IMPACTS OF AGRICULTURAL TRADE AND RELATED REFORMS ON DOMESTIC FOOD SECURITY IN CHINA

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INTRODUCTION

Food security has been one of the central issues of concern of policy makers in developing countries, including China. The progress in developing countries, however, has been unequal across regions and among countries. When studying food security, China is one of the most interesting cases to explore if one is interested in understanding how some nations have been able to improve its food security at both the macro (national) and micro (household) levels. At the national level, in contrast to many earlier analysts who expected that China would become more dependent on agricultural imports in the course of the rapid industrialization and liberalization of its economy, net food import growth did not happen. In fact, even after more than 20 years of reform and rapid growth, China has continued to be a net exporter of food (CNSB, 1981-2002).

At the micro level, China also has made remarkable progress in improving household food security and reducing the incidence of malnutrition during the past two decades. The incidence of rural poverty has fallen significantly from more than 30 percent in the late 1970s to around 10 percent in 1990; during the past decade, according to China's measure of poverty, the poverty rate has fallen to only 3 percent (CNSB, 2002). Such sharp falls in the rates of poverty have dramatically improved food security at the household level. According to a recent publication by FAO (2002), the number of people who suffered from any sort of malnutrition in China declined from 193 million in 1990/92 to 116 million in 1997/99, or from 16 percent to 9 percent in total population.

While most observers agree with the facts on the scope of the improvement in the national food security, fall in poverty and decline in malnutrition, there is less agreement about the cause. In particular, little is known about the linkage between trade liberalization and the enhancement of national food security, the decline in the number of rural poor and the degree of malnutrition. On one hand such linkages and the impacts seem obvious. Economic growth, poverty reduction and improvements in food security have been progressing at the same time that leaders have been reforming the economy. All have improved since the early reform period in the late 1970s. However, when one

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looks for empirical studies that show how food security has been affected by trade liberalization, there is a lacuna of evidence. This lack of evidence is surprising since policymakers and scholars frequently ask the question: How will changes in trade policy affect the economy and plight of the poor.

Recent events have brought this issue even more to the forefront of the agendas of many policymakers. China's recent entry into the World Trade Organization (WTO) promises many changes. It will undoubtedly make China's food economy even more dynamic than it is. Moreover, even before it is possible to understand the impacts of the nation's accession, the Doha Conference launched a new round of multilateral trade negotiations. Trade negotiators have been given a mandate in the next round of WTO negotiations to further liberalize the world economy, including agriculture.

Whether the impacts on China's agriculture and food security either from its own trade liberalization during the 1980s and 1990s or from the recent WTO accession are large or relatively small, given the size of the country and its rapid economic growth, the consequences of trade liberalization on China's food security are expected to have global implications. Consequently, the importance of understanding the determinants of success and failures of how trade policy has enhanced food security in China also is beyond its academic and China's national interest. As of 1996-97, there were nearly 800 million people living in 98 developing countries that are not getting enough to eat and are unable to lead a normal, healthy and active life; of this total, 116 million were in China (FAOSTAT, 2002). The World Food Summit of 1996 set a target to reduce the number of undernourished people in the world by 2015 by 50 percent. Unfortunately, according to the latest analysis of the FAO, if the world continues on its current path, it is unlikely that the target will be met. If the world is to meet it target, China must be effective in reducing its poverty and the number of undernourished people.

To have a better understanding of how trade liberalization might impacts on a nation's food security in the future, a thorough review of agricultural trade and related reforms in the past is required. However, unlike many of the other countries that are participating in this project, China is a new member of WTO. As a result it is impossible to base the impact assessment on the trade liberalization measures that were caused by the Uruguay round. That does not mean it is not possible to study the effect of trade liberalization on growth, poverty and food security. During the 15 years that it took for China to move from its initial application to accession, the leadership implemented a series of substantial unilateral reductions in trade control measures. The nation's unilateral effort at trade liberalization, as we will argue in this report, has actually gone far beyond the point that many countries arrived at after the Uruguay Round. After China acceded to the WTO in December, 2001, we expect that agricultural trade and trade related reforms will be furthered by the implementations of its new commitments.

Given the above background, the overall goal of this study is to draw lessons for national policies under a more open trade environment in order to enhance food security. In this case study we will focus on China and search for the policy implications for further trade

policy changes. At the same time, we also will look for the implications of China's experience for other developing countries.

With this goal in mind, in this report, we will attempt to answer the following three main questions:

- What economic and trade policy reforms have been introduced?
- What have been the impacts of these reforms on agricultural production and trade?
- How has domestic food security at the national- and household-levels been affected by the reform process?

To undertake this study and to meet the above overall goal, a project team was established, which is composed of four principal researchers, who are also the authors of this report. The research team has long standing experience in agriculture and trade policy analysis as well as a number of other areas of economic policy analysis. The team leader, Jikun Huang, participated in project planning workshop meeting in FAO headquarters in December 2002. Immediately after this meeting, the project leader discussed the terms of reference (TOR) and expected outputs of the planning workshop with the other three principal researchers, Scott Rozelle, Hongxing Ni, and Ninghui Li, and made a detailed work plan and assigned areas of responsibility for the China country case study. We also have enjoyed the assistance of two research assistants from the Center for Chinese Agricultural Policy of the Chinese Academy of Sciences.

In the following report, our work describes the structure of China's agricultural sector and reviews the institutional setting of the sector. In order to have a better understanding of policy reforms on a wide range of products, the commodities covered in this study account for about 90% of crops and nearly all livestock and fish products. The study also use a number of research tools. Specifically, we utilize a modified version of CCAP's China's Agricultural Policy Simulation and Projection Model (CAPSiM) to simulate the impacts of trade liberalization on the production, consumption, trade and prices of the study's agricultural commodities at both national and household levels from 1985 to 2000.

Using the CAPSiM framework, we examine the impacts of trade liberalization and domestic reforms on household agricultural production and consumption for different regions and households. Household agricultural production and consumption data are from the China National Statistical Bureau's household income and expenditure survey and are representative of all China in 1999.

While we believe this is one of the most comprehensive assessments done on the effect of trade policy changes on China's economy, there are several limitations. Because we lack demand and supply parameters for different groups of farmers that have different incomes and for those that live in different regions of the country, we have no option but to make several strong assumptions on the way prices are transmitted from the national level to households and price responses of producer and consumers. To some extents, the

study also has difficulties in fully separating the effects of trade liberalization from other structural changes in the economy as well as other policies that may have simultaneously been implemented with trade reform. Therefore, the results presented in this report need to be interpreted with caution.

The report is organized into six chapters. Chapter I introduces the economic and social context of the study and provides essential information needed to interpret the analysis that is carried out in the other chapters of the report. To establish the context, we include brief descriptions of China's natural and human resource endowments, the nation's recent macroeconomic performance and its efforts to eliminate poverty, and the role and performance of agriculture in the larger economy. The first section also includes a profile of food security at the national- and household-level. Special consideration also has been given to describing China's overall food balance, the consumption requirements of the population and the main strategies that leaders have used to achieve food security.

With the background information from Chapter I, Chapter II describes the main economic and trade policy reforms that have been introduced during the reform period. The discussions cover the reforms that have been introduced in terms of the policy instruments that are related to the agricultural sector and to those that also more indirectly affect the agricultural sector at the macroeconomic level. Specific changes in policy instrument design, implementation and the institutional framework are described. In order to provide a comprehensive picture of the reform process, all major reforms related to agricultural production and trade since the late 1970s are described. The findings of this part of report provide background information for the formulation of the policy scenarios that are used in the impact simulations to be presented in Chapters III to V.

Within the context of broader economic reforms, China has implemented structural adjustment program in the agricultural sector over the past two decades. These efforts have been primarily directed at correcting the bias against agriculture that was so prevalent during the Socialist period (Huang and Chen, 1999; Huang and Rozelle, 2002). The policy package included a reduction or elimination of government subsidies to producers as well as consumers, market deregulation, sharp unilateral reductions in import tariffs, the elimination of agricultural export subsidies and rebates, and the commercialization of most agricultural input, service and marketing entities. The sectoral reforms also were accompanied by liberalization in the foreign exchange and financial markets.

