dickey Fuller tests are the tests of interest.

our paper, we are conducting only the unit root test, where j equals zero, since the error term from equation (1) is an AR(1) process.

Table 5 contains the results of the cointegration analysis for all of our pairs of markets between 1999 and 2003, although we only display the results for the integration between each of the markets and the most remote producing area (Heilongjiang) and each of the markets and the most remote consumption area (Guangdong). The cointegration analysis strongly supports both our descriptive findings and the conclusions of the determinants of commodity price analysis, especially when they are compared to the findings of research on market integration in the late 1980s and early 1990s. Using the Dickey Fuller tests, *all* markets are integrated with Heilongjiang (rows 1 to 8); and all markets are integrated with Guangdong (rows 9 to 16). In addition, when we use data through the late spring of 2004, we find that the markets for which data are available (Heilongjiang, Hebei, Shandong and Henan) also are integrated (Table 6).

Using the results from the 1990s as a base line (as shown in Park et al., 2002 for 1990 to 1995; and Huang et al., 2003 for 1997 to 2000), our current analysis shows that during the past 5 years soybean markets in China have become remarkably integrated; 100 percent of the pairs in our sample are integrated. The integration of these markets is notable because in many cases, the pairs of market are separated by more than a 1000 kilometers. The soybean markets also continued along their previous path of maturation. In middle part of the reform era (1988 to 1995), a time when markets were starting to emerge, only around 28 percent of soybean markets showed signs that prices were moving together. In the late 1990s, the co-movement of prices between pairs of markets in a national sample of price showed that soybean markets had improved (to about 68 percent of the pairs). During the past 5 years (1999 to 2003), however, 100% of markets are integrated, which when taken with our previous results make China's soybean markets some of the most integrated in the world.

Regional Market Integration—Between Market Towns and Villages

While we have strong evidence for the national integration of major marketing areas, this is only half of the story. The analysis above demonstrates a remarkable degree of integration between markets on the coast and those inland. Such an analysis, however, is still not sufficient to insure that many of China's villages will be affected by the shocks that hit the coast and are transmitted inland.

To do so, we examine the extent to which villages are integrated into regional markets. Our test of integration will essentially test if farmers in China's villages are price takers or are villages isolated, making prices determined by local supply and demand. In briefest terms, if variables that affect local supply significantly affect prices, we will assume villages are isolated and markets are not integrated to the village level; in contrast, if the local supply shock does not affect the price, villagers are price takers and markets will be thought to be integrated. To perform this test, we use dataset 2, a

national representative sample of households in 60 village throughout China collected by the authors in 2000.

Our regression analysis clearly shows markets in China are integrated down to the village level (Table 7). The signs and level of significance of the coefficients on variables, such as the distance that a village is from the market, demonstrate that the further a village is from a market, the lower the price the farmer receives, which is the expected result. With good markets, villages that are further from the market town, will receive a lower price. More importantly for our purposes, the t-ratios of the coefficients of the village supply shock variables are all less in absolute value terms than 1.35, signifying that the output of the local village's crops does not affect the local price. One implication of this result is that it is factors outside the village that are affecting the price that farmers receive, making them price takers. In other words, farmers, even in China's remote villages, are linked to the markets of its main commodities.

Given the average impacts at national level and market integration presented above, when examine the benefits or costs for certain groups of farmers due to trade, one only needs to examine their production mixes and match them to the extent the prices of the products rose over the period or fell and if farmers have been moving into or out the production of those products, which will be presented in the sections below. Given the results of market integration analyses presented above, we can conclude that the changes in national prices due to trade in the late 1990s and early part of the 21st century were largely transmitted into almost all of China's regions.

IV. Trade Policies, Liberalization and Trade Trends

In this part of the report, we seek to understand in greater depth the trade policy initiatives that have helped create China's agricultural economy and the environment within which soybeans are produced, traded, fed to livestock, processed and consumed. To do so, we examine China's trade policy before and after the nation's accession to the WTO. We also examine how the reformers have implemented their agricultural trade and other trade-related reforms, and how the changes in trade policies might have influenced China's imports and exports. Although we review trade policies, in general, the focus will be on soybeans. Because many other policies also have had a great effect on the soybean economy of China, we have included a review of non-trade policies in Appendix A.

Trade policy

Although the effects of domestic and foreign exchange policies have been important, they are not the only important changes that have affected the trade environment. The reforms and changes in the exchange rate system occurred at the same time that China also began to liberalize its international trading system. Lower tariffs and rising imports and exports of agricultural products began to affect domestic terms of trade

in the 1980s. In the initial years, most of the fall in protection came from a reduction in the commodities that were controlled by single desk state traders (Huang and Chen, 1999). In the case of many products, competition among non-state foreign trade corporations began to stimulate imports and exports (Martin, 2002). Although many major agricultural commodities were not included in the move to decentralize trade, the moves spurred the export on many agricultural goods. In addition, policy shifts in the 1980s and 1990s also changed the trading behavior of state traders. Leaders allowed the state traders to increase imports in the 1980s and 1990s.

Moves to relax rights of access to import and export markets were matched by actions to reduce the taxes that were being assessed at the border. After the fall of restrictions on imports and exports of many of China's agricultural commodities, a new effort began in the early 1990s to reduce the level of formal protection. From 1992 to 1998, the simple average agricultural import tariff fell from 42.2 percent in 1992 to 23.6 percent in 1998 to 21 percent in 2001 (MOFTEC, 2002).

Overall, trade distortions in the agricultural sector have declined in the past 20 years (Huang and Rozelle, 2002). Much of the falling protection in agriculture has come from decentralizing authority for imports and exports and relaxing licensing procedures for some crops (e.g., moving oil and oil seed imports away from state trading firms) and foreign exchange rate changes. Other trade policies have reduced the scope of NTBs, relaxed the real tariff rates at the border and changed quotas (Huang and Chen, 1999). Despite this real and in some areas rapid set of reforms, the control of a set of commodities that leaders consider to be of national strategic importance, such as rice, wheat and maize, remain with policy makers to a much larger extent (Nyberg and Rozelle, 1999).

In the case of grain prior to the accession to WTO, for example, although the import tariff rates have been low, leaders have not allowed the importation of most grain commodities except by those agencies and enterprises that hold licenses and import quotas. When traders bring in grain that is specified as being within the quota, the tariff rate has been only about 3 percent. The tariff rate for grain that would be brought in above the quota, however, was as high as 114 percent. No above quota grain has entered China, however, because in the case of grain trade, imports have to be arranged by state-traders. For the entire reform period, China National Cereals, Oils and Foodstuffs Import & Export Corporation (COFCO) has been the nation's single-desk state trading company for grain. They also managed the imports of edible oils through the mid-1990s. COFCO is one of the largest state trade enterprises (STEs) in both Asia and the world. The value of imports (food and nonfood) by China's STEs likely exceeds that of all other STEs in all current WTO member countries. Over the past decade, COFCO has imported as much as 16 percent of world wheat that has been traded, and has exported as much as much as 20 percent of the world's maize (Nyberg and Rozelle, 1999). Even after China joined the WTO, COFCO continued to act as a key agent in the international grain trade for national and provincial grain trading companies and has maintained preferential access to import quotas.

However, COFCO itself has undergone a series of reforms since the late 1990s. Specifically, since the late 1990s, officials have tried to streamline importing procedures by commercializing COFCO and demonopolizing the trade of a number of commodities. For example, soybeans have been completely liberalized with a single tariff management scheme. The effective tariff rate on soybean imports has been only 3 percent after 1999. For rice and maize, the Jilin Grain Group Import and Export Company (JGIEC), a provincial level of STE established in April 2001, has taken over the import and export responsibilities of COFCO for most maize and rice exports from Northeast China. The establishment of JGIEC marked an end of complete monopolization of COFCO in China's grain trade. Moreover, within the COFCO network (COFCO has always had branches in each provinces and key municipalities), competition has also been introduced. Better incentives were also given to managers and branch officials to increase their attention to the activities that affect profitability. Also, an agency system has been imposed to implement a payment-for-services policy. COFCO traders are supposed to only trade on behalf of their clients for a fee, not on their own account.

Despite the above efforts in commercializing grain trade, the trade liberalization in for all grains before the late 1990s and particularly for maize and wheat, still is minimal (Huang, Rozelle and Chang, Forthcoming). Economic logic and casual observation gives us reason to believe that China's current system of grain trading causes substantial inefficiencies and creates distortions in the domestic economy. It is possible that such a system could even create uncertainty in world markets. Provincial grain companies serving China's domestic markets complain incessantly about the inconvenience and financial burdens associated with their dealings with COFCO (Nyberg and Rozelle, 1999). Although price stabilization has often been stated as a goal of trade policy, COFCO has failed in its bid to insulate China from fluctuations on international markets (Lu, 1999). As national and regional monopolies, both COFCO and JGIEC do not face competition in their dealings on global markets. They also often have considerable rents to protect. Lack of information also characterizes China's maize trade transactions, causing frustration to both domestic and international traders.

China also has had a policy to subsidize certain agricultural commodities from time to time. For example, China has used export subsidies in the years prior to its WTO accession to increase exports of two commodities, maize and cotton. By providing exporters with payments to encourage the export of maize, leaders have increased the protection of domestic producers by raising the price of domestic commodities. During interviews in the field during 2001, we found that maize exporters, especially those in Northeast China, received subsidies that averaged 34 percent of the export price. One trader said that for each ton of maize that his company exported in 2001, it received back 378 yuan per ton (or 45.7 US dollars per ton) after it produced an export bill of sale with the export sales price.

Soybean Trade Policy Before WTO

In some sense, the case of soybeans embodies many of the changes that have affected agricultural trade more generally. During the 1980s and early 1990s, soybeans and

soybean oil was highly protected by several means. Formal tariffs were high. In the 1980s, formal tariffs were above 100%.

Even if tariffs had fallen in the early years, it did not mean that soybeans would have flowed into China. During the 1980s, soybeans could only be imported by officially sanctioned state traders. Soybean oil was also handled by state traders. Each year, as was the case with the major grain commodities, the central leadership made a plan for trading. Regardless of the price relationship between the domestic economy and the international market, the state trading firm would contract for the designated amount of soybeans.

As occurred in the rest of the agricultural sector, China began to reform the soybean trading regime in the late 1990s in preparation for the nation's accession to the WTO. Formal tariffs that had been above 100% were brought down to 3% for soybeans and 20% for soybean oil. The cuts in 1998 for soybeans were among the sharpest cuts of any agricultural commodity. In addition to tariff reductions, in the early and mid-1990s, a number of different trading firms were allowed to import soybean oil. This, however, did not mean complete liberalization. The firms that were allowed to trade needed a license. And even more important, the quantity and timing of the imports were strictly regulated by the central leadership. In the late 1990s, however, the rules on soybean and soybean oil imports loosened and to an extent almost found nowhere else in the agricultural trade economy, a number of traders were allowed to begin to import soybeans and soybean oil with considerable less constraint. In short, the trade liberalization of the soybean sector was considerable before China entered WTO.

China's WTO Accession

In its most basic terms, the commitments in the agricultural sector can be classified into 3 major categories: market access, domestic support and export subsidies. The commitments on market accession will lower tariffs of all agricultural products, increase access to China's markets by foreign producers of some commodities through tariff rate quotas (TRQs) and remove quantitative restrictions on others. In return, China is supposed to gain better access to foreign markets for its agricultural products, as well as a number of other indirect benefits. Domestic support and export subsidies are the other two critical issues that arose during the course of negotiations. Together with a number of other market-access commitments make China's WTO accession unique among all other developing countries that have been admitted to the WTO's new environment.

Some of the direct import market access commitments that China has made to WTO members actually do not appear to be substantial. Overall agricultural import tariffs (in terms of its simple average) declined from about 21 percent in 2001 to 17 percent by 2004. A continuance of earlier trends, the simple average agricultural import tariff fell from 42.2 percent in 1992 to 23.6 percent in 1998. Although important, when taken in the context of the discussion in the previous section about China's external economy reforms of the last two decades, one would have to conclude that the commitments are merely an extension of China's past changes. WTO in this way can be thought of as just another step on China's road to opening up its economy.

Except for national strategic products, such as grain, cotton, edible oil and sugar, other agricultural products (horticulture, livestock, fishery, wine, tobacco, barley, and especially for this report: soybeans) will become part of a tariff-only regime (Table 8). According to this part of the agreement, all non-tariff barriers and licensing and quota processes will be eliminated. For most commodities in this group, effective protection fell by varying amounts by January 2002; for most the tariffs will fall even further by 2004. To the extent that tariffs are binding for some of these commodities, the reductions in tariff rates should stimulate new imports.

It is important to note, however, that although published tariff rates will fall on all of these commodities, imports will not necessarily grow summarily. Indeed, China has comparative advantage in many commodities under the single tariff regime. For example, lower tariffs on horticultural and meats might impact only a small portion of domestic market (e.g., those parts of the market that buy and sell only very high quality products—meats for five-star hotels that cater to foreigners). Although tariffs fall for all products, since China produces and exports many commodities at below world market prices, the reductions will not affect producers or traders.

Such movements, however, will almost certainly be (and can legally be) limited for a class of commodities called "national strategic products." China's WTO agreement allows officials to manage trade of rice, wheat, maize, edible oils, sugar, cotton and wool with tariff rate quotas (TRQs). These commodities are covered under a special set of institutions. As shown in Table 9 (column 5), except for sugar (20 percent) and edible oils (9 percent), the in-quota tariff is only 1 percent for rice, wheat, maize, and wool. However, the amount brought in at these tariff levels is strictly restricted. The in-quota volumes, however, are to grow over a three year period (2002 to 2004) at annual rates ranging from 4 percent to 19 percent. China does not have to bring in this quantity, but provisions are in place that there is supposed to be competition in the import market so if there is demand inside China for the national strategic products at international prices, traders will be able to bring in the commodity up to the TRQ level. Hence, for example, although there is a TRQ of more than 5 million tons of soy bean oil, if the domestic prices of China's edible oil is not high enough to merit the import of so much oil (either because oil from crushed imported soybeans is less expensive or because edible oil from China's own production has lowered the price of soybean oil inside China to the point that it would not be profitable to import that much soybean oil.