Based on a modified version of CCAP's CAPSiM, a partial equilibrium policy analysis model, Chapter III reports the impacts of trade liberalization during the reform period at national aggregated level. At this stage of analyses, the study focuses on the impacts of trade and domestic policy reforms on trade and the impacts of trade on domestic price, production, and consumption of major agricultural products. Appendix B reports the likely impacts of Chinas' WTO accession in 2002 on China's rural economy in the future. In order to examine how the impacts at the national level can transmit to regional and household levels, we conducted market integration analyses presented. Based on household income and expenditure survey data that include the production and consumption of a set of representative groups of households and the results from market

integration anlyses, Chapter IV discusses how trade changes to the agriculture sector (which were documented in Chapter III) have affected changes in household income and expenditures. The analysis is done on a group by group basis. To do this, we divided all rural households into 11 income groups. The analysis was also done separately for the nation's three main regions, western, central and eastern China. The impacts of trade on production, consumption and agricultural income for each sub-group of households and for each region are examined.

Impacts of trade on household non-agricultural employment and rural income are examined based on a separate database. We track rural income and employment trends and the impacts that liberalization policies will have on employment.

Chapter V provides a synthesis of how the reform experience has impacted domestic food security from both the national and household perspectives. The analysis draws upon the findings set out above to explain observed food security outcomes with reference to the reforms and other national policy changes. We also divide the specific income and regional groups into those that can be classified as *winners* and *losers*. The final part of this report concludes with a synthesis of the main findings on the impact of reform for domestic food security.

With the work contained in the five chapters, we hope that we can answer three key questions raised above. According to our analysis, we believe that we can show the following key points:

- Trade reforms, a key part of the economic reforms of the early transition leaders, have been rigorously implemented, but they also have gone hand in hand with domestic economic reforms.

- Domestic reforms have covered nearly every aspects of the economy, started from land reform and then gradually move to both input and output markets, from agricultural sector specific policy to macro economy policy. External reforms in general have paralleled those in domestic reform. China's foreign trade regime has gradually changed from a highly centralized, planned and import substitution regime to a more decentralized, market-oriented and export promotion regime. However, in the late 1990s, China also used various means to protect some of its crops such as maize and cotton.

- Even though domestic policies have been relatively more important, trade reforms have had important effects on China's domestic agricultural production.

- The nature of impacts of trade and domestic policies, however, differs. Domestic reforms have boosted the growth in all sectors. They also have increased food security primarily by increasing food availability. In contrast, trade or trade liberalization has had both positive and negative impacts. Although there has been less of an impact on aggregate production and consumptions, trade policy reforms have had powerful structural change

impacts, moving a country towards sectors in which it has a comparative advantage. As such, trade policies have been useful in improving allocative efficiency and making the sector more competitive.

- Because trade impacts are more commodity specific, they have more sharp regional and crop-specific impacts. This also means that they affect equity. In the case of China, while both eastern and western regions have benefited from trade, liberalization has hurt producers in central China primarily because the region is the largest producer of soybean and edible oil, two of the sets of commodities that are most hurt by liberalization. Although the government also has used trade policy to protect maize, and producers in central China, the gains from the rising protection is less than loss in other sectors. These findings also imply that central China will face an even large challenge after China joins the WTO (because under its WTO agreement, it is scheduled to gradually liberalize its maize sector).

- Interestingly, during recent years, the poor have gained its production in the absolute terms from trade policy change as much as the richer producers. Nearly all the gains have come from the nation's protection of maize, cotton and wheat (mainly maize). However, in the relative sense (relative to their production), the poor gain more than the richer producer. Therefore, recent trade policy changes have contributed to household-level food security.

- While overall the poor have gained, trade policy has not been completely poor pro. In fact, the poor also lost substantially since they also were large producers of soybeans and edible oils. Since the poor enjoyed gains that essentially were from higher protection, in the future as the nation liberalizes trade further (especially maize, cotton and wheat), the poor might face big challenges. Because the protection of this sector is not likely to last for long and the poor currently allocate a large share of their land to crops in which China has less of a comparative advantage, there is a role for government. In particular, the government is needed to help these farmers in shifting their production more towards crops and animals in which China has a clearer comparative advantage. In the meantime, China also needs to reduce the negative impact from trade by raising domestic production through productivity-enhancing investments.

- For the sector that China has competitive in the world market, the poor have gained less than the rich because despite having farms that are of a similar size, their land produces less than that of the richer producers. It could be that the lower production is due to inferior land and climate resources. It could also be that poorer producers have access to fewer inputs. If so, the clear policy implications are that the government needs to provide ways for farmers to access better technology, water control and credit.

- For China to have trade liberalization end up having a positive overall effect, they need to not only open up their markets, they need other countries to open

up their markets for China's products. So far in the aftermath of WTO, China has not been able to gain as much as it thought it would in the increased exports of horticulture and livestock commodities. In addition, developing countries, like China, need to heavily invest in quality and food safety to better meet international standards.

- The impact on agriculture, however, is only part of the story. Trade liberalization and domestic reforms have also affect the access of households to non farm employment and the wage they earn for being in the off farm market. In general, China has gained a lot from overall trade liberalization. Rising exports of manufacturing goods have been produced in factories that hire a lot of rural labor. These factories have also had spillovers that have helped make domestic factories more productive and increase the demand for labor. In country like China, raising the demand for off farm labor is probably the most important thing that can happen in the economy. So far, the success has been unparelled. The nation needs to keep promoting policies that facilitate investment and allows rural households, particular the poor, to move to these jobs without constraints.

In final summary, trade liberalization has had both a positive and negative impact on agricultural production. There has been more of a negative impact on those in central China. Those in the eastern part of the country have benefited the most; while those in the west have benefited but somewhat less. Interestingly, the poor have benefited more than the rich in relative terms. Most of the benefit arises due to the production structure of the poor; the protection enjoyed by the maize and cotton sectors has helped the poor. The overall negative impact would be more if China had not protected its maize, cotton and wheat commodities. However, if they liberalize them, the poor and producers in all regions in China will face greater challenges. Policies which force farmers to shift into crops in which they have a comparative advantage in the long run make for a healthier and more competitive economy. Both agricultural structural change and the rise in off-farm employment will drive growth in China's future. Overall effects in the future will depend on trade policies, but will also depend on other nontrade national policies and the liberalization of the rest of the economies in the rest of the world.

CHAPTER I: COUNTRY BACKGROUND

I. Resource Endowments

China is the largest agricultural producer in the world. The nation's territory is vast with diversified climates, abundant sunshine and thermal energy resources and rich in plant and animal resources. However, China also has the largest population in the world and in many key areas, its per capita natural resource endowment is limited.

A. Natural Resource

Climate and Biological Resources Owing to its unique geographic location, terrain and topography, China has complex and diversified weather conditions. The temperature gradient rises gradually from the north to the south part of the country. The annual accumulated temperature ranges from 2 500 C^o to 3 000 C^o in the northeast and northwest of the country where normally one crop is planted a year. It is 4 000 C^o to 5 000 C^o in the North China Plain where there are either two crops a year or three harvests in two years, and in southern plain areas along the middle and lower reaches of the Yangtze River 5 000 C^o to 7 000 C^o where there are up to three crops a year. In areas to the south of Nanling Mountains Ranges, the accumulated temperature ranges from 7000 C^o to 8,000 C^o and farmers can cultivate crops all year. Precipitation varies greatly from year to year, from season to season and from region to region. In most parts of the country, especially in the north, there is little rainfall in winter and spring. In the north, most of the precipitation comes in the summer and autumn.

Because of varied weather conditions and socioeconomic environment, China has a wide range of agronomic regions and is abundant in bio-resources. Currently, more than 300 families, 2 900 genera and 30 000 species of higher plants, over 200 species of mammals and birds and over 1 500 species of fish have been discovered in China (NEPA, 1994). In China's large number of genetic resource banks, there are over 360 000 accessions of crop varieties. Of these there are more than 50 000 accessions of rice, 15 000 of wheat, 14 000 of maize and 17 000 of sorghum. In line with local weather and resource conditions, China's farmers use various cropping systems. For instance, double- and triple-cropping rice systems (rice-rice, rice-wheat, and rice-rice-rice) are commonly practice in China's tropical and subtropical areas. Farmers that live in the north and in some upland areas have developed multiple cropping rotations that are widely used in the temperate zone (e.g., maize-wheat and cotton wheat). In areas with easy access to major markets, agricultural production has begun to become specialized with farmers growing high-valued products that are mostly destined for the market (Carter, Zhong and Cai, 1996). Farmers in these areas buy most of their food on the market. In contrast, households in remote regions are still largely subsistence oriented and produce staple commodities for their own use and only market limited quantities.

Cultivated and Others Land. Although China has a vast territory, its cultivated land resource is relatively limited. According to the official statistics, there were 128 million hectares of cultivated land in 2000 (CNSB, 2001). Compared to 1978, cultivated area has

fallen by 4.5 million hectares. In general, paddy field (irrigated lowland areas) account for about 25 percent of China's total cultivated area and non-paddy fields account for the rest. A large part of the non-paddy area is irrigated. China's irrigated area accounts for almost half of cultivated area, a share that is large internationally (Wang, 1998).

Beyond cultivated land, the country had 159 million hectares of forest in 2000, which increased by 44 million hectares over 1980 (CNSB). The rise in forest cover is the result of China's massive afforestation efforts that have gone on for the past several decades (Rozelle et al., 2000a). The forest coverage ratio was 16.55 percent in 2000, an increase of 4.5 percentage point over 1980. Its grassland area was 400 million ha in 2000, a decrease of some 19 hectares when compared with 1978 (CNSB). Declined grassland was results of combined impacts of agricultural expansion, afforestation and dissertification (World Bank, 2001).

Considering its large population base, more than 70 percent of which still live in rural areas, China is an extremely land scare nation. In 2000, there were 241 million rural households. On average, each farm has a land area of less than 0.6 hectare, which is quite small even compared with many populous Asian countries. In China the land is distributed among members of the former collectives (now they are called villages). Every rural household has land. When the land was divided during decollectivization in the late 1970s and early 1980s, it was done so in an equal way, although the exact method of distribution varied from village to village. As populations have shifted within villages, even though the land was supposed to have been allocated to household to long term leases (between 15 to 30 years), most villages reallocated land during the past 20 years and this has ensured that all families still have access to cultivated land. While the household farms are extremely tiny in southeast where population-land ratio is high, there are large-sized household farms in the northeast and northwest. With the rise of the economy, however, the average family size has fallen and today most families are nuclear in structure. In general, the limited amount of land resources makes it so few of China's households can accumulate enough land to capture scale economies.

Due to the great scarcity of cultivated land, the Chinese farmers have developed highly intensive farming systems. Multiple cropping is widely practiced throughout China as a way to raise land productivity. Before the 1970s when supply of manufactured inputs, such as chemical fertilizer, was insufficient, labor was mobilized and used intensively in cultivation. For example, per hectare labor input was as high as 600 labor-days for a crop of rice (SDPC, 2001). After decollectivization and when inputs became more readily available, this situation began to change. Labor use per hectare declined by about 50 percent and the application of chemical fertilizers doubled during 1980s (SDPC, 2001). These trends continued in 1990s and are expected to continue into the 21st century. Given the high input use, China's agriculture is highly productive on a per hectare basis. However, such high input use inevitably has a high cost in terms of the environmental problems, such as pollution of water, that they cause.

Pressure on agricultural land area no doubt will increase as the competition for land from the non-agricultural sectors grows, environmental degradation increases and irrigation

water supplies decline. Since China's farmers already use their land resources relatively efficiently, there is little room to make land more productive on a per hectare basis (except through continued use of new technology). Moreover, since the potential for land reclamation or expansion of the land base is modest, there also is little scope to increasing the quantity of land. In short, China is a land-scarce nation and will continue to be in the future.

Water Resources. The total amount of water resources in China averages 2 800 billion cubic meters, of which 19 percent is in north China and 81percent is in south China (MOWR, 2002). Measured in per capita water availability, China is one of the most water scarcity countries in the world, especially in the north part of the nation. After the People's Republic of China was established, the government devoted huge financial and labor resources to water conservancy, including the construction of irrigation projects, reservoirs and canal across the nation (Lohmar et al., 2003). A series of engineering projects, most started before 1980, have attempted to improve the supply of irrigation service to agriculture. Over the past five decades, the irrigated areas in China rose from 20 million hectares in 1952 to 54 million hectares in 2000 (CNSB, 2001). In the 1980s and 1990s, groundwater investments have boosted the utilization rates of water and expanded irrigated area (Wang, 2000). The continued increase of irrigated land areas has been the major factor that has contributed to the stable expansion of agricultural production capacity (Stone, 1993). However, the cost of new irrigation investment has risen rapidly since the 1980s, mostly due to the fact that the "easy" projects had all been completed. Because the nation has devoted most investment to new construction and little to maintenance, existing irrigation systems perform badly (Lohmar et al., 2003). Many water projects have deteriorated due to waterlogging, salinization and mining of ground water aquifers. Agricultural productivity growth in irrigated areas has slowed.

Water shortages in China, particularly in the North China Plain and in the Northwest part of the country, have become more acute over the last two decades when compared to earlier in the 20th century. Weather records show that droughts have risen and precipitation is down. With intensified farm and non-farm uses of water, the water table has declined rapidly in north China and many rivers stop flowing during the dry season (Wang, 2000). In central and south China, both surface and underground water in some regions have been polluted. These problems reduced water availability to both farm and non-farm users.

Natural Disasters. Given differences in natural resources distribution, weather conditions and cropping systems in the country, agricultural production is frequently stricken by natural disasters (Kueh, 1984). Drought, floods and frost negatively affect yields and total output each year. Because of the intensity of cultivation, diseases, insects, rats and weeds are the major pests. Of all disasters, drought is the one that has affected farming production the most severely in recent years. For example, in the year 2000, a total of 40 million hectares of farmland were affected, reducing output by 50 MMTs (MOA, 2001). Floods mainly affects the valleys and tributary valleys of the Yangtze River, the Yellow River, the Pearl River, the Huaihe River, the Haihe River, the Liaohe River and the Songhua River. Sicne 1978, floods have affected an average of

about 7 million hectares of cultivated area annually. Frost and unseasonable low temperatures mainly occurs in the middle and lower reaches of the Yellow River and the Yangtze River. During the 1990s, frost has affected about 3.5 million hectares. In China, there are more than 1 000 kinds of diseases and insects that affect crop production. The pests that cause the most damage include oriental migratory locust, rice borers, meadow moths, asparagus caterpillar, the Asian bollworm and the meadow mouse. Currently, an average of about 224 million hectares of farmland is affected by pests each year (MOA, 2001).

B. Human Resources

Population. China is a country with the largest population in the world. Its population was nearly 1.3 billion in 2001 (CNSB, 2002). About two-thirds of the population resides in rural areas. Almost all of rural households make their living on agriculture and related farm production activities. The annual growth rate of the population was as high as 1.8 percent in the 1970s. Since then, it has declined significantly. By the late 1990s, the population annual growth rate lowered to 0.9%. In part the fall was due to the growing economic prosperity and in part the fall can be attributed to the effective implementation of the nation's aggressive family planning policy. The growth of food supply has surpassed the population's growth rate. From this, we can safely conclude that the rise in population in recent decades is not one of the main causes of China's current food insecurity.

Rural Illiteracy. The education level of farmers has significantly improved while the rate of illiteracy dropped significantly (Table 1.1). However, the total number of illiterate people in rural China remains very high. According to official statistics, the number of illiterate people was 85 million in 2000 (CNSB, 2002). Of these, 67 million (or 8 percent of the rural labor force) were in rural areas. Surely illiteracy mainly is a rural problem. The rate of rural illiteracy was relatively high in the western provinces such as Yunnan, Guizhou and Tibet in southwest and Gansu, Qinghai and Ningxia in northwest, two of China's poorest regions.

With the recognition of the importance of human capital, China's government decided to increase fiscal appropriation to education in recent years. In 1998, the government raised the share of educational expenditure in national fiscal budget by one percentage each year through 2002 (CNSB, various issues). Central leaders called for provincial governments to take similar steps. These rising general funds are supplemented by special funds that are given to poor regions to improve educational facilities and assist in rural compulsory education.

One of the main problems in rural areas is that tight budgets have led to teachers being owed wages and receiving untimely payments (Nyberg and Rozelle, 1999). In order to solve the wage-default problem for rural teachers, some provinces have taken measure to turn the responsibility of wage payment from township government budgets to county government budgets. Apart from fiscal appropriations from the government budgets at all levels, non-governmental funds are being now attracted into the development of primary and higher education by allowing the establishment of private schools, colleges

and even universities. It is expected that, with such reforms, the educational system can be more responsive to the social demand in future, although such measures could exacerbate inequities that exist in rural China.