At the same time, there are still ways theoretically to import these commodities after the TRQ is filled. Most poignantly, tariffs on out-of-quota sales will drop in the first year of accession and fall further between 2002 and 2005. It should be noted, however, that despite the fact that these out of quota rates are low, internationally, during the transition period, most people believe such rates are so high (e.g., 65 percent for grains and

sugar in 2004 and edible oils in 2005) that in the coming years they will not bind (Table 9).[4]

After the first four to five years of accession, a number of other changes will take place (Table 9, including table notes). For example, after 2006, China agreed to phase out its TRQ for edible oils. If the TRQ was binding during the phase-out period, then its elimination would likely affect imports in the future; if the TRQ did not fill because the prices were not right, the elimination of the TRQ would mean there would be no immediate change.[5] In addition, there are some innovative parts of the agreement that make it so the State Traders inside China can not stop the trade by purely administrative actions. Private trading firms and end users are able to bring in a certain part of the TRQ volume (Table 9, rows 2, 4, 6, 8, 11). Finally, the out of quota tariffs come down over time between 2002 and 2004 (columns 6 to 8).

In its commitments to WTO accession, China also agreed to a number of other items, some of which are special to the case of China. First, China must phase out all export subsidies (most subsidies were used in maize export in 2001) and not to introduce any these subsidies on agricultural products in the future. Moreover, despite clearly being a developing country, China's de minimis exemption for product-specific support is equivalent to only 8.5 percent of the total value of production of a basic agricultural product (compared with 10 percent for other developing countries). Some measures, such as investment subsidies for all farmers and input subsidies for the poor and other resource-scarce farmers, that are generally available for policy makers to use in developing countries, are not allowed in China (i.e., China must include any such support as part of its aggregate measurement of support which should be less than 8.5 percent of agricultural output values).

Because of its Socialist background and the difficulty that the world has had in assessing the scope of the government's intervention into business dealings of all types, China was enforced to accept a series of measure governing the way that they will deal with the rest of the world in cases of anti-dumping and countervailing duties. Most simply, special anti-dumping provisions will remain for 15 years. According to these provisions, in cases of anti-dumping China will subject to a different set of rules that countries can use to prove their dumping allegations. In addition, the methods that countries can use against China to enforce anti-dumping claims when they have won will differ from most of the world. In essence, this set of measures makes it easier for countries to bring, prove and enforce dumping cases against China. It should be noted, however, that although the rules differ from those governing trade among other countries, China will get the same rights in

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[4] Although 65% above tariff rates seem high, it is important to note that in fact when compared to other countries, this is low. Most Asian countries that have a TRQ system, high tariff bindings are 2 or more times higher than this.

[5] China is likely to maintain the TRQ for maize after 2005 though the amount of TRQ will be certainly raised. State trading monopolies also will be phased out for wools after 2004 and gradually disappear for most of other agricultural products (Table 9). Although China National Cereals Oil and Foodstuffs Import & Export Co. will continue to play an important role in rice, wheat and maize, there will be an increasing degree of competition from private firms in the importing and exporting of the grains in the future.

their dealings with other countries, a element that could help them in some cases with their dealings with dumping matters when they concern their partners' exporting behavior. While issues related to safeguard measures could have significant impacts on China's many agricultural commodities, they are less relevant to maize and China is likely to increase its maize import in the post-WTO era.

China's WTO commitments and privileges associated with the measures in other parts of the agreement also will directly or indirectly affect its agriculture. For example, on agricultural chemicals, China has committed to replace quantitative import restrictions on three types of fertilizers (DAP, NPK and urea) by TRQs. Tariffs will be cut on accession and further cuts will be phased in by 2005 in almost all industrial products (e.g., tractors and pesticides). Furthermore, China will reduce significantly its non-tariff measures and eliminate all quotas, tendering and import licensing on non-farm merchandise by no later than 2005.[6]

The WTO and Soybeans

One of the least understood things about China's accession to the WTO is that for some of the commodities that were liberalized the most by the accession agreement, the impact would be among the least. The reason for this should be clear from a careful reading of this and previous sections. During the pre-accession period tariffs for soybeans and soybean oil were already reduced substantially. Especially for the case of soybeans, the pre and post accession tariff schedules were exactly the same. In addition, the emergence of competing traders also had already begun during the late 1990s and the role of state trading already diminished. Finally in the 1990s, few SPS barriers or other NTBs were used for limiting soybean trade.

Because of the radical pre-accession liberalization, there is no reason to expect that additional trade would be affected by trade policies per se. Since tariffs rates were low and competition existed prior accession, there is no reason to believe that the WTO trade measures should have had any dramatic effect. Instead, additional trade flows would almost certainly be related to non-trade policy factors.

Policy Distortions and Trade in Agricultural and Soybean Sectors

In this section, we seek to document and assess the impact that trade policies have had on China's pricing structure (versus international markets) and the volume of its trade flows. One of measures that is often used for examining the presence or absence of distortions in an economy is the nominal rate of protection (NPR). The NPR is an aggregate measure of the combined distortions from all policies. NPRs are generated by comparing China's domestic prices with international ones. Table 11 shows the

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[6] For textiles and clothing, however, the current 'voluntary' export restraints will not be completely phased out until end of 2008, meaning that the expansion of exports may not expand as fast as they would under a less restrictive regime. Substantial commitments to open up services markets in China also have been made.

protection rates for China's major grain and soybean since the reform started in the late 1970s.

Nominal Rates of Protection (NPRs)

Based on our analysis, we can see the experience of China's agricultural trade policy. Before the mid-1980s prior to the beginning of China's efforts to liberalize agricultural trade, the domestic wholesale price of four major commodities all far exceeded the world price (Table 10). For example, the market price in China of rice was 10 percent above the world market price (row 1). The nation's wheat and maize prices exceeded the world price around 90 percent. Soybean price was more than 40 percent higher than the price on the international market.

During the next two decades, however, the protection rates fell as China opened its agricultural trade door. For example, the NPR on rice became negative (Table 10, rows 3 to 10). The rates for wheat and maize fell to around 30 or below during most periods. Soybean NPRs also fell.

The driving force behind this fall in protection has been the gradual but sustained effort in the implementation of trade liberalization policies, which include but are not limited to tariff rate reductions, over the past two decades (Martin, 2002; Lardy, 1995). Published agricultural tariff rates fell from more than 40% in the early 1990s to only 21% in 2001. Hence, tariff policies certainly need to be given at least partial credit. However, it is important to note that during this time assessed tariff rates actually have fell more than the published schedules. During this time period (as discussed above), some of the fall in assessed tariffs may have been due to the reduced intervention by state traders and the use of NTBs. China also has tried to gain access to markets outside of China for some commodities.

In fact, the reduction of tariffs in recent years can be seen to have been accomplished to a large part by the reduction of non-tariff sources. The evidence for this can be seen by examining the policy distortions that existed during the immediate pre- and post-accession period and the Nominal Rates of Protection (Table 11). As it can be seen during the 1997-2003 period, much of the protection can be attributed to domestic taxes (VATs), other non tariff barriers (NTBs) and to export subsidies and rebates.

The increasing prominence of non tariff sources of protection is especially true for soybeans (Table 11, rows 13 to 20). For example, in 1997, the official tariff rate was very high and the actual NPR was high also (40). By 1999 (and thereafter), however, after the tariff reductions (to 3%), the NPR ranged between 16 to 20 percent. During these years, non tariff barriers (4% in in 2000) and the VAT (in all years between 2000 and 2003) were by far the largest sources of protection. Hence, all of the reduction in the NPR since 1999 (which was modest—from 20 to 16 percent) was due to reductions of non tariff sources. The current protection is almost all being provided by tax policy. In most of the domestic economy, traders that buy from farmers and wholesale markets do not have to pay a VAT. The VAT is assessed, however, on all imports. Hence, future

reductions, if made, will also have to come from changes in the way the VAT are assessed on domestic and international shipments.

Therefore, in assessing the record of the impact of trade policies on China's NPRs, it can be ascertained that distortions have declined significantly in the past 20 years. Based on the timing of China's trade policy efforts, much of the falling protection in the early years came from tariff reductions. In addition, in later years, reductions appear to have come from decentralizing authority and relaxing licensing procedures for some crops (e.g., moving oil and oil seed imports away from state trading firms), reducing the scope of NTBs, as well as the relaxation of real tariff rates at the border and changing quotas (Huang and Chen, 1999).

Trade Patterns

One immediate effect of falling protection has been the shift in the level and nature of agricultural in China. In the early 1980s, the volume of trade was small (Figure 9). Moreover, China was a net importer of food. Since 1983, however, exports have exceeded imports during each year. Agricultural trade also has expanded steadily (although unsurprisingly the rate of growth of agricultural trade has been much less than that for trade in general).

Perhaps most significantly, along with the rising volumes of imports and exports, the structure of trade has shifted sharply and it has moved in a way that suggests China's producer and traders are efficiently responding international prices and resource scarcities (Figure 10). In the mid- to late-1980s China was a net exporter of both land- and labor-intensive agricultural commodities. Since then, however, there has been a sharp shift in the composition of exports and imports. China has begun to exports large quantities of commodities, such as fruits, vegetables, meat products and aquaculture commodities. All of these commodities are relatively labor intensive. In contrast, China has imported increasing quantities of wheat, cotton, hides and edible oil, commodities that are less labor intensive and more land-intensive. Clearly such trends show how China, which is rich with low-wage labor, is moving into exporting commodity in which they have a comparative advantage while at the some time beginning to import land-intensive products.

Soybean and Edible Oil Import, Price and Production Trends

The case of soybeans and soybean oil, in some sense, are the best examples of the shifts that China has made into more land-intensive commodities (Table 12). In the early 1980s China imported only a small amount of soybean oil (rows 12 to 22). During the late 1980s through the mid-1990s, imports rose steadily, reaching a high of 1.1 million tons in 1996, which was the equivalent of importing about 4 million tons of soybeans. Since the mid-1990s through 2003 (with the exception of 2000 and 2001), China's imports of soybean oil has remained about 600 to 850 thousand tons.

Although beginning the expansion stage later, the import soybeans also has increased its presence steadily (Table 12, rows 1 to 11). In fact, when looking at the entire period the transformation is even more dramatic. Between 1980 and 1995, China was a net exporter of soybeans, albeit at fairly low levels. In the late 1990s, however, soybean exports rose rapidly. In 1997, the net import of soybeans surpassed that of soybean oil (in soybean equivalents). During the period, 2000 to 2003, China imported more than 10 million tons in each year; they hit 20 million tons of imports in 2003. This level of soybeans represents almost one-third of the world's total trade. Clearly, the importation of land-intensive crop, such as soybeans, is a sign that China has committed itself during the past decade to import crops that they do not have an advantage in producing.

While the large volume of increased trade in an economy such as China's (which as we have seen is highly integrated) will necessarily have a depressing effect on price (a point that we will return to in detail later), when looking at prices of soybeans and other major grain commodities, it is not evident that soybean producers have suffered adverse price effects, at least relative to the producers of other commodities (Figure 11; Table 13). Since the early 1990s, soybean prices rose until the mid-1990s, fell in the late 1990s and then leveled off after 2000 and rose slightly in 2003. If one were to look only at the soybean price trend, it might be tempting to blame at least part of the fall in prices in the late 1990s to the rise in imports. However, several facts would support an argument that the rapid rise of soybean exports has not hurt soybean producers relative to other producers that have not experience such large volumes of import increases. First, during the periods of the greatest surge in imports, prices have been steady and have not fallen. In fact, as we have seen, in 2003, the year in which imports have surpassed production, prices rose. Second, trends over time of soybean prices are similar to those of other major food and feed grain, rice, wheat and corn. Finally, not only are the contours of the trends the same, the relative ratio of soybean prices to the price of other commodity is about the same in the period before 1997, the point of the start of the upward surge in soybean imports. For example, between 1990 and 1996 the soybean to rice price ratio average 1.41; between 1997 and 2003, the price ratio was exactly the same. Clearly, there appears to be other forces at work on soybean prices, since even though the rise of imports are so high (especially relative to the other crops—rice and corn are being exported; wheat imports are falling), the price trends are quite similar.

Like the effect on price trends, the rise in soybean imports also does not appear to have had a noticeable effect on soybean production or sown area (Table 14). During the period between 1995 and 2003 when China begins to import large quantities of soybeans, production actually rose slowly but steadily, from about 13 million tons to more than 15 million tons. At the same time, sown area also increases, rising from 8 to 9 million hectares. The most surprising thing about the performance of soybean production and sown areas is that is appears to be even better when compared to that of rice and wheat; during the same period, rice production and sown area fell steadily, especially between 1999 and 2003 (China National Bureau of Statistics, 2003).

Hence, in summary, although we know that increased imports will have a negative price effect, it is clear that in another sense that the rise in imports at the very least kept price from rising too far, which would have had adverse consequences for consumers and other users of soybeans and its products. It should also be noted that in the analysis so far we have only been working with aggregate statistics and have not been controlling for other factors. Since the analysis of the effect of increased trade on soybean prices, production and consumption requires the simultaneous consideration of a number of other factors and considerable disaggregation, we need to turn to more sophisticated analytical methods to take a closer examination of these issues.

V. Methodology and Scenarios Formulation

An Overview of the Methodology

In order to evaluate the impact of soybean trade liberalization on China's soybean and the rest of agriculture, a quantitative method has been developed based on CCAP's Agricultural Policy Simulation and Projection Model (CAPSiM). CAPSiM was developed out of need to have a framework for analyzing policies affecting agricultural production, consumption, price and trade at the national level. CAPSiM is a partial equilibrium model. It is the first and most comprehensive model for examining the effects of policies on China's food demand, supply and trade. Most of the elasticities used in the CAPSiM were estimated econometrically by ourselves using state-of-the-art econometrics and with assumptions that make our estimated parameters consistent with theory. Both demand and supply elasticities change over time as income elasticities depend on the income level and cross-price elasticities of demand (or supply) depend on the food budget shares (or crop area shares). The commodities include 12 crops and 7 animal products. The crops included are rice, wheat, maize, sweet potato, potato, other coarse grains, soybean, cotton, all edible oils, sugar crops, vegetables and fruits. Farmers cultivate the 12 crops on more than 90 percent of China's total sown area. The animal products include pork, beef, mutton, poultry, eggs, milk, and fish.