II. Macroeconomic Considerations

A. Economic Performance

Remarkable progress has been achieved in the performance of the agricultural sector, even though its growth rate does not match that of the overall economy; growth in all sectors are highly correlated with the time periods in which China's leaders implemented the various reform measures that have gradually liberalized the institutional and market structure of the economy (Table 1.2). Although there is a cyclical pattern in China's growth rates (Figure 1.1), China's economy outperformed almost all other countries in Asia. Indeed, China has had one of the fastest growing countries in the world since 1980 (World Bank, 2002). The rapid growth has been accompanied by sharp structural changes in the economy. Whereas agriculture accounted for more than 30 percent of gross domestic product (GDP) prior to the economic reforms in 1979, by 2000 the share of agriculture had fallen to 16% (Table 1.3).

Economic Growth before the early 1990s. In the early reform period, annual growth rates of GDP increased dramatically from 4.9 percent in 1970-78 to 8.8 percent in 1979-84 (Table 1.2). During this same time period, as economic growth and family planning effectively lowered the nation's population growth rates, the annual growth rate of GDP per capita more than doubled between the pre-reform period (1970-78--3.1 percent) and 1979-84 (7.1 percent). During the early reform period, the growth in the agricultural economy also was remarkable (7.1 percent annually, Table 1.2), which provided the foundation for the successful transformation of China's reform economy (McMillan and Naughton, 1992; Perkins, 1992).

After reaching its peak growth in 1984 (15 percent), the pattern of rapid economic growth continued into the later reform period in the late 1980s (Figure 1.1). In fact, growth may have been too fast. In the late 1980s, in response to an overheated economy and unprecedented inflation rates China's leaders were forced to adopt a set of stringent contractionary macro-economic policies (Naughton, 1995). As a consequence, after China experienced two years of high inflation, the economic growth slowed sharply in 1989-1990. The annual rate of GDP in 1989-1990 only reached about 4 percent, the lowest rate in the entire reform period. After the brief slowdown, the government responded promptly and implemented a series of policy measures to re-stimulate the economy through the use of fiscal and financial expansions, the devaluation of the exchange rate and the expansion of special economic zones and higher of agricultural prices. The economy quickly rebounded and the annual growth rate of GDP accelerated to 14 percent in 1992 and it maintained the rates of 10 to 13 percent during the years of the mid 1990s (1993-96--Figure 1.1). When the economy was growing at it top speed during the mid-1990s, inflation rates rose again (Figures 1.2a and 1.2b).

Recent Economic Growth. Although the economy was growing fast, inflation was high in the mid 1990s and in order to avoid a repeat of the economic slowdown that occurred in the late 1980s, China's leaders implemented a range of measures aimed at achieving a soft landing (Zhu and Brandt, 2001). As before, financial and credit policies were tightened. Administrative controls over new investments also were implemented. To keep the economy from flagging too much, leaders increased urban wages and invested heavily in agriculture in an attempt to counterbalance the contractionary measures. The growth decelerated gradually, but unlike in the late 1980s, it only slowed marginally. During the late 1990s, economic growth remained high, about 8 percent annually (Table 1.2 and Figure 1.1).

It is worth noting that despite the Asian financial crisis, an average annual growth rate of 8.2 percent during the years, 1996-2000, was still remarkable (Table 1.2). China was able to keep the crisis from spreading into it borders, in part as a consequence of the more insulated nature of its financial sector. In addition, since the size of its domestic capital market was so large, China was better able to weather the international financial crisis. During this time also, the growth rates were among the highest in the world (CNSB, 2002).

Foreign Trade. Throughout the reform era, foreign trade has been expanding even more rapidly than the GDP. Annual growth rates of foreign trade reached nearly 15 percent in both the 1980s and the early 1990s (Table 1.2). Despite the Asian economic crisis adversely affected China's foreign trade growth rate, it still grew at nearly 10 percent annually between 1996 and 2000. During 2000 and 2001, the average annual growth rate of foreign trade reached 19 percent. Although the growth rate of agricultural exports declined, so did those of all other Asian countries. Most observers believe the slower growth rates occurred because of depressed world commodity markets and the general slowdown of the world economy (ADB, 2002).

With the rapid growth of China's external sector, foreign trade has been playing increasing role in the national economy since the beginning of the reforms in the late 1970s. China's trade to GDP ratio increased from less than 13 percent in 1980 to 45 percent in 2001 (CNSB, 2002). During the same period, the total value of China's primary goods trade (mainly agriculture) increased from US$16.1 billion to US$72.1 billion, an annual growth rate of 7.4 percent (CNSB, 2002). With China's entry in the WTO in late 2001, the growth of foreign trade is likely to remain high and even accelerate in the coming years.

Inflation and Agricultural Prices. Over the past two and half decades, China's consumer prices have increased by about four times (Figure 1.2a). Most notably, prices have experienced two periods of high inflations, averaging 18 percent during 1988 and 1989 and 19 percent between 1993 and 1995 (Figure 1.2b). During the rest of years of the reform period between 1979 and 2001, the average inflation rate was only 3.6 percent (CNSB, 2002). During both periods of high inflation, the efforts to control the rising price proved to be effective. The price inflation in 1988-89 quickly was reduced to 2.1 percent in 1990 and 2.9 percent in 1991. Likewise the high inflation rates in 1993-95 also were rapidly reduced to 8.3 percent in 1996 and 2.8 percent in 1997. Indeed, during recent years China has been experienced a negative rate of inflation (in 1998-99) and one that was almost zero in 2000 (0.4%) and 2001 (0.7%).

The changes of agricultural input and output prices followed the same pattern experienced in the rest of the economy (i.e., CPI, Figures 1.2a and 1.2b). Despite these similarities, the terms of trade have varied among periods. To promote agricultural production, agricultural procurement prices had been raised continuously until the late 1980s. During this period, the real prices of agricultural output increased more than those of agricultural inputs (Figure 1.3). Rising terms of trade provided a favorable policy environment and high incentives to farmers (Swinnen and Rozelle, 2003). In contrast, after the late 1980s, despite the fact that the real prices of agricultural inputs experienced a slight decline, agricultural output prices have declined more than input prices in all years except for in 1994.

Employment. Structural changes in economy have also been substantial in employment. While the share of employment accounted for by the industrial sector has remained at about 40 to 50 percent over past three decades, employment in the service sector has risen rapidly from 13 percent in 1970 to 21 percent when the economic reforms were started (Table 1.3). By 2000, the share of employment accounted for by the service sector reached 33 percent. During this same period, employment in the agricultural sector (including part time agricultural labor) fell from 81% in 1970 to 69% in 1980 (Table 1.3). Employment in agriculture has continued to fall through the reform era, reaching about 50 percent in 2000. In the late 1990s, more than 40 percent of the rural labor force was employed in the non-agricultural sector (deBrauw et al., 2002). Expanding non-agricultural employment has contributed substantially to the growth of farmer income (Rozelle, 1996). Non-agricultural income exceeded agricultural income in 2000 for the first time, accounting for just over 50 percent of the total income of farmers. In 2001, the share rose to 51 percent (CNSB, 2002).

Despite the rapid growth and significant structural changes that have occurred in the economy, the recent record of urban and rural employments has raised concern about the emergence of a new phenomenon of urban poverty and slowing farm income growth (Fan and Zhang, 2002). China's official estimate of the urban unemployment at end of 2000 was 6 million, a figure that increased to nearly 7 million in 2001 (about 3.6 percent of the urban labor force--CNSB, 2002). These figures are generally believed to be understated since many of those unemployed in the urban area are not recorded by the government.

B. Challenges and Development Objectives

While China is often recognized as of one the most rapid growing economies in the world, its economy also is facing a number of challenges. The nation's high growth economy is currently suffering from rising inventory, excess capacity and weak aggregate demand. The economy's success in creating new jobs in the nation's urban and rural enterprises has slowed (CNBS, 2002). Rural income growth also has slowed since the middle 1990s as the growths of employment in off-farm sector and agricultural price declined.

The rapid economic growth also has been accompanied with rising income disparity (World Bank, 1997). The income gap among regions, between urban and rural, and among households within the same location has been continually increasing since the

middle 1980s (Table 1.4). The rural to urban income ratio exceeds 3.4, a level that it was at in 1980. Although the rural reforms increased rural incomes at a faster pace than urban ones during the 1980s, after the one time impact of the institutional reforms were exhausted, since the middle 1980s, urban income growth has been consistently higher than that of the rural sector. Recent falling agricultural prices and the slowdown in the growth of off-farm employment have further constrained rural income growth.

Income disparities also have risen within rural areas (World Bank, 1997). On average, per capita rural income increased by 330 percent between 1980 and 2001 (Table 1.4). While the increase in the income levels of poorer farmers (the bottom 20 percent of the population) also increased by 224 percent, this growth was more than 30 percent lower than the national average. The rising income disparity among rural residents can be shown by rising Gini coefficients, which increased from 0.24 in 1980 to 0.35 in 2000 and 0.32 in 2001(Table 1.4).

In response to the sluggish growth of rural incomes and widening disparities, the government has taken a number of different policy actions. The major policies implemented include a.) providing investments to assist in the restructuring of the economy; b.) privatization of rural enterprises; c.) reforming financial institutions; d.) loosening monetary policy; e.) the expansion of fiscal spending on infrastructure investment; f.) increasing aid to poor areas, including implementing the western development plan. The efforts have not been minimal. For example, fiscal spending on infrastructure rose by 100 billion yuan in 1998, 110 billion yuan in 1999 and 150 billion yuan in 2000 (ADB, 2002). Investments were targeted to stimulate demand and increase the efficiency of the nation's business environment. The government spending plan is continued in 2001 and 2002.

In the midst of the rural income slowdown, the accession of China to the WTO has raised new concerns about China's food security. While most studies show that China's WTO accession could contribute to GDP growth, policy makers worry about the negative effect on the service and agricultural sectors. The main concern is whether or not China's small farmers can compete in international markets.

In this environment, food security has been and will continue to be a central goal of China's agricultural policy. The Tenth Five-year Plan for 2001-2005 and the National Long Term Economic Plan for next 15 years both call for continued expansion of agricultural production and increases in farmer income growth. The nation's commitment also is reaffirmed to eliminate absolute poverty. Our review of recent policy changes shows that China has already positively responded to the challenges that confront it as a result of the accession to the WTO (Huang and Rozelle, 2002). If done well, China's policies can play an important role in improving its food security and helping the nation meet its other development goals.

C. Rural and Urban Poverty

Poverty in China always has essentially been a rural phenomenon. In 1978, about 260 million people, all of whom lived in rural areas, were under the absolute poverty line (Table 1.5). Since the economic reforms started in 1979, remarkable progress has been

made in the nation's war on poverty. In the two decades since then, more than 220 million Chinese rural residents have escaped poverty. The absolute level of poverty fell to less than 100 million in the middle 1980s. The reductions continued in the 1990s, falling to about 50 million in the middle 1990s and 29 million in 2001 (Table 1.5). The incidence of rural poverty has fallen equally fast, plunging from 32.9 percent in 1978 to about 3.2 percent in 2001. Although the greatest reductions in poverty came in the early years of reform, the rate has continued to fall gradually since then. Recent increases in urban unemployment and the breakdown of the State's urban welfare system have begun attracting attention.

Despite the significant reduction of rural poverty during the past two and half decades, China's fight against poverty is far from over. Recently China issued a new 10-year Poverty Reduction Strategy for 2000-2010 that will focus assistance on the 30 million rural people with incomes under the official poverty line of RMB 625 per capita annual income. It is worth to note that the official poverty line was set in the middle 1980s and is substantially lower than the international standard norm. World Bank estimates that more than 18 percent of China's population still live below the international standard norm in the late 1990s (about 1 dollar per day--World Bank database).

Rural Poverty

The Poor in the 1980s. In the 1980s, besides those in counties under special military administration, most of China's poor lived among the more than 200 million residents who resided in officially designated poor counties. These poor counties were distributed across 23 of China's 27 provinces. About 78 percent of the counties were concentrated to the west of a north-south line that runs through the central mountainous parts of the country from Heilongjiang, Gansu, and Inner Mongolia in the north to Guangxi and Yunnan in the south (World Bank, 1992). The remaining "poor" counties, generally better off among all poor counties, were located in less contiguous islands of poverty in the hills of eastern and southeastern China.

Poor counties in the first wave of officially designated counties were normally characterized as being poorly endowed by geographic location (remote and mountainous) and at a disadvantage in terms of agricultural resources (such as soil, rainfall, and climate). Many of these areas suffer from severe ecological damage such as deforestation and erosion (Li, 1994). Poor counties also tend to have more variable yields (Weersink and Rozelle, 1997). Partly as a result of these poor natural conditions, and partly as a result of poverty itself, farmers in poor areas suffer from below average irrigation facilities, fertilizer use, and general infrastructure (Tong et al., 1994). Poor counties in the 1980s were still highly subsistent in their grain needs, and in net terms, often needed to procure grain to meet household demand (Piazza and Liang, 1997). Participation in non-farm labor markets in the 1980s lagged far behind the national average (Rozelle et al., forthcoming).

The Poor Now. After more than two decades of reform and 10 years of an intense implementation of the nation's poverty alleviation effort, absolute poverty, more than

ever, is concentrated in resource-constrained remote uplands (Piazza and Liang, 1997). Since leaders allocated land to all of China's rural population, there are no landless farmers in the nation. Instead, the poorest of China's poor area are concentrated in resource-deficient areas, comprise almost entire communities located mostly in upland sections of the interior provinces of northern, northwestern, and southwestern China. The plight of the poor in the richer provinces has gradually improved.

Although the poor have land use rights, in some cases the land itself is of such low quality that it is not possible to achieve subsistence levels of crop production. The poorest are typically also disadvantaged by high dependency ratios, ill health, and other difficulties. Minorities are known to represent a highly disproportionate share of the rural poor. Although there is no evidence that women are overrepresented among the poor, poverty does adversely influence female schooling, female infant mortality, and maternal mortality.

The health and education of China's poor is distressing (Piazza and Liang, 1997). At least 50 percent of the boys and girls in China's poorest villages do not finish primary school. The infant mortality rate and maternal mortality ratio in very poor counties are nearly 100 percent greater than the national average. Incidence of infectious and endemic disease, including tuberculosis and iodine deficiency disorders, is concentrated in poor areas. Vitamin and micronutrient deficiencies remain a severe problem among the poor. Lack of health care has left as many as 90 percent of the poor suffering from chronic worm infections.

Economic Growth and Poverty. Economists have long debated the relationship between the macro economic development or growth and poverty, and most recognize that growth is an important and necessary though not sufficient condition for poverty and undernourished population reduction. The evidence reviewed by a joint work of China's government, World Bank and UNDP and a number of recent studies (Park, et al., 1998) confirm that economic growth appears to be one of the major determinants of poverty alleviation in China. The growth and the reform policies that underlie the growth have influenced non-farm employment of rural labor and therefore rural poverty and household food security.

A strong case can be made for the importance of the linkages to the rest of the economy by examining the results of a simple graph presented in Figure 1.4, which looks at the relationship between falling poverty incidence and overall economic growth. The figure shows that as growth occurs, poverty has fallen sharply though the reduction in poverty incidence per percentage point of economic growth is smaller over time. Although the simplistic nature of the analysis precludes us from drawing any firm conclusions, it does aid us in specifying several hypotheses that future analysis can look at more carefully. Economic growth appears to be one of the major determinants of poverty alleviation. As the poverty levels fall, it is becoming more difficult to pull these people out of poverty by relying on economic growth.

Urban Poverty

Urban poverty began to rise in the middle 1990s when SOE reforms deepened and SOEs began to layoff large numbers of workers (Fan and Zhang). The official estimate of urban unemployment rose to 5.7 million in 1998 (about 3.1 percent of the urban labor force) and increased to nearly 7 million in 2001 (about 3.6 percent of the urban labor force--CNSB, 2002). As the official estimate does not cover the urban unemployed workers who are not registered with the Ministry of Labor and Social Security, the actual unemployment rate could be much larger than the official figures. After correcting for the unregistered unemployed, the Asian Development Bank estimated that there were about 15 million people (or about 8.2 percent of the urban labor force) who were unemployed (ADB, 2002). Although the families with laid off workers are receiving minimum income support from the government, parts of these families are likely to fall into urban poverty if they can not find new jobs within a couple of years.