CAPSiM explicitly accounts for urbanization and market development of the demand side. In our supply side analysis we account for changes in technology, other agricultural investment, environmental trends and competition for labor and land use. Supply, demand and trade respond to changes in both producer and consumer prices. Details of the model description can be found in Huang and Li (2003).

Because the analysis based on the original CAPSiM framework can only be done at national level and was designed to be used to simulate the future effects of policy shifts, we have had to make a number of changes for this study in order to do *ex post* analysis (that is, in order to analyze the impact of trade shifts on soybean prices, production, consumption and income during the 1997 to 2003 period). We also had to modify the original model in order to allow us to disaggregate the national impacts into

household production at the regional level and to assess the impact that soybean trade liberalization has had on household production and incomes of different income groups.[7]

In our analysis, we generate the production impacts of soybean trade on producers in EVERY province. However, due to space limitations we only present the results of a subset of the most important provinces: Liaoning, Jilin, Heilongjiang, Inner Mongolia, Henan, Anhui, Hunan, Sichuan and Guangxi. According to Table 15, which presents the soybean area and production shares of each province (and ranks them according to production share), our subset of provinces includes nine of the top 12 producing provinces.

Among the many changes and new assumptions, work done for this project includes:

1) Creation of a database on production, consumption, price and trade for the study period (1997-2003) at the national level;

2) Generation of a database for household food production, farmgate prices of agricultural products and procurement prices of foods by income group and by province. Our original database is from CNSB and is for 2003. In order to link this unique database with CAPSiM, we estimated a similar household database (that was also disaggregated by income group and province) in 1997 by transforming the 2003 household data. The transformation was made by dividing the 2003 production, consumption and price levels for each subgroup by the changes that occurred at the national level between 1997 and 2001. With this new (estimated) household database in 1997, we then apply CAPSiM to simulate how supply, demand and prices change over time due to the changes in soybean trade;

3) Separating the impacts of soybean trade from other policy impacts;

4) Ensuring the results of CAPSiM's "backward projection or simulation" be largely consistent with the actual realizations of agricultural production, consumption, price and trade patterns during 1997-2003.

In addition, we also break the study down by time periods. Because, as discussed in the sections above, soybean trade liberalization was mainly started in 1997/1998, the study is limited to the period of 1997-2003. In fact, by December 2001 when China joined WTO, soybean trade had been mostly liberalized. Because of this, it should be expected (ex ante) that the impacts of China's WTO accession on soybean is minimal. Therefore, in this study we do not present the impacts of WTO accession on China's agriculture per se. Instead, our analysis separates the impacts of soybean and soybean oil trade on China's agriculture into 2 sub-periods, 1997-2001 and 2001-2003. The readers

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[7] In our analysis, we unfortunately can not include by province expenditures for each of the income categories due to data problems. China National Statistical Bureau restricts access of researchers to the household-level data and so we are not able to resolve a number a obvious inconsistencies in the data base.

who are interested in China's WTO accession and its impacts (on agriculture, in general—not specifically on soybeans) are referred to our recent publications (Huang, Rozelle and Chang, Forthcoming; Huang, Li and Rozelle, 2003).

Approach Used to Analyze the Trade Impacts

In addition to the time dimension, we need to break down the impacts of soybean (including soybean oil) trade and other policies on the economy (i.e., trade liberalization in other sectors and policies that affect domestic production, consumption and domestic prices). Ideally, this could be analyzed through varying policy instruments such as exchange rate, tariff levels, non-tariff barriers (i.e., state stating issues, import quotas, VAT on imports, export subsidies, tax rebate for export, etc.), domestic price restrictions, etc. However, due mainly to data limitations, we are not able to take this approach. Rather, we set up a counterfactual experiment by varying exogenously the levels of soybean and soybean oil trade variables, and simulating with our model the effects that alternative trade scenarios have on domestic price, production and consumption. In utilizing this approach, we estimate the impact of domestic policy and trade policy variables on domestic supply, demand, and prices before we simulate the impacts of trade flow shifts on the economy. Because import/export of soybean and soybean oil could be caused not only by trade policies but also domestic policies, we do realize this limitation.

Scenario Development

Given the above discussions, any change in the economy (i.e., in production, consumption or price) between time period *t-1* and time period *t*, dY_t, can be decomposed into the impacts of trade and other factors as:

(1) $Y_t = Y_{t-1} + \bullet\ Y_{At} + \bullet\ Y_{Bt}$, or
$$dY_t = dY_{At} + dY_{Bt}$$

where *d* denotes the difference that occurred during the time period; subscript *A* refers to soybean and soybean oil trade shocks; subscript *B* refers to all other shocks except for soybean/soybean oil trade shocks. To simply discussion, from now on we call *B* other policies. In our analysis, we assume that all changes in any of our outcome variables of interest can be precisely portioned into those due to soybean/soybean oil trade changes and the other policies.

We will simulate the effect of soybean/soybean oil trade on the economy, by examining the effects of changes in imports or exports of soybean/soybean oil. To do so, we let X_t be the volume of soybean/soybean oil trade in time *t*. We assume that if leaders in China change their policies (i.e., trade policies) to affect trade, the policy shifts will be reflected in external trade changes, that is, X will change. Conceptually, of course as we discussed above, changes in domestic policy *(B)* could also lead to changes in *X*. For this reason, the results of our study may overstate the pure impacts from trade reform. However, because of the heavy influence of China's leaders in border activities,

particular soybean trade before its liberalization, we believe that at least during 1997-2003, most of the changes in X capture the impacts of trade and trade related policy changes.

Given these assumptions, the impacts of soybean and soybean oil trade changes on the economy are fairly easy to analyze with our revised CAPSiM framework. To do so, we assume that there are two alternative, mutually exclusive scenarios that could have occurred in the case of trade in China's external economy:

(2) $dX_t^I = X_t - X_{t-1} \mathbin{^1} 0$ which we call *Scenario I*, and

(3) $dX_t^{II} = 0$ and $X_t \neq 0$ which we call *Scenario II*.

Scenario I is used to simulate the economy in which trade changed over time (for simplification, the term of "trade" refers to soybean and soybean oil trade in the following discussions). This, in effect, is trying to examine what actually happened. If we set X equal to the *actual trade* that occurred in the country during each time period, then the outcomes that occur during the simulations periods embody the impacts of trade and trade related policies. In contrast, scenario II seeks to replicate an economy in which there was no change in trade during the study period. If the period between *t-1* and *t* covers each of the periods 1997-2001 and 2001-2003, scenario II attempts to project what would have happened to production, consumption and prices had there been no trade changes. In other words, the forecasts in scenario II would be made assuming that trade remained at the 1997 level during the entire study period (from 1997 to 2003).

To quantify the impact of trade, we can use CAPSiM to simulate separately the economy when the conditions imposed in either condition (2) or (3). We then can examine the difference in the differences of the outcome variables during the study sub-periods (from t-1 to t), and summarize the results with the following equation:

(4) $dY_{At} = dY_t^I - dY_t^{II} = dY_{At} \mid_{dXt = Xt - Xt-1 \mathbin{^1} 0} - dY_{At} \mid_{Xt = Xt-1 \mathbin{^1} 0}$

In other words, equation (4) calculates the impacts of trade on Y_t in *t* over *t-1*. If we know the actual changes, we can then use equation (1) to generate the residual of the change between the actual performance of the economy (dY_t) and the changes due to trade (dY_{At}). This residual can be interpreted as the impact of all other factors besides trade (soybean and soybean oil trade). In other words:

$dY_{Bt} = dY_t - dY_{At}$

In summary, then, to simulate the impacts of soybean and soybean oil trade changes on production, consumption, and price, two scenarios are formulated based on conditions (2) and (3). To implement these changes, we impose these restrictions on the CAPSiM model. The simulations will then generate the impacts of trade on price, production and consumption.

Following this logic, in the rest of this report, we first provide basic information on China's rural households. The characteristics of farm households in terms of income, expenditure, agricultural production and consumptions and other characteristics are discussed. Second, the impacts of the changes in the trade of soybean and other agricultural prices at the aggregate level are examined and the effects on overall expenditures are measured. Finally, the responses of producers to these prices changes due to soybean/soybean oil trades are analyzed at the household level in different parts of China are studied.

VI. Variations Across China: Differences Among Soybean-Producing Households

Two decades of economic reform have changed the economic landscape of China. During the 1980s and 1990s, per capita grain output reached a level similar to that in developed countries. Many farmers have shifted into higher valued crops, making decisions increasingly on market-oriented principles. China's research system has steadily produced new technologies that have pushed up productivity by almost double the rate of population growth. The nation has by far the most sophisticated agricultural biotechnology program in the developing world—indeed many of its breakthroughs are of global importance. Emerging domestic markets not only deliver the new technologies to farmers throughout the nation, the output of the farmers that use them is being delivered to consumers across ever-widening reaches of the nation. Rising food exports demonstrate that China's farmers are now able to compete in international markets. Off the farm, more than 40 percent of rural residents have employment; about 100 million of them—most of them young and eager to make new lives in the city—have left home and moved to urban areas for employment. Rural incomes have risen dramatically and hundreds of million of people have escaped poverty during this time. By 2003, average per capita income in China had reached 2704 yuan (or about US $1300 in Purchasing Power Parity Terms—Table 16, column 1, row 1). The per capita income of the richest 10 percent of China's rural economy was more than three times this much and similar to the average level of per capita incomes of urban residents (row 2). The growth in agriculture, non farm employment and rural industry and the transformation of domestic and international markets have changed the face of much of rural China (rows 3 and 4, columns 2 to 11).

While the new landscape should fill leaders with optimism, it is still well-known that not all have shared equally in China's growth and, according to the China's national poverty office and the World Bank (2000), there are still millions of people still in poverty. Using the *government's poverty line* (about US $0.70 per capita per day) more than 30 million people lived below the poverty line. In the rest of this report we call those living under the government poverty line as the poorest of the poor (or those in poverty group 1—PG1). Using the World Bank's poverty line (US $1.00 per capita per day), a line drawn somewhat higher, there are still more than 100 million people that live in poverty. In the rest of this report we designate these as the poor (or those in poverty group 2—PG2). It should be noted that PG2 necessarily is larger than PG1 since all of those in PG1 also are, by definition, in PG2.

Statistics from China's National Income and Expenditure Survey clearly show the vast differences between the average and above average rural resident in China (Table 16, rows 3 and 4) and those the are in PG1 and PG2 (rows 1 and 2). Mostly directly, the average annual income of the poorest of the poor (PG1) is only 327 yuan per capita, less than 15 percent of the average rural resident. Those under the World Bank Poverty line (PG2) have incomes that are higher (572 yuan per capita) than those of the poorest of the poor but individuals in the PG2 category still only have incomes, on average, that are less than one-fifth of the average.

China's poorest households also differ from their richer counterparts in a number of systematic ways (Table 16, rows 1 to 4). For example, farming income makes up around 60 percent of the income of the poor; it only makes up around 40 percent or less of those in the average and richest income categories (column 3). Food expenditures, as a percent of total expenditures, also are much higher for the poor (above 50 percent) than for the richer (between 36 to 46 percent—column 5). The better off also have more access to off farm jobs and higher levels of education (columns 8 to 11).

In addition to differences across income categories, our data also show that there are considerable differences in income and other factors across provinces (and across income categories). For example, the average incomes in the provinces in the Northeast (Liaoning, Jilin, Heilongjiang and Inner Mongolia—Table 16, rows 5 to 20) are different from the national average. Those in Liaoning are slightly above average; those in the other provinces are below average. Interestingly, average incomes in the other major soybean producing provinces (rows 21 to 40) are all below the national average, ranging between 2095 in Guangxi and 2535 in Hunan.

The higher degree of reliance on agriculture and food in most of the soybean-producing provinces show the differences in economic structure of different provinces (Table 16, columns 3 and 5). Except for Hunan, all of our subset of provinces has a higher share of agriculture in income share (versus the national average). In the Northeast provinces (except for Liaoning, which although above average, is less than the other Northeast province), the share of the economy in agriculture is even greater (around 75 percent in Jilin, Heilongjiang and Inner Mongolia). In all of the sample provinces—outside of those in the Northeast—the share of expenditure that is devoted to food is above average (rows 21 to 40).

Differences among Provinces in Soybean Production and Use

In any study of China on the impact of trade on a single commodity, such as soybeans, one of the most important facts to understand is the degree to which China's farmers are diversified. Farmers in developing countries, almost uniformly grow a wide variety of crops. In addition to trying to spread out their family labor and use all of the niche environments on their farm, households also plant a number of crops to diversify

their risk. China's farmers are a major producer of many crops, including rice, wheat, maize, cash crops and soybeans (China National Statistical Yearbook, 2003).

Our household data confirms what is found in the national statistics. When looking at the average household in China that is farming in 2003 (which, according to our data, has about 13 mu per household—about 2 acres--or about 2 mu per capita), China's great diversity of crop is clear (Table 17, row 3). The average household cultivates between 2.44 to 2.66 mu per household of rice, maize and (non-soybean) oilseeds, such as rapeseed or peanuts. The rise of recent years of vegetable and cash crop production has resulted in farmers cultivating between 1.13 to 1.35 mu to vegetables and other cash crops.