III Role and Performance of Agriculture

A. Changing Role of Agriculture in the Chinese Economy

The average annual growth of agriculture has been at about 5 percent throughout the entire reform period (Table 1.2). Despite the expansion of agriculture, the even faster growth of the industrial and service sectors during the reform era has begun to transform the rural economy from one based on agricultural production to one the is focused on industry.

Successive transformations of China's reform economy are based on economic growth in the agricultural sector (Nyberg and Rozelle, 1999). During this process, the share of agriculture in national economy has declined significantly. Agriculture has made important, but declining contributions to national economic development in terms of gross value added, employment, capital accumulation, urban welfare, foreign exchange earnings and poverty alleviation. Before 1980, agriculture contributed more than 30 percent of the nation's GDP and half of its export earnings. By the mid 1990s, the share of agriculture in the economy and the share of agricultural exports in total exports fell below 20 percent (Table 1.3). In 2000 agriculture's share of GDP was only 16 percent.

The shifts in the economy can also be seen in employment (CNSB, 2001). Agriculture employed 81 percent of labor in 1970, but 50 percent in 2000. With such a sharp shift in the structure of employment also shows China also is shifting from a rural-based society to an urban-one.

The declining importance of agriculture is historically common to all developing economies. China is densely populated; farm sizes averaged less than one hectare as early as the 1950s. Population growth and limited land resources will shift China's comparative advantage from land intensive economic activities like agriculture to labor intensive manufacturing and industrial activities (Anderson 1990).

B. Agricultural Sector's Performance

The growth of agricultural production in China since the 1950s has been one of the main accomplishments of the country's development and national food security policies. Except during the famine years of the late 1950s and early 1960s, the country has enjoyed rates of production growth that have outpaced the rise in population.

After 1978, decollectivization, price increases and the relaxation of trade restrictions on most agricultural products accompanied the take off of China's food economy. Between 1978 and 1984, grain production increased by 4.7 percent per year; the output of fruit rose by 7.2 percent (Table 1.6). The highest annual growth rates came in the oilseed, livestock and aquatic product sectors, sectors that expanded in real value terms by 14.9 percent, 9.1 percent and 7.9 percent, respectively.

However, as the one-off efficiency gains from the shift to the household responsibility system were essentially reaped by the mid 1980s, the growth rate of the food and agriculture sectors decelerated (Table 1.6). The declining trend was most pronounced for grain crops. While dropping below the rate of growth generated in both the pre-reform and early reform periods, production of rice, other grains, and cash crops has continued to expand after 1985 (Table 1.6). In the meantime, rapid economic growth, urbanization and food market development have boosted the demand for meats, fruits and other non-staple foods, changes that have stimulated sharp shifts in the structure of agriculture (Huang and Bouis, 1996; Huang and Rozelle, 1998). For example, the share of livestock output value more than doubled from 14 percent to 30 percent between 1970 and 2000 (Table 1.7). Aquatic products rose at an even more rapid rate. One of the most significant signs of structural changes in the agricultural sector is that the share of cropping in total agricultural output fell from 82 to 56 percent.

Within the cropping sector, the importance of the three major crops, rice, wheat and maize, have waxed and waned. The share of the major cereal grains increased from 50 percent in 1970 to a peak level of 57 percent in 1990 and then gradually declined to less that 50 percent in 2001 (Table 1.8). Most of the fall has been due to falling wheat sown area. The area share of rice declined marginally. In contrast, the sown area of maize grew by about 50 percent between 1970 and 2000 (Table 1.8). The rise in maize area, China's main feed grain, is correlated in no small way with the rapid expansion of the nation's livestock production during the same period.

In additional to maize area expansion, other cash crops such as vegetables, edible oil crops, sugar crops and tobacco have expanded. In the 1970s, vegetables accounted for only about 2 percent of total crop area; by 2001, the share had increased by five times (Table 1.8). The area share of edible oil also grew by two to three times. Field interviews reveal that the livelihood of the poor relies more on cropping than livestock and fishery (when compared to richer farmers, see more details on this in Chapter IV). Within the cropping sector, poorer farmers produce more grains (particular maize) than cash crops. These figures might imply that the poor have gained somewhat less than better off farmers gained from the diversification of agricultural production during the course of reform period.

During each subperiod of the reform era, the output structure of agriculture also has varied among regions. Southern China produces more than 70 percent of the nation's

rice; most of the wheat is produced in northern China. Southern China has a more diversified agricultural production system than Northern China. But if we divide China into the regions based on income level (income increases from Western to Central to Eastern China), variations in agricultural output structure are less than what we observed when dividing the nation into north and south. The major differences among the more developed and less developed regions are in the fish production sector (Table 1.9). Rice, cotton, horticulture, livestock and oilseeds also vary somewhat between richer and poorer areas (Table 1.9).

Past studies have already demonstrated that there are a number of factors that have simultaneous contributed to agricultural production growth during the reform period. The earliest empirical efforts focused on measuring the contribution of the implementation of the household responsibility system (McMillan et. al. 1989; Fan, 1991; Lin, 1992). These studies concluded that most of the rise in productivity in the early reform years was a result of institutional innovations, particularly the household responsibility system (HRS), a policy that gave individual farmers control and income rights in agriculture.

More recent studies show that since the HRS was completed in 1984, technological change has been the primary engine of agricultural growth (Huang and Rozelle, 1996; Fan, 1997; Fan and Pardey, 1997; Huang et. al.; 1999a and 2000a). Improvements in technology have by far contributed the largest share of crop production growth even during the early reform period. The results of these studies show that further reforms outside of decollectization also have high potential for affecting agricultural growth. Price policy has been shown to have a sharp influence on the growth (and deceleration) of both grain and cash crops during the post-reform period. Favorable output to input price ratios contributed to the rapid growth in the early 1980s. However, this new market force is a two-edged sword. A deteriorating price ratio caused by slowly increasing output prices in the face of sharply rising input prices was an important factor behind the slowdown in agricultural production in late 1980s and early 1990s. Rising wages and the higher opportunity cost of land have also held back the growth of grain output throughout the period, and that of cash crops since 1985.

Irrigation has played a critical role in establishing the highly productive agronomic systems in China (Wang, 2000). The proportion of cultivated area under irrigation increased from 18 per cent in 1952 to a level at which about half of all cultivated land had been irrigated after the early 1990s (CNSB, 2001). However, rising demand for domestic and industrial water uses poses a serious threat to irrigated agriculture and increasing water scarcity has come to seen as a major threat to the future food security and well-being of people especially in the northern region. Wang et al. (1993) shows that the water management reform has been helping increase the efficiency of water use in north China, although the scope for such reform in the long run is somewhat limited.

Trends in environmental degradation, including erosion, salinization and the loss of cultivated land suggest that there may be considerable stress being put on the agricultural land base. Erosion and salinization have increased since the 1970s. The amount of land under cultivation has declined. These factors have been shown to affect the output of rice, other grains and other agricultural products in a number of recent studies (Huang and Rozelle, 1995; Huang et.al., 1995).

C. Agricultural Trade Performance

While agricultural production was growing fast, agricultural trade was growing faster. Agricultural trade (both imports and exports) nearly tripled from 1980 to 1995 (Table 1.10). During this time, exports have risen faster than imports. Since the early 1980s, China has been a net food exporter.

In the same way that trade liberalization has affected growth in the domestic economy (Lardy, 2001), changes in the external economy have affect the nature of China's trade patterns (Huang and Chen, 1999). Whereas the share of primary (mainly agricultural) products in total exports was over 50 percent in 1980, it fell to only 10 percent in 2000 (Table 1.3). Over the same period, the share of food exports in total exports fell from 17 to 5 percent. During the same period, the share of food imports fell from 15 to 2 percent.

Disaggregated, product-specific trade trends show equally sharp shifts and suggest that exports and imports increasingly are moving in a direction that show China's is trading goods in a manner that is consistent with its comparative advantages (Table 1.10 and Figure 1.5). In general, the net exports of land-intensive bulk commodities, such as grains, oilseeds and sugar crops, have fallen (or imports have risen). At the same time, exports of higher-valued, more labor-intensive products, such as horticultural and animal (including aquaculture) products, have risen. Grain exports, nearly one third of food exports in the middle 1980s, was less than 10 percent of what they were during most years of the 1990s. By the late 1990s horticultural, animal and aquatic products accounted for about 70 to 80 percent of food exports (Huang and Chen, 1999; Table 1.10).

However, Table 1.10 also shows that there have large variations among periods. The rapid growth of exports has halted and most of food exports have declined after 1995 due to increasing protection on China's exports. Grain (mainly maize) is one of major exception, its export rose significantly in the late 1990s and now become number 3 in terms of export values (the last column, Table 1.10). The import trend after 1995 was diverged from previous 15 years. Oil seeds (mainly soybean) imports surged from 110 million in 1995 US$ to 1.531 bullion US$ in 1999 (Table 1.10) and more than 2 billion in 2000 (BSNC, 2002), while grain import (mainly wheat) decline rapidly.

IV. Food Security Systems

A. National food security

Food security at the macro national level implies that adequate supplies of food are available through domestic production and/or through imports to meet the consumption needs of the country's population. China has experienced substantially increased its per capita food consumption over last 3 decades. Per capita food availability rose from 1717 kcal in the early 1960s to 2328 kcal per day in the year between 1979 and 1981 (Table

1.11). By the late 1990s, per capita food availability reached more than 3000 kcal per day, a level that is near that achieved in most developed countries. Hence it is clear that by the early reform period, China's food availability far exceeded the UN's minimum daily requirement of 2100 kcal (WHO standard). Given China's status as a net food exporter, when examining the rise in domestic food availability, it is clear that the increase was almost achieved exclusively through increases in domestic production.

During the same period (between the 1960s and late 1990s), other indicators of nutrition also improved. For example, protein intake and fat consumption measures on a per capita per day basis increased significantly. Protein intake rose from 45 to 84 grams. Fat consumption increases from 17 to 82 grams. Table 1.11 also shows evidence that most of the improvement in the quality of China's diet was achieved after 1980. In the early 1960s, nearly 96 percent of calories came from grains and other non-livestock products. By the 1990s, the reliance on non-meat food products was reduced to about 81 percent. During the same period, the share of calories contributed by animal products rose from 4 to 19 percent (Table 1.11). Similar trends during the past four decades can be traced out for the changing sources of protein and fats.

The diets in rural areas are also changing rapidly. In rural areas per capita food consumption increased for all products expects for maize, other cereal grains and sweet potato (Table 1.12). Decline in coarse grains consumption is expected as the income elasticities of demand for these grains are negative. While per capita rice and wheat consumptions reached the highest points between the mid 1980s and mid 1990s, the rise in the population has made the absolute level continue to rise. The consumption of meats and non-staple foods has been rising more rapidly during the 1980s and 1990s.

A different story exists in cities. In urban areas per capita grain consumption has been declining since the late 1980s (Table 1.13). At the same time, however, the consumption of meats and non-staple foods has grown. The most significant increases in demand have been for meat, fish and fruit.

Increase in food consumption has occurred almost entirely from the growth in domestic production. In 1980, China imported nearly $US 2.9 billion of food from world markets (Table 1.10). During this same year, China also exported more than $US 3 billion to the rest of world. Since that year, China has been a net exporter. Moreover, during the 1980s and 1990s, net exports of food have risen significantly. In 1999, China's food net exports reached 4.5 billion US$. Even in the grain sector in which China has less of a comparative advantage, the nation has been able to nearly achieve self-sufficiency since the 1950s.

B. Household food security

At the micro level, household or individual food security depends on a number of factors. These are related, for the most part, to various forms of entitlements to income and food-producing assets as well as to the links between domestic and external markets and the

transmission effects, from the latter, on small, low-income and resource poor producers and consumers.

Urban food security

Urban residents consumer less grain than those in rural area, but much more consumption of meat and other non-staple foods. On the average, the people in city spend more food expenditure than the villagers because the income and food prices are relative higher in urban than in rural. Significant increase in per capita food consumption has accompanied with a decline in the share of food in total expenditure because the income grew faster. The share of food expenditure decreased from nearly 60% in 1981 to less than 40% in 2000 (Table 1.13). However, these aggregate figures underestimate the urban food insecurity of the emerging urban poor in the recent years. China's urban social security system used to be designed to service a centrally planned economy. The government provided lifetime jobs and housing, health care, and pensions. This social security system has been facing great challenge since China started to reform its SOEs. The pension system also faces the problem of poor financial performance of SOEs, many of them cannot even afford to pay employees' salaries (ADB, 2002). Among urban citizens, the families with lay-off workers are the most vulnerability group.

Rural food security

Access to food in China has changed over time. In the early years of the reform, decollectivization policies gave all farm households in China a piece of land. During this time, however, markets did not function well (deBrauw et al., 2003). As a result, most farmers produced mostly for their own subsistence. Access to food was primarily through the land that was allocated to them by the state.

As China has changed, so has the food economy and nowhere has the change been more noticeable than in access to food. From an economy that was mostly subsistence, in recent years China has one of the most commercialized rural economies when compared to other developing economies (Table 1.14). On the average, the shares of marketed products in total production ranged from 54 percent for grain to more than 90 percent for fish (Table 1.14, first column). Even the poorest of the poor (column 2) also marketed all products they produced (column 3) though the rate of commercialisation is less than those of the richer. Chinese farmers have also been increasingly purchased their food from the rural market. Part of the reason that food markets have emerged in rural China is that demand for food is still strong. However, the share of food expenditure in total expenditures is still much higher than the food expenditure shares of their counterpart in the urban area. During the early 1980s, villagers spent about 60 percent of their total outlays on food. The share has fallen over time, but was still about 50 in 2000 (Table 1.12, last row). The pattern of changes across China's provinces, however, portends more changes in the future (rows 1 to 10, Table 15). Although rural consumers in poorer provinces in the western regions spend nearly 60 percent of their income on food, those in the eastern provinces spend less then 50 percent. To the extent that this continues, demand for food, at least relative to non-food commodities will become less important.

But with such high demand and with reliance on the farmer's own land for food production as well as markets, China's rural consumers still face a number of uncertainties in the access to food, the nature of which most likely differs from other countries. In other countries, production risk is often thought to be one of the most important sources of risk that will affect rural residents. In China this is likely to be less so. While China's farmers also face production risks, these may be less important relative to the importance risk in other nations. A much higher share of China's land (nearly 50 percent) is irrigated (CNSB, 2001). A higher share of households (around 80 percent) are diversified by having at least one family member in the off farm market (deBrauw et al., 2003). Giles (2000) shows that risks in China come from a number of non-traditional sources, such as wage and policy risk. With an increasing number of households relying on markets to procure their food, households also face rising market price risk.

When farmers in China are hit by adverse shocks, there are a number of ways that households cope with shock. Above all, Park et al (2003) have shown that farmers in China borrow from informal sources. Most of these loans are among family members, though friends and acquaintances also play a role. Few loans, especially for emergency consumption needs are available from formal sources. If a family is unable to insure itself from these sources, China's farmers are still able to go to the local government for help. Although the "safety net" is low in rural China, in most areas it is still there. But, it should be pointed out that the local government is really the source of support for those at the bottom of the income scale. Leaders are more than likely to try to coerce family, relatives and friends to help a farmer who is food stressed rather than provide them directly with cash or food subsidies.

In this environment of increasing marketization and rising income, household food security in China also has improved significantly over time. According to the FAO's database, household food security in China from the beginning of the 1970s (as measured by the aggregate household food security index—AHFSI--and by the level of food inadequacy) have followed closely the average levels of availability at the national level. The status of AHFSI increased from a level of 70 percent in 1969-71 (a relatively low level) to 80 percent in the middle 1990s (a relatively high level). At the same time, the food gap (a measure of food inadequacy) declined from 14 percent to 3 percent over the same period.

Data limitations prevent us from examining the progress of household food security over time for different income groups in details. On the other hand, Tables 1.4 and 1.5 already showed that the improvements in household food security can be seen by examining both income growth and poverty reduction in rural areas. Income is an important measure of food access and human health, particularly for children. Annual per capita rural real income rose by 3.31 times over 1980-2001 (Table 1.4).

Poverty is the major causes of undernutrition, and therefore, food security. From this point of view, improvements in household food security situation can also be shown by examining the reduction of poverty that has occurred in China during the past 20 years.

The number of absolute poor has declined from roughly 260 million in 1978 to 34 million in 1999. The poverty rate has fallen from more than 30 percent to less than 4 percent of the total rural population.