Despite being the second largest producer of soybeans in the world and being the center of origin of soybeans, it is interesting to note that in 2003, soybean in some sense is a fairly minor crop, although the importance differs somewhat across income categories. The average farming household only planted 1.08 mu (or about one-sixth of an acre) of soybeans. At an average yield of less than 2 tons per hectare (or 25 bushels per acre), this means that the average household only produces 120 kilograms or 4 bushels (which on a per capita basis is only about 1 bushel per person in the farming sector, since the average household size in China is around 4 persons).   Interestingly, compared to the average household, both the richest rural households and the poorest cultivate above average areas of soybeans (Table 17, rows 1, 2 and 4). In particular, the poorest of the poor cultivate 1.91 mu per household, about 75 percent above the average. On a share of total area planted, the poorest of the poor allocates 11 percent of their land to soybeans, while the average farmer only allocated 8 percent.

The geographic size of China also accounts for part of the diversity of its cropping patterns. When examining the patterns of cropping across provinces, there is a great deal of difference (Table 17, rows 5 to 40). For example, households in the Northeast cultivate more maize than the average farmer, but much lower levels of rapeseed and peanuts (and other non-soybean oilseeds—rows 5 to 20). In contrast, the average household in most provinces outside the Northeast produces more rice (rows 21 to 40) and those in some produce more cotton (rows 21 to 28). There are many provinces in which the average household has high production in one or more crops and none in another.

While crops, in general, are somewhat bunched up across China, soybeans are in particular. When compared to other crops, the variation of soybeans across the country is the highest in China. Specifically, the standard deviation (a statistical measure of dispersion) is higher when examining per household sown area of soybean producers than those of the producers of other crops. When examining our household data, it becomes immediately clear that the big interregional variations are due to the concentration of the crop in the Northeast, especially in Heilongjiang (Table 17). The sown area of the average household in Heilongjiang Province is 19.24 mu, more than 18 times the average; those in Inner Mongolia and Jilin are also more than double the average. Outside of the Northeast, except for Anhui, there are no provinces in which the average

farmer reaches the national average. Interestingly, in all of the major producing provinces, the poorest of the poor (PG1) have higher levels of per household sown area than the average. Hence, when examining the effect of trade policy, these findings show use that most of our attention will be put on producers in the Northeast, especially Heilongjiang, as well as in Anhui. *Poor farmers, by virtue of the vulnerability (as a result of being poor), as well as by virtue of their greater reliance on farming, in general, and soybean production, in particular, need special attention.*

The vulnerability of farmers in Heilongjiang is further exacerbated by the distribution of crops in the province (Table 18). With the exception of Heilongjiang, there is no province in China in which the average farmer allocates more than 11 percent of their area to soybeans (column 6). In the poorest counties, the same is true; outside of Heilongjiang, there is no province in which the households in PG2 allocate more than 13 percent of the area to soybeans (column 5). In Heilongjiang, however, typical farmer in the average category (column 6), the poor (PG2—column 5) and the richest (column 7) all have more than half of their area in soybeans.

Our data show that the exact same conditions, and thus the relative vulnerability, hold for the households that specialize in the production of soybeans (Table 19). The average farmer in all of the Northeast provinces (Liaoning, Jilin, Heilongjiang and Inner Mongolia) produces more than the national average (column 4, rows 1 to 20). The average farmer in Heilongjiang produces more than 15 times as much as the average farmer in China. According to our data, only the average farmers in Anhui province have production higher than the national average; the others are far below (rows 21 to 40).

The rise of livestock production and the use of soybean in livestock feed in recent years have without a doubt helped reduce the risk in China for liberalizing soybean trade. When farmers produce livestock they gain from falling soybean prices. Thus, even if a farmer, as a producer of soybean, is hurt by increasing imports, they can at least in part such a loss if they also produce livestock and use soybean (or soybean meal) as feed. And because of the trends in livestock, the rise of production of livestock has far outpaced soybean production. Livestock production (even after adjusting for problems with the statistical system) has risen at about 10 percent per year (Ma et al., 2003). The rise has happened in all provinces and in all income categories.

Although farmers in the provinces that produce most of the soybeans (e.g., Heilongjiang, Jilin, Inner Mongolia and Anhui), have increased their production of pork, poultry and other meat commodities, according to our household data, in many of the provinces (and in many of the income categories) the farm households still produce below the national average in China (Table 20). Whereas Liaoning produces above average levels of pork, households in the other Northeast provinces and Anhui fall below the national level. Moreover, in each of these areas, poor households in PG1 and PG2 produce even less. The same is true for poultry (except in the case of Anhui and Heilongjiang). It is interesting in some provinces that have lower levels of soybean production, such as Sichuan, except for the poorest of the poor households, households in all income categories have higher than average pork production. Such households, in

contrast to those poor ones that have high levels of soybean production and low levels of meat production, stand to gain from increased soybean trade.

VII. The Impact of Rising Soybean Trade on China's Population

In this section, we review the results of our impact analysis and attempt to measure of the effect of rising soybean trade on China's rural and urban population. To do so, we take two approaches. First, we examine the impact on *price*, *production* and *consumption* (rural and urban) at the *aggregate* level. Using the CAPSIM model, we look at the changes between 1997 and 2001 and between 1997 and 2003 in order to isolate the time period that the largest effects were experienced. Second, we use our *disaggregated* data to examine how increased soybean trade has affected *production* in some of China's key soybean producing provinces and among households inside different income categories. Absence of data keeps us from doing a similar disaggregated analysis on the expenditure side.

Aggregate Analysis

To understand the logic underlying the findings of this part of the study, one has to consider both the direct and indirect effects of a price shift (such as the fall in price) that is induced by an exogenous event. In this section we focus on a particular type of price shift, that caused by increased imports of a commodity into China, that is caused by the action of an actor outside the immediate economy.   Specifically, we are considering the effects of the importing activities of traders that are able to bring in increased volumes of soybeans between 1997 and 2003 in response to the actions of trade officials that reduced tariffs and issued additional import permits during the period. We do not start with producers or consumers inside the economy, since they will necessarily be both reacting to and creating price changes. Once the initial import-induced price fall occurs, however, we then will track the reaction of soybean producers *and* consumers (including those that use soybean as feed) as well as the responses of producers and consumers of substitute commodities.

The also attempt to separate changes in prices during the study period into those caused by increase trade and other changes, such as rising incomes, technological change and shifting preferences. To do so, we first measure the *actual* change in price (as documented in Table 13). Given that there was a large rise in soybean imports during this time (as documented in Table 12), the actual price shifts include the effects of changing trade patterns. We then run our simulation model (described in section V), creating an alternative *no-trade* scenario (which, in fact, means no increase in trade from the levels before 1997) in order to answer the question: What would have been the price of soybeans had there been no change in trade. The difference between what actually happened and the results of the no-trade scenario is the *net effect of changes to all other policy and other economic factors* on soybean prices, production and consumption.

Price Effects of Rising Soybean Trade

Rising imports of soybeans into China, especially in the volumes that have flowed into the nation between 1997 and 2003, should be expected and, according to our analysis, in fact have played a major role in keeping the price of soybeans, edible oil and the prices of other commodities low. The direct of effect of imports on soybean prices themselves is the most evident (Table 21, rows 1 to 3). For example, between 1997 and 2001, the price of soybeans actually fell by 37.3 percent (columns 2 and 3). This actual price fall, however, includes the effect of all forces that affect price, including *both* increasing trade and non-trade factors. Using CAPSIM to simulate China's soybean economy if there were no change in trade between 1997 and 2001, we find that if there had been no increase in trade, the effect of other forces operating on the economy would have increased prices by 12.5 percent (column 5). Although we can not isolate the exact cause, economic theory and our knowledge of China's economy suggests that most likely the increased demand for soybean meal for feed and changes of preferences in favor of soybean oil pushed up soybean demand and put upward pressure on prices between 1997 and 2003. Holding these other effects constant, however, our analysis also shows that trade by itself was responsible for reducing the price of soybeans by 49.9 percent. In other words, according to our analysis, had there not been an increase in soybean imports during this time, China's domestic prices of soybeans would have been 50 percent higher than they were. Clearly, the reductions in tariffs, loosened import restrictions and increased competition in the import of soybeans (as well as other factors that have raised the demand for imported soybeans) have contributed importantly to keeping the domestic price of soybean low inside China.

The effect of rising trade on soybean prices also continues through the WTO period (which can be seen by comparing the results from the 1997 to 2001 shift—which does not include the accession to WTO; with the results from the 2001 to 2003 shift— which does include the period during which China was acceding to the WTO). During this period, despite the large increase of imports into China, the price of soybeans rises by 19.2 percent (Table 21, row 3). In fact, the rise of price in the face of large increases in soybean imports is remarkable and the importance of trade in dampening the price effects by surges in demand is clear in our results. According to the analysis, increased demand for soybean products put such high upward pressure on soybeans that without trade, prices would have risen by 89.2 percent between 2001 and 2003 (column 5). As it was, however, the rise in imports by themselves dampened the price effects by 70.0 percent (column 4). In other words, whereas the price of soybeans between 2001 and 2003 rose by 19.2 percent, without trade the price would have nearly doubled (that is, it would have risen by 89.2 percent).

The same price effects, albeit not as sharp, appear for the price of edible oil (Table 21, rows 4 to 6). As the case of soybeans, the price of edible oil falls between 1997 and 2001 and then rise between 2001 and 2003 (columns 2 and 3). In both cases, the increase of soybean trade has dampened prices of soybean oil.[8] While at first it may

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[8] Although China is importing fairly large volumes of soybean oil, the import volume remains fairly stable between 1997 and 2003 (as documented in Table 12), so most of the effect likely must be attributed to the

seem curious that the price of edible oil (and the trade effects on price) moves relatively less than soybeans, it should be remembered that edible oil includes soybeans and other edible oils, rape, peanut, cotton and other oils. This aggregation necessarily covers up much of the price effects. Despite the shortcoming, it is interesting to note that the effect of soybean trade affects edible oil prices significantly both during the 1997 to 2001 period, when trade liberalization is occurring, and during 2001 to 2003, after trade liberalization of soybeans was mostly complete.

Regardless of looking at the effects of soybean trade on soybean or edible oil prices, we believe that we can extract one of the most important finding of our study by comparing the sources of the effects of trade on soybean prices between the two study periods. When searching for the cause of the rise of imports, unlike the previous period (1997 to 2001) when officials were liberalizing trade policy (and such policy effects certainly were at least partially, if not mostly, responsible for the rise of imports and the subsequent price falls), it should be recalled that by 2001, soybean trade was almost completely liberalized. Therefore, as trade during the WTO period (2001 to 2003) surges, it must be concluded that the rise of imports has to be due mostly to market forces (since there is really no new trade liberalization for soybeans after 2001). Moreover, according to the analysis, the market-driven rising trade during the 2001 to 2003 period almost certainly is almost all demand driven. It should be recalled that between 1997 and 2003 domestic soybean production stays almost unchanged (as was documented in Table 14). Hence, the rising pressure of prices must come from the rising demand for soybeans, which, as we know, is most likely based on the soybean feed requirements to fulfill the increasing demand for meat and aquaculture products. The rising demand is also almost certainly coming from rising demand for soybean oil. The link between trade, price and production and consumption are examined more comprehensively below.

In summary, the point that is important for this section is that our analysis clearly suggest that the rise in the volume of soybean imports into China are mostly in response to the demands of soybean consumers and other users and trade flows have played a major role in meeting the heavy demands put on the sector and have kept prices moderated. The importance of such a price moderating effect perhaps is shown to be clearest during the period since the fall of 2003. During this time, while the price of other commodities, such as rice and wheat rose steeply, those of soybeans did not rise nearly as much.

Other Price Effects. In addition to the more direct effects of rising soybean imports on bean and oil prices, the increased availability of soybeans inside China's food sector affects many other commodities, both competitors and commodities that use soybeans as an input (Table 21, rows 7 to 21). For example, in the case of maize, the main in-the-field competitor of soybeans, during the 1997 to 2001 period rising soybean

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trade of beans. However, a more nuanced examination of soybean oil trends show that imports fell between 1997 and 2001 and then rose between 2001 and 2003. Hence, it might be that the downward effect of prices of bean trade was actually greater and was dampened because of the falling import of oil. In contrast, the upward trend of soybean oil imports may have contributed to the downward effect of the overall trade of soybean complexes, which would have reduced the effect of bean trade.

imports affected the maize price, albeit, this was one of many factors that affected the price of maize (rows 13 to 15). According to our analysis, the price of maize fell by 21.0 percent between 1999 and 1997 (columns 2 and 3). Trade, however, only accounted for 7.8 percent of the fall, only about one-third of the fall (column 4). With the rise of soybean imports and fall of soybean prices, the demand for maize, a substitute, also should fall (according to economic theory). With lower demand for maize, the price of maize also falls (which is what our analysis tells us, in this case by 7.8%). However, unlike the case of the direct effect of soybean trade on soybean prices, other effects dominated and accounted for nearly two-thirds of the fall of maize price between 1997 and 2001 (-13.2 percent—column 5). Although we do not know exactly what is included in the other effects, our knowledge of China's maize economy would suggest that at least part of the effect was due to either maize subsidies paid to producers in parts of China or storage policy that at times more supply onto the domestic market (both of which would lead to falling maize prices). During the 2001 to 2003 period, the negative effect on maize prices continues as soybean imports rise (-2.1 percent), although the effect is smaller, and really moderates only marginally the price rise of maize (row 15). Apparently policy and economic effects beyond those that affect soybean imports, such as China's aggressive maize export subsidies and the rising demand for maize as a feed for the nation's burgeoning livestock sector, are instrumental in raising prices far beyond the marginally negative cross-price effect induced by rising soybean imports.

Similar effects are found in the case of food grains, rice and wheat (Table 21, rows 7 to 12). As in the case of maize, regardless of whether rice or wheat prices were falling (between 1997 and 2001) or rising (between 2001 and 2003), rising soybeans has a negative effect on food grain prices. The mechanism of the effect is the same; falling import-induced soybean prices reduce the demand for other foods and lead to price falls. Despite the direction of the price effect, however, the magnitude of the effects are much weaker, almost certainly due to the fact that cross price effects are smaller since there is less substitutability between soybeans and food grains (than there is between soybeans and maize).

Increased soybean imports in both periods also lead to falling livestock prices, although the mechanism is somewhat different (Table 21, rows 16 to 21). In the case of livestock producers, rising soybean imports means that more meal is available on the market and the price of meal will fall. With lower prices of meal, producers expand supply and the price of livestock and related meat products fall. And, as expected, this is exactly what our results find. Between 1997 and 2001 the prices of pork and poultry fall (by 14.2 and 24.2 percent); likewise between 2001 and 2003 the price of pork continues to fall (18.0 percent), while that of poultry rise marginally (3.7 percent—columns 2 and 3). While producers welcome lower meal prices, as it helps increase profits and encourages the expansion of livestock production, it should be noted that other factors (such as the increased productivity of China's livestock industry and changing preferences for meats) also have important effects on livestock prices.

Summary—Price Effects. In summary, then, increased soybean trade has had both important and broad reaching effects on prices in China's food economy. Rising

imports have substantially reduced prices of soybeans and edible oils during both the entire study period, 1997 to 2003. For example, in the case of soybeans, without trade, the domestic price of soybeans would have risen dramatically to a level almost double its actual price. Rising soybean imports also have had effects on a broad range of commodities throughout the economy, including maize, the most direct competitor of soybeans, and livestock, one of the fastest growing sectors of China's agricultural economy. While important, in many cases, the effect of soybean trade policy is substantially less than other policies and economic forces affecting supply, demand and prices. More importantly, it should be noted that although much of the change in prices in the early period, 1997 to 2001, was a direct consequence of trade liberalization measures, since the soybean trading regime was largely liberalized by 2001, the changes since 2001 were largely responses to surging market demand for soybeans, a demand that increased trade was instrumental in meeting.

Impacts on Production and Consumption

Using CAPSIM, beyond price effects, we also can track the net effect of rising soybean imports on production and consumption. Production effects measure the responses of producers to all soybean-induced price changes, including both the direct effects of falling soybean prices and the more indirect changes in prices of other goods in the food economy due to cross-price and derived demand effects. Consumption effects are similar. In this section, we first examine the aggregate effects on producers, then we look at consumers, both rural and urban, and finally we produce a net overall effect on aggregate consumption expenditures. If the net effect is negative, this means that soybean imports have allowed consumers to enjoy rising welfare because they can, ceteris paribus, reduce expenditures because of falling soybean prices. In the next section, we examine disaggregated results on the production side by province and income group.

Production. The direct effects of rising soybean imports on production are straightforward and important (Table 22, rows 1 and 3). Although during the 1997 to 2001 and 2001 to 2003 periods there was little change in production (columns 2 and 3), this does not mean that rising soybean imports did not affect the behavior of producers. Indeed, as imports rose and soybean prices fell (as indicated in Table 21), producers, ceteris paribus, cut back substantially on their soybean production. According to our analysis, if prices had not have fallen, production of soybeans in China would have been 33 percent higher between 1997 and 2001 and 46.7 percent higher between 2001 and 2003 (column 4). From the findings, it is then obvious that other factors in the economy, outside of soybean imports, induced farmers to keep their areas and yields of soybeans at the pre-import levels.

Soybean imports also affected the producer of non-soybean oil seed producers (Table 22, rows 4 to 6). As soybeans prices fell, we saw from Table 21, that the price of oil and other oil seed crops fell. In response, our analysis shows that rapeseed and peanut producers cut back on their production, by 4.2 percent in the 1997-2001 period and by 5.0 percent in the 2001-2003 period. These dynamics show that as increased soybean

availability made soybean oil more widely available at a lower price, then the producer of other oil seed crops had to cut back on their production. However, this is the case under the assumption that all other things were held constant. In fact, during this time, the area sown to oil seed and yields rose (and led to higher production—columns 2 and 3) by 20.9 percent between 1997 and 2001 and by 2.1 percent between 2001 and 2003. Hence, it is clear the other factors in the economy more than offset the negative trade effect in both study periods (column 5). Maize, the other main competitor of soybeans, experienced an identical pattern (Table 22, rows 13 to 15). Increased soybean trade marginally led to lower maize production (ceteris paribus); at the same time other factors in the economy more than offset the soybean import effect and overall maize production rose during both sub-periods.

In contrast, rising soybean imports lead to increased livestock production (Table 22, rows 16 to 21). During both periods, as soybeans imports rise and prices fall (as documented in Table 21), livestock producers expanded production. Such an effect provides supports for economists and policy makers in China that are pushing for more relaxed imports on maize. Since the prices of livestock products in China already are below those on international markets, increased imports of feed grains (and soybeans) make China's livestock sector even more competitive and could help them expand livestock exports. It should be noted, however, that the forces of other factors, such as rising demand from higher incomes, also are exerting strong positive forces on livestock production.

In addition, rising soybean imports do not hurt the production of food grains (Table 22, rows 7 to 12). Although rising imports marginally put downward pressure on food grain prices (from demand side pressures), from the producer's point of view the direct fall of soybean prices is greater than the indirect fall in rice and wheat prices. Consequently, producers choose to expand the crops that, ceteris paribus, have the higher relative prices—in this case these are both rice and wheat. Hence, from this analysis, we see that rising soybean imports do not adversely affect the nation's production of food grains; and, in fact, help it marginally. Moreover, our analysis also lends support to those that believe other effects, not trade policy or rising soybean trade, has been behind the falling food grain production in recent years. As seen from columns 2,3 and 5, of the net fall in food grain production between 1997 and 2003, virtually all of it is due to non trade factors.

Consumption. While the effect of increased soybean trade had mixed effect on the production side, due to the fairly complex interactions of soybeans as a directly produced good, as a substitute or as an input, on the consumption side, both on in the rural and urban sector, the results are unambiguous (Tables 23 and 24). The import-induced direct, negative price effects for soybeans and the indirect negative price effects both lead to rising per capita consumption of all commodities. While some commodities rose over time (e.g., soybeans, edible oil and meat) and others fell (rice and wheat—mostly due to negative income elasticities in both rural and urban areas), rising soybean imports had a positive effect.

The biggest effects on per capita consumption, as might be expected given the large direct price effects, were on soybeans (directly consumed) and soybean oil. In the rural economy, per capita soybean consumption would have fallen if it had not been for lower prices due the rising soybean imports (Table 23, rows 1 to 3). The same is true for urban consumers (Table 24, rows 1 to 3). While per capita soybean oil consumption would not have fallen in either the rural or urban economies, the lower prices that resulted from increased imports in both study periods had large and important effects. In fact, in the urban economy, much of the remarkable rise in per capita soybean oil consumption (rising by nearly 3 percent—1.04 + 1.71—between 1997 and 2003) was due to the rising imports of soybean.

In fact, the large effect of imports on per capita soybean oil consumption is completely consistent with the casual observation made by those familiar with the China's food economy over the past decade. In the early and mid-1990s, the marketing of oil was quite backward, consumption was regional in nature and there were few national markets for soybean oil or any other edible oil products. Oil most often was purchased in an shopper's own container. Oil was sold only through special shops or in the corners of wet markets. There was no branding and mostly the only oil that was available were from local producers, which made it so that those in the South consumed peanut oil; those in Central China consumed rape oil; and those in the North consumed soybean oil (Fang and Beghin, 2000). Per capita consumption levels were far below those of other East Asian nations. Today, however, the edible oil market is radically different. Almost certainly stimulated by the large rise of availability and rising demand, soybean oil products are now available throughout the nation, there are high-quality brands in attractively packaged product lines and they are available in the most convenient of venues in large quantities. There is little doubt that such an expansion of a product could have happened without the rapid increase in soybeans imports.

A Summary of the Effects—Expenditures Analysis.

Although it is difficult to come up with one summary measure of the effect of increased soybean trade on China's economy, many economists would favor expenditure-based measures. In a sense, taken with the information contained in Table 21 to 24, our analysis shows for China as a whole—and for the rural and urban economies separately—the powerful effect of liberalizing soybean trade (during the 1997 to 2001 period) and allowing market forces to attract in large volumes of imports between 2001 and 2003. As seen in Table 21, prices of all major goods in the food economy, not just soybeans and soybean oil, fell as a result of increased trade. Moreover, as seen in Table 22, Although lower prices led to lower production of soybean and its direct competitors, other edible oilseeds and maize, it also stimulated production of food grains (marginally) and livestock activities. While certainly soybean producers would suffer falls in income, those in industries would only increase production if they were more profitable, so for many producers income (at least on part of their farming activities) would have risen. Finally, as seen in Tables 23 and 24, the consumption of all households rose. Since

economic theory tells us that rising consumption leads to higher utility, trade policy in this dimension led to higher welfare from the consumer point of view.

Considering all of these effects, our expenditure analysis confirms the positive effects of increased imports (Table 25). Despite the higher levels of consumption, our analysis demonstrates that households achieve the consumption levels with lower levels of expenditure. In fact, in the earlier period (1997 to 2001), because of lower prices rural consumers were able to achieve the higher levels of consumption on 15 yuan less expenditures (column 1, row 1)). Such a lower level of expenditure represents a reduction in food expenditures of 1.83 percent and a reduction in overall expenditures of 0.87 percent (rows 2 and 3). Moreover, despite the higher levels of consumption, even greater reductions in expenditures are achieved between 2001 and 2003 (rows 4 to 6). During the 1997 to 2003 period, rising imports allowed households to reduce their expenditures by 3.99, while consuming more.

Even greater impacts are experienced by the urban sector (Table 25, column 2), in part because there were no reductions in income due to falling production prices and so the rises in consumption levels (as seen in Table 24) were higher. Between 1997 and 2001, to buy a larger consumption bundle, urban consumers needed 36.40 yuan less (Talbe 25, column 2, row 1). This represented 1.81 per cent of food expenditures and 0.69 of the entire expenditure outlay (rows 2 and 3). The savings rose nearly proportionately when extending the study period by 2 years from 1997-2001 to 1997-2003 (rows 4 to 6). While many other factors have been helping increase the standard of living of China's rural and urban populations in the recent decade, clearly our results show how the increased trade of soybeans has contributed significantly.

Impact of Soybean Trade on Production—Disaggregated Analysis

In the preceding section, our analysis built a strong case for the idea that the liberalization of soybean trade and the rise in the import of soybeans has had a positive impact on the economy. Prices have fallen, many producers (especially livestock producers) have gained and all consumers, both rural and urban, have benefited. The only weakness of this analysis is raised in the first part of Section VI of this report: although households benefit, in general, the distribution of households across the economy that are engaged in soybean production is uneven. It is true that consumers and livestock producers benefit from lower trade-induced soybean prices. It also is true that food grain producers do not reduce their production when prices fall from increased imports. But, soybean producers do. Hence, the one remaining issue that we need to address is which producers get hurt, and by how much. If we know this, then policy makers that may favor trade liberalization and increased trade, in general, but who are concerned with the effect of increased trade liberalization on certain subsets of household, can use the information to devise measures to mitigate adverse effects on sub-groups of producers in the economy.

Given this goal, it is reasonable to focus our attention of the main soybean producing provinces in China. We also will want to disaggregate the analysis by income group since those with lower income groups, as seen, are both more specialized in agriculture (and soybeans) and have fewer alternative ways (such as, drawing on own savings) to insure against price falls or to invest in alternative production activities. The CAPSIM model using disaggregated data described in Section V is ideal for such an analysis.

To carry out the analysis, we follow the aggregate analysis in some ways and then adjust it in others. First, we present the actual levels of production in 1997 and 2003. As before, we know that one part of the change is due to increased soybean imports and another part of the change is due to other factors. We then use CAPSIM to simulate the scenario without trade liberalization of soybeans and without any increase in soybean trade. The difference is then presented as the impact on production (measured in kilograms of soybean production) of the increase in trade. In breaking with the analysis from above, we not only run our results at the aggregate, we also disaggregate by province and by four income categories—the poorest of the poor (PG1); the poor (PG2); the average household; and the richest decile. These are all presented in Table 26. In Table 27 we then try to estimate how large the magnitude it is by comparing the size of the production effect with household income and the value of agricultural output.

The analysis shows that, in fact, there are fairly small negative effects on agricultural production, in general for the nation (Table 26, rows 1 to 4). For the average household, the reduction in production is only 92 kilograms. This was calculated by comparing the actual level of production in 2003 with the level that would have been produced had there been no change in soybean trade from the 1997 level. Without trade, soybean prices would have risen and producers would have produced 93 kilograms more. The levels of production falls due to increased soybean train in the poorest areas (85 kilograms) and richest areas (131 kilograms) are remarkably the same in absolute value terms and the total reduction in physical terms seems relatively small. When examining the value of the output change (which is DQ*P + DP*Q), we find that indeed as a function of average household income and value of production the impact is relatively small (Table 27, rows 1 to 4). For the average household (and for the richest ones), the share of total chance in soybean output value is only 2.1 percent (1.1 percent) of household income and only 2.8 percent (2.4 percent) of total agricultural value. Although the share of total change in soybean output value is higher in relative terms for the poorest of the poor (13.5% of household income and 4.2 percent agricultural output value), when measuring the a better measure of the real effect (that is the change in profits, which is estimated to be DP*Q), the share of the impact on household income is 8 percent and is only 3 percent of total agricultural value. Clearly, however, for the poor this is not a small amount, so for those soybean growing households, there was a net fall in income. However, from another point of view it should be noted that the absolute reduction is fairly small, only about 150 yuan per household. Hence, if leaders were concerned about trying to compensate farmers, especially poor ones for whom the trade effect accounts for a significant part of income, any transfer scheme that would provide 150 yuan in compensation would more than offset the loss. It should be noted that is

amount is a conservative figure, since it should be remembered that as long as the household is also a net consumer of soybeans, soybean oil or if it raises livestock, the additional earnings from these activities and reduced expenditures that are needed to keep consumption at the same level should at least offset part of the fall of production income. In Huang, Li and Rozelle (2003), it is suggested that any policy that began to pay even a part of the tuition fees of farm households in poor areas would more than offset the negative effect on soybean producing households.

Although in general the effects are small (this was the same conclusion that we came to in the section using the aggregate CAPSIM analysis), when we examine province by province, it becomes evident that the impact in some provinces can be fairly large. This, in some sense, should be expected given the unequal nature of the distribution of soybean production in China. Above all, the concentration of soybean production in Heilongjiang means that farmers in that province will be the major losers. In fact, since more than one-third of production is in Heilongjiang, farmers in that province account for by far the largest effect (Table 26, rows 13 to 16). The average and above average farmers in Heilongjiang reduce production by 1598 to 3248 kilograms. The poorest farmers reduce production by 729 kilograms. In relative terms (measured as the change in output value as a fraction of household income), the average Heilongjiang farmer's household income fall 42.3 percent (Table 27, rows 10 to 12); when measured as profits, however, the value falls only by about 15 to 20 percent (not shown). Clearly such large income effects are noteworthy. Those in poor areas are even bigger, although in 2003 it is ever harder to measure because incomes were so low due bad weather. The impact of production shortfalls on households is higher, the greater is soybean's share of agricultural income. In other words, the effects in Jilin, Inner Mongolia and Anhui are large, especially for the poor in these areas. If farmers in these areas want to be fully paid back for their losses, a large subsidy or investment program would be needed.

Therefore, according to the disaggregated analysis, we can make the following summary and conclusions. For most households in China, the average effect on production is small, only about 90 kilograms or the equivalent of 1.3 percent of average household income. In poorer areas, in general, although the relative effect (that is as a fraction of household income) is larger, the total absolute amount of the impact is still small (only about 73 to 85 kilograms). But although the problem is not that bad in either the average or poor areas in general, the problem is much worse in the important soybean producing provinces. In fact, it is almost fair to say that ultimately the problem lies in several provinces, Heilongjiang, Jilin, Inner Mongolia and Anhui. Since the nation in general wins, and wins significantly, leaders in these provinces need to either make sure that their farmers are in some way compensated for the losses that they have suffered. Or, a program of investment is needed to help those that rely on soybeans, but that want to get out of production, switch to another farming enterprise or move off the farm all together.

Conclusions

In this report we have documented one of the major events of the past 10 years in China's agricultural economy: the nearly complete liberalization of trade for a major commodity, soybean. The purpose of the report is to analyze the effect that the liberalization has had on China's producer, consumers and other users of soybeans. In the paper we find that because the nation's domestic soybeans markets function so well that when imports increase producers and consumers across China will be affected. We then show how while the first surge of trade happened as a direct consequence of China's trade liberalization policies in the late 1990s, and so trade liberalization can be directly linked to the price impacts of the first increase in imports. By 2001, over 10 million tons of soybeans had been imported. However, most of the liberalization was done before China's accession to the WTO, and therefore, when the next surge of soybean imports occurred between 2001 and 2003, reaching over 20 million tons, it must be assumed that market forces provided the impetus for traders.

In assessing the impacts, the report first notes that despite the rapid rise in soybean imports, many of the fundamentals did not change. First, domestic production did not change much. The domestic price of soybeans actually rose from 2001 to 2003. Moreover, the price trends of soybeans paralleled contours of the rice, wheat and maize prices. In short, although traders were importing on average more than 15 million tons per year since 2000, there appeared to be little change. Of course, the main reason for this finding is that there were many things changing during the past decade and so a complex, multivariate analysis is needed to isolate the trade effects from other events in the economy.

When using our CAPSIM modeling framework to measure the effect of increased soybean trade, we actually find a nearly win-win-win scenario. First, as imports rise, the effect of the increased availability (given all other factors constant) reduced the price of soybeans and other crops and commodities (including soybean and other edible oils), inducing consumers in all parts of the economy, both urban and rural, to increase their demand. Second, as prices fall, the profitability of livestock production also rises, and livestock producers expand production. Finally, with the exception of soybeans and other close substitutes, the production of major food grains are shown not to fall, since the relative price of these grains rise. In other words, there is really no direct (or large) effect on the reduction of crops that the national government is concerned about in terms of national food security. In undertaking our expenditure analysis we find that on average consumers gain by being able to reduce their expenditures by up to three percent while at the same time increasing their consumption.

The main set of producers that get hurt is the relatively small number of poor, soybean farmers. The average farmer and relatively rich farmers do suffer, on average, but the impact of soybean trade increases is only around 1 percent of income. This level of income is far lower than the over gain from reduced expenditures, implying a net gain for most in the economy. The main problem is for small, poor farmers. Although the absolute loss for these farmers is less than the average farmer, because their incomes are

so low, the negative effect of increased soybean trade is a relatively large share of their income. In addition, farmers, both poor and not-poor, in a small subset of provinces (e.g., Heilongjiang, Jilin, Inner Mongolia and Anhi) also appear to be vulnerable. In these provinces, the effect of increased soybean trade is largest, sometimes more than 10 to 20 percent of income (or even higher in areas that suffered production shocks). Hence, we are able to precisely identify the province and income category of soybean farmers that are "at risk." By doing so, it should be possible to devise subsidy, payment schemes, target loan programs or fee/tax reductions to help the farmers adjust to the new prices. Although this policy is fair, not very expensive and is easily implementable, it should be noted that in some sense the loss that we are talking about is mostly a "paper" loss. It needs to be recalled that because of other factors in the economy (such as high demand for edible oil and livestock commodities), most farmers have not actually experienced the drop in price. Rather there were forces that in the absence of increased trade would have forced up China's domestic price. As it has been, as these forces put upward pressure on prices, the increased trade offset it. The net result has been a soybean economy that is characterized by large imports and price trends that are similar to other prices trends in the economy with commodities that have not experienced large imports. The presence of imports, however, during late 2003 and early 2004 made it so the pressures that finally succeeded in pushing up the prices of other commodities, did not affect soybeans as much. Hence, trade has played a moderating role at a time when leaders were worried about agricultural prices moving up too much.

Given this, it is clear that China's soybean policy has benefited most people in China. It has helped fulfill rapidly rising demand in areas that are key to the long run growth the food economy: livestock and edible oil. Although it has had a negative effect on a small number of producers, other price pressures have covered up the effects. We believe that should China's leaders want to compensate those hurt by increasing imports, it will be relatively easy given their geographic and socio-economic concentration. Hence, in the end almost everyone wins.

Appendix A
A Review of Agriculture and
China's Domestic and Exchange Rate Policies during the Reform Era

In this appendix, as background for the reader of this report that is unfamiliar with China's reform experience, we present a brief overview of the policies that have affected the agricultural sector.

A. Institutional Reform

China's rural economic reform, first initiated in 1979, was founded on the household responsibility system (HRS). The HRS reforms dismantled the communes and contracted agricultural land to households, mostly on the basis of family size and number of people in the household's labor force. Although the control and income rights after HRS belonged to individuals, the ownership of land remained collective.

The HRS reforms were completed in 1984. At its conclusion, on average, average farm size in terms of cultivated land was about 0.6 hectare. Because of regional variations in land endowments, however, the size of farms vary among regions, ranging from more than 1 hectare in the Northeast and nearly 1 hectare in North China to about 0.5 hectare in Southwest and 0.2 to 0.3 hectare in South China. Because the multiple cropping index (the number of crop seasons planted per year on a single plot of land) increases from 1 (one crop per year) in the Northeast to 2 to 3 crops in South China, variations of sown area among China's regions are less than those of farm size.

China's land rights are complicated and changing. The first term of the land contract was stipulated to for 15 years. During this time, while the ownership of the land stayed with the collective, income and controls rights were given to farmers. The effects of such a land policy on the equitable distribution of land to farmers and its effect on food security and poverty alleviation have been obvious and well documented. The land policy also has contributed greatly to efficiency. Specifically, the income and control rights contributed significantly to the agricultural production and productivity growth in the early 1980s. Huang, Rosegrant and Rozelle (1996) demonstrate that agricultural output and yields grew as a direct result of decollectivization.

Although local leaders were supposed to have given farmers land for 15 years in the early 1980s and 30 years starting in the last 1990s, collective ownership of land has resulted in frequented reallocation of village land. Many people have been concerned that such moves by local leaders could result in insecure tenure and negative effects on investment. Many authors have shown, however, that in fact there has been little affect on either short- or long-run land productivity. There is still concern by officials that collective ownership and weak alienation and transfer rights could have other effects, such as impacts on migration and rural credit. As a result, China has recently passed a new land law, the Rural Land Contract Law (effective after March 1, 2003), which seeks to greatly increase tenure security.

Above all, the government is now searching for a mechanism that permits those that stay in farming to be able to gain access additional cultivated land and increase their incomes and competitiveness. Even without much legal protection, over the past decade, researchers are finding increasingly more land in China is rented in and out. In order to accelerate this process, the new Rural Land Contract Law further clarifies the rights for transfer and exchange of contracted land. The new legislation also allows family members to inherit the land during the contracted period. The goal of this new set of policies is to encourage farmers to use their land more efficiently and to increase their farm size.

B. Input Price and Marketing Policies

The reforms in fertilizer, seed and other input markets follow China's gradual reform strategy. In the first stage, reformers only implemented measures that provided incentives to sets of individuals and for less important commodities and did not alter the institutional structure that was set up to provide abundant and inexpensive food to the urban economy. Decollectivization and administrative output price hikes improved incentives to farmers. Leaders, who remained responsible for meeting the same ambitious food sector goals, did little to the rest of the rural economy in the early 1980s, leaving machinery, fertilizer and the seed systems virtually unchanged, and heavily planned. Since the middle 1980s, the market liberalization has been gradually implemented, starting with machinery, pesticide, and farm films. The meaningful liberalization of strategically important inputs, such as fertilizer, occurred only in the early 1990s. The reform of the seed industry did not begin until the late 1990s.

Fertilizer. In most years of 1980s, the Agricultural Inputs Corporations (AICs), state-owned enterprises with local trade and retail sales monopolies, rationed subsidized fertilizer and controlled the flow of fertilizer into and out of each jurisdiction in almost the same way they had in the 1970s. In the early years of the reforms, however, poorly developed markets often made government sales agencies the only viable marketing channel for agricultural inputs, and it is doubtful that if the input markets would have emerged quickly or effectively even if the sector had been liberalized. The state-owned trading arm of the AIC handled rationed and subsidized fertilizer before fertilizer markets were liberalized. Leaders kept the nominal price of subsidized fertilizer constant for the entire 1970s and 1980s, and the state-run system dominated fertilizer markets even when trade was allowed. For example, urea retail prices were about 450 to 500 yuan per ton between 1970 and 1985. In the real terms, however, urea prices declined by 50 percent between 1970 and 1990.

Like the rest of the economy, however, reform gradually spread to input markets (Ye and Rozelle, 1994). Fiscal deterioration and commercialization of the state-owned fertilizer industry started in the late 1980s and induced policy makers to liberalize fertilizer markets. While farmers lost access to the inexpensive fertilizer from the state, when officials reduced the quantity of subsidized fertilizer, removed price controls, and formally allowed private individuals to sell fertilizer markets opened new opportunities for markets to develop.

One of the most important policy reforms was the fundamental shift in incentives provided to the state-owned fertilizer trading and retailing enterprises in the late 1980s and the early 1990s. Government officials offered AIC managers and employees use of the system's trucks and warehouses and a share of trading profits in consideration for keeping workers on the payroll, supporting retirees and carrying out a limited number of policy duties, such as keeping their local input retail outlets open. Following a similar pattern as grain marketing reform, a two-tiered price system was implemented. Fertilizer became available at in-quota and above-quota prices. Above-quota prices of fertilizer were about twice as much as in-quota ones. For example, urea prices during the transition period of the late 1980s and early 1990s became available at a low price from the AIC if individuals had access to fertilizer coupons; above quota fertilizer was also increasingly available from private traders or from agents from the commercialized branches of local AICs. The amount of fertilizers that farmers could purchase at in-quota prices depended on the amount of grain that farmers sold to government grain procurement agency.

Although at first, there were few traders in the late 1980s, gradually liberalization of fertilizer market seemed to work well. Private traders multiplied quickly. Fertilizer, to an extent never before, became available to farmers, even those in poorer areas (Stone, 1993). Even the presence

of the government in the fertilizer market, which could have dampened the effectiveness of markets to convey demand-driven price signals, did not slow down liberalization. Competition in the sales of out-of-plan fertilizer helped AIC employees learn about operating out of the plan and develop procurement and sales networks. Soon, AIC-based companies not only were competing against private individuals, they also competed with each other.

In the early 1990s, two key decisions were perhaps the most far-reaching in their impacts on encouraging the emergence of competitive fertilizer markets that initially had been less developed than grain markets: private trading was authorized and leaders issued a clear central policy document allowing other state-agencies to join in the commercial fertilizer trade. Hence, after the implementation of the policies, with surprisingly little disruption, fertilizer markets supplanted planned distribution networks. Rising competition raised the efficiency of markets, made traders more responsive to consumer demands and reduced transactions costs. Fertilizer markets, like those for grain, rapidly saw the entrance of a large number of private firms and fertilizer availability became less of a concern for farmers.

The only perceived disruption caused by the reforms did not occur until the mid-1990s when the country experienced an imbalance in the supply and demand for food and fertilizer. Fertilizer prices doubled between 1993 and 1996. In part, this was a result of China's phasing out their in-quota fertilizer program. In part, subsidies to production units in China were eliminated and factory managers had to raise prices for the fertilizer that was being sold on the market. During this time, local, regional and national policy makers asked the quasi-commercialized traders and retailers to reduce their prices. The leadership appealed to the commercialized AIC employees to refrain from raising prices on the distribution of goods that fell under their formal areas of government-designated duty. However, since such policies reduced profit margins of the commercial operations, in most cases policy directives were ignored. Attempts to keep locally produced fertilizers inside a region also met with only partial success as the already fluid markets made it impossible to enforce marketing restrictions. By the late 1990s, the government once again officially encouraged fertilizer market integration. After liberalization, fertilizer prices stabilized and declined. At first this was due to rising availability through domestic production and imports. Later imports levelled off and most of the rise in supply of all but potash fertilizers fertilizers came from China's own producers. As a sign of the sectors success in increasing supply, the retail price of urea declined from 2209 yuan/ton in 1996 (measured in 2001 constant prices) to 1361 yuan/ton in 2001.

Seeds. Efforts to build a national seed system began in the 1950s shortly after the Communist regime took control. Following several reorganizations, China's seed production and distribution system now is the largest in the world. The state seed supply organization (part of them have been commercialized recently) currently consists of approximately 2,200 county seed companies, 500 prefectural seed companies, 30 provincial seed companies, the National China Seed Corporation, and hundreds of seed companies owned by the public plant breeding and other agricultural research institutes and universities. The sizes of seed companies have increased over time and vary across regions. On average, provincial seed companies employ 30 staff members and county seed companies employ about 20, both up since the mid-1980s.

Over the past several decades, Ministry of Agricultural officials have developed a number of rules and regulatory institutions to administer the seed industry. In contrast to the common practices in many other countries, policy makers limited ownership of seed companies that produced and distributed hybrid rice and maize seeds to state-owned enterprises until the late 1990s. According to the policy, the regulations were needed to ensure high seed quality. As part of a reform package created in part due to the financial stress that affected many public

agricultural research units, China has allowed research institutes and universities to distribute the hybrid varieties that produce. In recent years, private firms have been allowed to do the same. According to the policy, seed companies attached to the breeding stations are only supposed to sell material that was bred in their own breeding programs.

Meaningful reform of seed industry and related legislation has begun later than in almost any other sub-sector, beginning only after the mid 1990s. Recently, however, the laws that govern the seed industry have been changed in such a way that the seed industry in general is now being commercialized by encouraging entry of new domestic firms. The law also has allowed a trickle of foreign investment into the seed industry. In 1997 China passed a Plant Variety Protection Act and signed the UPOV agreement (an agreement for the *Union Internationale pour la Protection des Obtentions Vegetales* [or an agreement for the International Union for the Protection of New Plant Varieties]). A few large Chinese firms have been allowed to raise money by selling some of their shares on the stock market. The latest new seed law of 2000 defines the role of private sector. It makes it clear that any investor that meets the minimum requirement for capital investment and facilities can sell seed. Companies are now allowed to sell all crop seeds that were bred by public institutes. Such legislation has begun to erode the local monopolies that county seed companies have long held. Companies that meet certain requirements can get permits to sell seed in all of the counties of a province or in all provinces in the country instead of having to apply to each county and province separately.

While significant reform has taken place, numerous constraints still continue to limit the development of China's seed industry. Thousands of small, local seed companies dominate the industry. Many are publicly owned. Although within a region markets often are competitive, in some cases local markets are isolated by a number of measures adopted by local governments. In many cases, only small local firms are able to participate. While many of the firms produce, sell and distribute a number of high quality seeds, the products and services that they provide vary across regions. Certainly by not allowing farmers access to a larger selection of new varieties hurts efficiency and by limiting the market size of larger firms, research and development also inevitably suffers. As a consequence, the system is likely to result in the slow spread of new major varieties across large regions. The current seed system also appears to affect the rights and ability of breeders to profit from the development and sale of their varieties. Seed regulations require that the breeder hand over parent lines and all breeding information at the start of the registration process. With the information in the public domain, and the foundation seed in the hands of seed companies, breeding institutes earn almost no revenue from their varieties over the long run, a factor that has reduced the incentives of breeders to search for new breakthroughs.

The lack of separation of policy functions and commercial activities is one of the main problems facing seed industry managers who, under complete liberalization might otherwise take a number of positive steps to make their firms more efficient and service-oriented. Although prices have risen recently, in international terms they are still low and many international observers believe this is a major constraint to expansion of China's seed industry. Prices of hybrid rice and maize seed in China rank among the lowest in the world. China's seed companies charge rates similar only to seed agencies in Sub-Saharan Africa, and only 30 to 50 percent of the price charged in other parts of Asia, Latin America and other developing countries. Judging by the prevailing level of seed prices, the government appears to have met its goal of keeping crop seed affordable for farmers, particular for poor farmers, and has only begun the process of making seed companies more profitable. However, it is by no means clear that the current low level of seed prices is desirable. Low seed prices obviously benefit farmers, but they also have several disadvantages. In an era in which research institutes and seed companies are being asked to help support themselves through commercial sales of their products, low seed prices undermine the

ability to generate increased revenues. Denied opportunities to earn profits, research institutes and seed companies have less incentive to generate new products and/or improve their services.

Lack of competition within many counties and continuing subsidies for local seed companies may be at the root of the reform problems for the seed sector. Weak plant breeder rights have kept the research institutes from becoming serious competitors. Without fully commercialized county seed companies and without reducing administrative intervention in local seed markets, firms do not have much of an incentive to increase services to farmers and will not search hard for new innovations and cost-saving techniques. Even if entry restrictions were relaxed, however, high current levels of support and priority access to new products and local distribution networks for state companies may make it impossible for new entrants to survive and expand. Serious reform must address both sides of this issue: both encouraging competition and ensuring that new firms can compete on even terms.

C. Commodity Price and Marketing Policies

Grains marketing policies. Price and market reforms are key components of China's transition strategy to shift from a socialist to a market-oriented economy. The price and market reforms initiated in the late 1970s were aimed at raising farm level procurement prices and gradually liberalizing the market. These reforms included gradual increases in the 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.

Although most of the many liberalization efforts have been partial, in most cases they have had a significant impact on productivity and crop selection decisions at the household and national levels. The shift from the collective and household responsibility system also raised the price responsiveness of farm-households. While few works document the effect of market reform, Lin (1992) shows that there was a small, positive impact in the early 1980s.

As the right to private trading was extended to include surplus output of all categories of agricultural products after contractual obligations to the state were fulfilled, the foundations of the state marketing system began to be undermined. After a record growth in grain production in 1984 and 1985, a second stage of price and market reforms was announced in 1985 aimed at radically limiting the scope of government price and market interventions and further enlarging the role of market allocation. Other than for rice, wheat, maize and cotton, the intention was to gradually eliminate planned procurement of agricultural products; government commercial departments could only continue to buy and sell at the market. For grain, incentives were introduced through the reduction of the volume of the quota and increase in procurement prices. Even for grain, after the share of grain compulsory quota procurement in grain production reached 29% in 1984, it reduced to 18% in 1985 and 13% in 1990. While the share of negotiated procurement at market price increased from 3% only in 1985 to 6% in 1985 and 12% in 1990.

Because of the sharp drop in the growth rate of grain output and rise in food prices in the late 1980s, the pace of marketing reform stalled. Mandatory procurement of rice, wheat, maize, soybean, oil crops and cotton continued. To provide incentives for farmers to raise productivity and to encourage sales to the government, quota procurement prices were raised over time. The increase in the nominal agricultural procurement price, however, was lower than the inflation rate, which led to a decline in the real grain price.

As grain production and prices stabilized in the early 1990s, however, another attempt was made to abolish the grain ration system. Urban officials discontinued sales at ration prices to consumers in early 1993. For a year and a half, the liberalization move succeeded. Then, while it appeared that both the state grain distribution and procurement systems had been successfully liberalized, food prices rose sharply; other price in the economy also rose. Some people blamed the nation's inflation on the rises in food prices. As a result, the state compulsory quota system was again re-imposed in most parts of China in 1995, but at a lower procurement level. The share of grain compulsory quota procurement in total production kept at only 11% in 1995-97.

Since the middle 1990s, several new policies were implemented. Immediately after the price rises in the middle 1990s, China started the provincial governor's "Rice Bag" responsibility system.[9] The policy was designed to strengthen food security and grain markets by making provincial governors and governments responsible for balancing the supply and demand of cereals in their provinces and for stabilizing local food markets and prices. Policies under the system included re-imposing grain rationing to poor consumers, investing in production bases inside the province and attempting to keep grain from being shipped outside of the province. If implemented, this policy may have reduced short-run agricultural price fluctuations, however, it would not have been without costs. It has been widely believed that the policy may have adverse impact on the efficiency of resource allocation, diversification of agricultural production, and farmer's incomes. Moreover, a great number of efforts to restrict the flow of grain were not successful. Market flows continued as the share of total government procurement (both quota and negotiated procurement) in domestic production reduced from 26% in 1994 to 22% in 1996, being driven by the profits that traders could earn by shipping grain from low to high priced areas.

With three record levels of grain production in China in the late 1990s, and almost zero or negative inflation since 1997, rising grain stocks and declining food prices showed the economy had bounced back. However, in some sense, the government's policies were a victim of their own success. With prices falling sharply, leaders worried of a repeat of the mid 1990s. Instead of proceeding with market reform, leaders actually opted to try to exercise greater control over grain prices by price protection policy..

In fact, leaders in the late 1990s attempted to curb market forces more than in earlier retrenchments but a complete different measure. Market intervention policy shifted from taxing grain producers through lower government quota procurement price (lower than market price) to prevent grain price falling through implementation of grain protection price (higher than market price). To reduce the financial burden of protection price policy, in 1998 the central government initiated a controversial policy change prohibiting individuals and private companies from procuring grain from farmers.[10] In contrast to past policies, grain quota procurement prices were first time set at a level more than market prices, which meant a transfer in favor of those farmers able to sell at that price. Leader expected that they could monopolize grain markets through the commercial arms of grain bureau, and that the grain bureau would be able to sell the procured grain at an even higher in the market and meet the nation's goal of raising farmer income. If the state could have exercised monopoly power in grain markets, it is possible that they could have implemented the price supports while enabling the state grain companies (i.e., the commercial arms of grain bureau) to earn a profit and while reducing the government's financial burden of maintaining the state-run grain procurement

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[9] "Rice" in China, sometime, meat staple food. "Rice Bag" here includes rice, wheat, maize and soybean.
[10] Farmers were supposed to deal solely with the commercial arm of grain bureaus and the grain reserve system--although traders were allowed to operate in wholesale and retail markets.

and marketing system. The loser under this policy would have been the consumer who would have had to pay a higher price for grain.

The win-win (from the government's point of view) policies, however, did not work, primarily because the government could not suppress market activities of traders and the commercialized grain system employees. While the above market prices were offered to farmers in some years, cash strapped grain bureaus could not procure all of the grain that farmers wanted to sell. Grain production increased, but since grain bureaus were trying to sell grain to urban and commercial users at above market prices, they had few takers. Unable to stop the activities of millions of private grain traders, urban users continued to buy from their original channels at market set prices. Not surprisingly, stocks started to accumulate, the real price in the market fell even further, and the commercialized grain bureaus that had been forced to buy grain at high prices, now had huge stocks of grain that was worth less than they had bought it for and their debts rose greater than ever.

Perhaps most surprisingly through these recurring cycles of reform and retrench, commodity markets have steadily strengthened in rural China. The proportion of retail commodity sales sold at market prices has kept rising. According to Lardy (2001), the share of agricultural goods sold through the market was just 6 percent in 1978. By 1995 it had risen to 79 percent and by 1999 to 83 percent. Transaction costs have fallen while the degree of integration has risen. As seen, markets also are robust. Despite attempts to intervene, the government has increasingly been unable to halt grain flows in their attempts to implement local price controls.

However, the cost of good markets is that China's time-tested methods of executing grain policies no longer works. By 2000, the leaders found the retrenchment policies started in 1998 had reached few, if any, of the originally intended policy objectives. The incomes of farmers from agriculture were falling as market prices declined. The financial position of grain bureaus continued to deteriorate. And finally, the government's fiscal burden rose to historic highs as stock accumulated. In 1998, the government's grain marketing subsidies in the form of payments to farmers reached nearly 100 billion yuan. Although the program was scaled back, in 1999 and 2000 subsidies remained at a level between 60 to 80 billion yuan annually. Yielding once again to market forces, another round of liberalization was launched in 2000. Leaders decided to eliminate the grain procurement quotas in grain deficit regions (such as, in the coastal provinces of Zhejiang, Jiangsu and Shandong). By 2001, the liberalization efforts spread to inland, surplus regions.

In addition to the development of China's grain markets, the gradual, albeit stop and go, marketing reforms have also slowly reduced the tax burdens of grain farmers. Huang and Rozelle (2003) shows that grain farmers, in general, have been taxed heavily by grain procurement policy. Importantly, however, with marketing reform, the degree of taxation has been declining significantly over time. Indeed, although historically, China's tax on farmers through the procurement system has been high, since 2000 with the elimination of procurement quota and the initiation of the payment of subsidies to farmers and traders, we may be witnessing the beginning of a regime shift from taxation to subsidization.

Livestock and feed marketing. Livestock was one of a few major agricultural commodities that had been mostly liberalized since the middle 1980s. Currently, market prices of livestock are completely based on domestic demand and supply as well as a limit amount of trade. Pork is the major meat product, accounting for about two third of total meat supply in China. Household producers dominate the livestock industry. Most of households with hogs raise them in traditional ways in their household's backyard. Nearly two-thirds raised less than three hogs per year (RERC, 1997). In 2000, among all hogs raised in China, household backyard production accounted for nearly 80 percent; the rest is produced by farm households that specialize in livestock production

(15 percent) and intensive, large-scale commercial producers (around 5 percent--CCAP, 2002). Households raise backyard hogs with a variety of feed mixes that include maize, sweet potato, other low quality food and feed grains, meal and waste products from home produced crops (e.g., potato vines).

With the rise of specialized households and the evolution of backyard hog raising in many areas, the way farmers feed livestock has changed over time. Most prominently, the role of maize as a feed has increased over time. It accounted for more than 75 percent of feed in the late 1990s and reached 78 percent in 2000. Currently, marketing and pricing policies of maize as a feed are the same as those of maize used as food, which has been fully discussed (i.e., it is being increasingly liberalized).

While policies historically have affected maize, China's most important feed, there has been only minimal interference in the other feed crops. Sweet potato and soybean meal are the second and third important sources of feed in China's feed sector. Grain policy has virtually ignored sweet potato and soybean. About the only type of direct policy influence has been due to the effect of the marketing and pricing policies for soybean meal. Since soybean in China is categorized as grain, during the 1980s and 1990s when dealing with soybean meal in international trade issues, it was treated as a grain crop and subject to tight control by the government. However, in the late 1990s, restrictions of soybean meal imports were relaxed earlier than those for grain. As a result, there have been times when livestock producers would bring in large quantities of soybean meal, perhaps at levels beyond what they would have done had all markets been liberalized. More recently large volumes of soybeans have come in to supply the large, modern soybean oil plants in the coastal regions.

The role of sweet potato in China's economy also has been changing rapidly on both the supply and demand sides. Sweet potato is the fourth major staple crop and the second largest feed grain in China. While production has remained fairly stable at 20 to 23 mmts annually since the 1970s, sweet potato area has declined significantly. Hence, yield growth of sweet potato has generally been lower than maize (with the exception of the past several years).

On the demand side, the utilization of sweet potato also has changed rapidly. As a food staple, like maize, it has also declined. The proportion of sweet potato used as feed and for food processing surpassed the use for direct food consumption after the mid 1980s. Between the 1980s and the end of the 19990s, the use for food fell from about 50 percent of total production to less than 15 percent. In contrast, the use of sweet potato for feed and industrial uses grew significantly. By the late 1990s, feed use accounted for more than 40 percent and processing demand accounted for one third of total sweet potato production. Among all feeds in China, sweet potato contributed to about 7 percent in 2000.

D. Fiscal and Financial Investment Policy

To have a better understanding of government policy bias among sectors, we need to look at both the state's agricultural product procurement policy (implicit tax) and investment and tax policies. Appendix Table A.1 shows that government fiscal expenditures on agriculture have been consistently higher than the fiscal revenues from agricultural taxes and other fees collected from agriculture. However, the fiscal revenue from agriculture based on explicit tax and fees is only small portion of the capital contribution of agriculture to industry and to the urban sector. It is also interesting to note that rural enterprise development has contributed significant fiscal income for the government and has led to a net capital outflow from rural to urban areas since the early 1980s.

When taken together, a significant capital outflow from agriculture to industry occurred in the last two decades through financial system, particularly through Rural Credit Cooperatives. A much higher value of capital outflow from rural to urban than agriculture to industry clearly shows that capital accumulated from agriculture not only supports industrialization in the urban sector but also provides notable financial resources for the successful development of rural industry. After accounting for the implicit agricultural taxes that is levied on farmers through the government's procurement system, China extracted a total value of about 1289 billion yuan (at 2000 price) of capital from the agricultural sector for use in the nation's industrialization between 1980 and 2000. About 2297 billion yuan flowed from the rural sector for the urban economy during the same period (Appendix Table A.1). The shifting of capital from agriculture to industry and that from the rural sector to the urban sector has accelerated since the 1980s.

E. Rural Credit

Despite the fact that the movement of capital from agriculture to industry is to be expected, mobilizing and efficiently using available financial resources in rural areas is important for achieving high rates of economic growth, especially in rural areas of developing countries where such funds typically are in short supply. Evidence is strong that greater financial intermediation accompanies higher incomes. As economies grow, financial institutions often play an important role in directing resources to their most productive use. However, governments in developing countries often use state control of the banking system to pursue policy goals not always consistent with efficient intermediation. The fear is that little funds are available for farmers and the activities that they want to pursue.

Concern over China's rural financial institutions stems from several factors. Despite a number of important financial sector reforms, financial markets have been liberalized more slowly than most sectors. Regulated interest rates imply credit rationing, making private entrepreneurs and farmers, especially the poor, likely to have difficulty gaining credit access. If rural enterprises have had difficulty gaining access to bank credit, farmers have had even more. Even without interest rate deregulation, small farmers are often rationed out of formal credit markets. Field researchers observe that in many poor villages, local credit cooperatives have stopped lending to farmers; although in the past couple of years, the government has made an effort to expand lending. Between 1988 and 1995, farmers reduced credit financing for key activities, such as fertilizer and livestock purchases (Appendix Table A.2).

Without access to formal credit, Park, Brandt, and Giles (2001) have shown how informal credit has taken the place of formal credit in agriculture. In China most informal credit takes the form of informal loans to farmers from relatives and friends. Most loans are no interest, but there is often an implicit obligation to loan back to the household at zero interest if there is a need in the future. Interestingly, although credit does constrain the plans of many households to invest in businesses and large consumption goods (such as housing), there is little evidence that farmers – even those in poor areas -- are constrained in their day to day agricultural production activities.

F. Exchange Rate Policy

Macroeconomic policies can have a significant influence on the overall incentives of producers in agriculture (Nyberg and Rozelle, 1999). One of the main mechanisms by which that influence is created is through the nation's exchange rate policy. Exchange rates can have great implications for trade. Other external trade policies, e.g., the management of flows across the border, can also affect trade. China's policies governing the nation's external economy have played a highly

influential role in shaping the growth and structure of agriculture production and trade for many decades. During the reform years, new policies have sought to counteract some of the earlier distortions and has itself contributed to lower levels of protection.

Before economic reform, to support the nation's import-substitution industrialization strategy, China adopted a state monopolized unified system of foreign exchange management (Lardy, 1995). Under this system, the government strictly controlled the earnings and allocation of all foreign exchange. In 1979 with the implementation of economic reform, China introduced the foreign exchange retention system that was aimed at providing incentives to various enterprises and local governments to increase foreign exchange earnings through the expansion of exports. Under the foreign exchange retention system, enterprises and local governments were able to retain a certain proportion of the foreign exchange that they earned through their exports.

In 1988, additional reforms attempted to strengthen the earlier incentives. In particular, leaders began allowing local governments and enterprises to control and use all of the foreign exchange that they earned as long as they did so in accordance with state regulations. While the implications were wide ranging, the policy shifts provided strong incentives to leaders in Northeast China to encourage exports. This was true for many agricultural commodities, such as maize. For example, when maize exports led to increased foreign exchange earnings, officials were able to relax the severe constraints that existed on the importation of technology, capital and other commodities. Soon after the incentives were put into place, annual maize exports reached an average of about 4 mmts in the late 1980s. After the incentives were strengthened, exports nearly doubled (to 7.7 mmts) in the early 1990s.

Even during this time, however, the foreign exchange market was highly regulated. Exchange rate management was controlled by a two-tiered foreign exchange rate system. One rate, the official foreign exchange rate, was set by policy. The other rate was set by a swap center (where those units with extra foreign currency could exchange it with those units that needed additional allotments). The foreign exchange rate from the swap center was based on mostly on supply and demand forces. The swap rate was about 20 percent higher than the official rate in the mid 1980s. It was as high as 75 percent higher in the late 1980s (Appendix Table A.3, column 4). When China's leader devalued the official rate by more than 40 percent in the early 1990s, the gap between the swap and officials rates fell to only about 25 percent.

In its efforts to further liberalize the foreign exchange rate system, China's leaders unified the official exchange rate and the swap market exchange rate and adopted a single currency, managed exchange rate system. The rate was supposed to be managed at the rate that was consistent with supply and demand in 1994. As a result, the RMB exchange rate was effectively devalued from the official exchange rate of 5.76 yuan per US dollar in 1993 to the managed floating market exchange rate of 8.61 yuan per US dollar in 1994. This shift was a one step devaluation of more than 50 percent (Appendix Table A.3). In December 1996, after the currency stabilized at that rate, the RMB became convertible on China's current account. Since, 1996, black-market or unofficial secondary markets for foreign exchange have moved closely with the official exchange rates since 1996 and stayed remarkably constant.

The impacts of the devaluation China's RMB on China's trade are substantial. Foreign reserves rose from US$ 28.6 billion in 1990 to US$ 73.6 billion in 1995 and reached US$ 166.5 billion by 2000. Such large rises in reserves have actually caused a gradual appreciation of RMB after the middle 1990s. Since 1996, China has been the second largest foreign reserve holder (just behind Japan) in the world.

China's exchange rate policy changes have significantly affected the production and trade incentives for producers and traders of imported and exported agricultural commodities. While a nominal exchange rate devaluation is only effective in raising the price of tradables relative to non-tradable goods, if inflation does not erode the increase in the exchange rate, a real depreciation of the domestic currency raises the local currency prices of tradable relative to non-tradable and contribute to the price competitiveness of domestic exports (Appendix Table A.3, column 3). Since agricultural products are generally tradable, agricultural incentives may be expected to increase with real depreciation of the domestic currency.

Appendix Table A.3 reveals that China's exchange rate policy during the reform period has clearly been successful in effecting substantial depreciation (increase) in real exchange rate. Whereas nominal exchange rates remained constant, and even appreciated over three decades prior to the reform period (reform started in 1979), real exchange rates rapidly depreciated during the entire reform period except for a couple of years after 1985. From 1979 to 1993, the real exchange rate depreciated by 422 percent (397/94). Evidently, nominal exchange rate depreciation was not eroded by inflation despite significant expansion in the money supply.

The success of the exchange rate adjustments stemmed mainly from the productivity effects of economic reforms and technological innovations in agriculture, foreign trade and industry that contributed to the relatively low inflation. China was second only to Indonesia in pursuing aggressive adjustments in the real exchange rate in Asia before the middle 1990s or prior to the Asian economic crisis. The favorable trends in the real exchange rate also sharply increased export competitiveness and thus significantly contributed to the export growth record on the whole and also contributed to the spectacular economic growth performance of the country in the 1980s and the early 1990s.

However, after adopted the managed floating exchange rate system in 1994, the value of RMB has appreciated slightly in recent years (Appendix Table A.3). The official exchange rate declined from 8.61 yuan per US dollar in 1994 to about 8.28 in 1998-2001. It is widely believed that the domestic currency has gradually overvalued since 1994 such provided disincentive to tradable agricultural sector.

G. Technology Development

After the 1960s, China's research institutions grew rapidly, from almost nothing in the 1950s, to a system that now produces a steady flow of new varieties and other technologies. China's farmers used semi-dwarf varieties several years before the release of Green Revolution technology elsewhere. China was the first country to develop and extend hybrid rice. Chinese-bred conventional rice varieties, wheat, and sweet potatoes were comparable to the best in the world in the pre-reform era.

Agricultural research and plant breeding in China is almost completely organized by the government. Reflecting the urban bias of food policy, most crop breeding programs have emphasized fine grains (rice and wheat). For national food security consideration, high yields have been major target of China's research program except for recent years when the quality improvement was introduced into the nation's development plan.

A nationwide reform in research was launched in the mid-1980s. 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.

Today, the record on the reform of the agricultural technology system is mixed and its impact on new technological developments and crop productivity is unclear. Empirical evidence demonstrates the declining effectiveness of China's agricultural research capabilities. Our previous work found that while competitive grant programs probably increased the effectiveness of China's agricultural research system, the reliance on commercialization revenue to subsidize research and make up for falling budgetary commitment weakened the system.[11] It is possible that imperfections in the seed industry partly contributed to the ineffectiveness of research reform measures in crop breeding.

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[11] Findings based on a series of intensive interviews and survey data gathered from a wide range of agricultural ministry personnel, research administrators, research staff, and others involved in China's agricultural research system.

Appendix Table A.1: Capital flows (billion yuan in 2000 price) from agriculture to industry and from rural to urban through fiscal, financial and grain procurement systems, 1980-2000.

	Fiscal system		Financial system		Grain	Cash flow from	
	Agri to industry	Rural to urban	Agri to Industry	Rural to Urban	Marketing (implicit tax)	Agri to Industry	Rural to Urban
1980	-33.6	-25.8	15.9	7.2	39.3	21.6	20.7
1985	-14.9	13.2	29.5	9.2	11.3	25.9	33.7
1990	-29.6	14.5	62.5	28.8	33.3	66.2	76.6
1995	-18.4	115.8	131.7	89.1	33.5	146.8	238.4
2000	-46.5	153.2	206.9	247.8	-0.1	160.3	400.9
Total: 1980-2000	-533.2	1069.7	613.4	1734.7	613.9	1289.3	2297.0

Not: Values are in real terms in 2000 price (use the general retail price index as price deflator)
Source: Authors' estimates.

Appendix Table A.2: Percent of households engaged in different activities that finance activity with loans and average loan amounts of households receiving loans by activity.

Year	Fertilizer	Livestock	Small Business	Illness	Construction.	Other
Percent of households engaged in activity						
1988	30	25	32	38	56	25
1995	22	18	34	37	56	24
Average loan amount of household receiving loan (yuan, in 1988 prices)						
1988	125	238	1205	494	1667	499
1995	90	143	3767	849	2161	550

Note: There are 32 observations for Zhejiang, Sichuan, Hubei, Shaanxi, and Shandong; and 24 observations for Yunnan.
Source: Nyberg and Rozelle, 1999.

Appendix Table A.3: Official and swap market exchange rates and the real effective exchange rate indices, 1979-2001.

Year	Official exchange rate (yuan/US$) (1)	Black market or swap-center exchange rate (yuan/US$) (2)	Real effective exchange rate index (1994=100) (3)	Ratio (4)=(2)/(1)
1979	1.56	2.33	397	1.50
1980	1.50	1.95	403	1.30
1981	1.70	2.05	359	1.20
1982	1.89	2.27	343	1.20
1983	1.98	2.39	337	1.21
1984	2.32	2.69	299	1.16
1985	2.94	3.05	254	1.04
1986	3.45	4.03	185	1.17
1987	3.72	4.40	160	1.18
1988	3.72	6.50	133	1.75
1989	3.77	6.60	154	1.75
1990	4.78	6.60	137	1.38
1991	5.32	6.60	121	1.24
1992	5.51	6.92	108	1.26
1993	5.76	8.28	94	1.44
1994	8.61	8.70	100	1.01
1995	8.35	8.50	109	1.02
1996	8.31	8.60	117	1.03
1997	8.29	8.60	123	1.04
1998	8.28	8.60	123	1.04
1999	8.28	8.60	117	1.04
2000	8.28	8.50	118	1.03
2001	8.28	8.40	121	1.01

Source: From IMF's database.

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