Stability of food supplies and access of food by the poor are the other dimensions of food security. In this regard, the government has developed its own disaster relief program. It also runs a national food-for-work scheme, although this is less for disaster relief and more for more long-run investments. The nation's capacity to deal with emergencies has been demonstrated repeatedly during the reform period. For example, the government responded massively and in a timely fashion during the floods in 1990s. The way the government handled the situation was highly commendable (WFP, 2000). Through these types of action, China's government has proven that its capacity to deal with the consequences of natural disasters is adequate. During the 1980s and early 1990s, one of the major constraints that affected the stabilization of food supply in China was the poor marketing and transportation infrastructure (Nyberg and Rozelle, 1999).

Other Issues

Although the nutrition of the population has improved, malnutrition remains, particularly in China's inland and poor areas (World Bank, 2001). Children are among the most vulnerable and affected groups. Food consumption and expenditure surveys in 1995 show that 39 percent of children that are under five years old in rural China were stunted and 18 percent were underweight (WFP, 2000). By income group, almost half the stunted children in urban areas and 75 percent of those in rural areas were in households with a per capita income below 500 yuan (or in household below the poverty line). Iron, vitamin A and D, iodine and other micro-nutrient deficiencies remain a severe problem among the poor. Energy intake by the poorest (bottom 10 percent) was only about 82 percent of the level of the sample average. A similar pattern is also shown for protein and fat intakes.

Data availability on drinking water, public health programs and farmer education has kept us from being able to analyze the impact of these factors on the health status of individuals. Recent works on China's rural poverty by World Bank (2001) and UNDP, however, ask that the government make a greater effort in improve drinking water quality, expand public health programs and improve education programs in rural areas, particular in the poor regions.

CHAPTER TWO: THE REFORM EXPERIENCE

To understand in greater depth the policy initiatives that have helped create China's agricultural economy and the environment within which the nation is trying to achieve a degree of food security (i.e., the issues that we examined in the previous chapter) in this chapter we discuss China's major reforms. We examine the reform strategy by looking at its various components, their implementation and the objectives of and rational for each reform component. We also examine how the reforms have affected agricultural trade and trade-related reforms, and how the changes in trade policies might have influenced China's food security.

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 (Brandt et al., 2002). 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 (Lin, 1992; Huang and Rozelle, 1996). 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 (Brandt et al., 2002). 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 (Johnson, 1995). 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 (Zhang et al., 2001). 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 (Huang, Rozelle and Hu, 1997). 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 (Stone, 1988). 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 (Huang and Rozelle, 2003). 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 (Xiao and Fulton, 1997). 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 (Xiao and Fulton, 1997; Ye and Rozelle, 1994). 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 (Xiao and Fulton, 1997). 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 (Huang and Rozelle, 2003).

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 (Hu, 1995). 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 (Huang et al., 1997).

Over the past several decades, Ministry of Agricultural officials have developed a number of rules and regulatory institutions to administer the seed industry (World Bank, 1996). 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 (Rozelle et al, 2000). 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 (Pray et al., 1998). 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 (Huang et al., 1997). 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 (Huang, Rosegrant and Rozelle, 1996). The shift from the collective and household responsibility system also raised the price responsiveness of farm-households (Huang and Rozelle, 1996). 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 (Rozelle et al., 2000).

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 (Huang and Rozelle, 2003).

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.[1] 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

[1] "Rice" in China, sometime, meat staple food. "Rice Bag" here includes rice, wheat, maize and soybean.

1994 to 22% in 1996, being driven by the profits that traders could earn by shipping grain from low to high priced areas (Huang et al., 2003).
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.[2] 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 (Huang, 1998; Lu 1999). 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 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

[2] 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.

it had risen to 79 percent and by 1999 to 83 percent. Transaction costs have fallen while the degree of integration has risen (Park et al., 2002). 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 (CCAP, 2002). 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 (Huang et al, 2001). 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 (CCAP, 2002).

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. Table 2.1 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 (Table 2.1). 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 (Nyberg and Rozelle, 1999). 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 (Nyberg and Rozelle, 1999). 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 (Table 2.2).

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 (Park and Wang, 2001).

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 (Huang and Rozelle, 2002). 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 (Table 2.3, 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 (Table 2.3). 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 (MOFTEC, 2002). 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 (Table 2.3, column 3). Since agricultural products are generally tradable, agricultural incentives may be expected to increase with real depreciation of the domestic currency.

Table 2.3 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 (Table 2.3). 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. Trade policy

The effect of foreign exchange policy has not been the only important change in the trade environment. The 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).

Changes in trade and domestic marketing policies have resulted in dramatically shifting trade patterns. Agricultural exports and imports have both soared (see previous Chapter). Huang and Chen (1999) also that the net exports of land-intensive bulk commodities, such as grains (except for maize), oilseeds and sugar crops, have fallen; while exports of higher-valued, more labor-intensive products, such as horticultural and animal (including aquaculture) products, have risen. The proportion of grain exports, which was around 20 percent of total agricultural exports in the 1990s, is less than half of what it was in the early 1980s. By the late 1990s horticultural products and animal and aquatic products accounted for about 80 percent of agricultural exports. These trends are even more evident when reorganizing the trade data grouping them on the basis of factor intensity.

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 rate has been low, leaders have not allowed the importation of grain 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 manage the imports of edible oils. 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 grains, particular maize, still is minimal (Huang and Rozelle, 2003). 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.

H. 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 (Stone, 1988).

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 (Jin et al., 2002). 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.[3] It is possible that imperfections in the seed industry partly contributed to the ineffectiveness of research reform measures in crop breeding.

I. 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, soybean and Barley) will become part of a tariff-only regime (Table 2.4). 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

[3] 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.

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 2.5, 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.

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 substantially in the first year of accession and fall further between 2002 and 2005. But, 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 2.5).[4]

After the first four to five years of accession, a number of other changes will take place. For example, after 2006, China agreed to phase out its TRQ for edible oils. But 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 2.5). 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.

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).

[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.

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 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.[5]

J. Other Policies and Impacts – Rural Incomes and Employment

A full discussion of rural income and employment is in Chapter IV.

[5] 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.

CHAPTER THREE: THE IMPACT ON AGRICULTURAL PRODUCTION AND TRADE

A. Commodity Selection

In an earlier chapter, we discussed how China's various regions differ in terms of its climate and natural resources. A dominant crop in one location could be a minor crop in the other part of the country. For example, rice is one of the major crops in South and Northeast China; it is only a minor crop in North and Northwest China. Since there is such great regional heterogeneity, therefore we need to select a broad basket of commodities for this study that cover most of the crops and animal products that are significant in all of the important agricultural production regions in China. In order to make the analysis manageable, however, we classify all commodities into 11 crop or crop-groups and 7 livestock-product groups. The crop groups include those for rice, wheat, maize, sweet potato, potato, other course grains (millet, sorghum, barley and other minor coarse grains), soybean, cotton, edible oil crops, sugar crops (cane and beet) and vegetables. This bundle of crops accounts for about 90 percent of the total cropped area in China. Our group of livestock products includes pork, beef, mutton, poultry, egg, milk and fish. Fish include marine and fresh water fish that are either caught or raised in aquaculture fisheries. Ideally we should include fruit since its role in production, consumption and trade has increased sharply over the reform period. Lack of data and the extreme heterogeneity of the sector, however, make it difficult to quantitatively assess the impacts of trade liberalization and other reforms.

Even with these groupings, however, in many of our analyses, there are still too many commodities. As a result, the presentation of our commodity analyses, we show only those results for commodities that have relative large impacts from trade liberalization and ignore others. For example, the impacts on some commodities, such as eggs and milk, are aggregated into the figures representing a total impact, but are rarely shown or discussed separately.

B. Methodology and Scenarios Formulation

An Overview of the Methodology

In order to evaluate the impact of domestic reform and trade liberalization on China's agricultural price, production, consumption, trade and food security in China, 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). Appendix Table 3.1 in Appendix A provides supply elasticities matrix for crops in 2001.

In the projections or policy simulation, prices can be determined endogenously or exogenously for all crops with the exception of cotton. 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). A brief description of the model is provided in Appendix A.

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 and generate a new set of assumptions for the current analysis in order to assess the impacts of actual reform and trade liberalization during the past two decades on *past* supply, demand and trade. We also had to modify the original model in order to allow us to disaggregate the national impacts into household production, consumption and food security at the regional level and to assess the impact that trade liberalization has had on households in different income groups. 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 (1984-2001) at the national level;
2) Collection of a database on all commodity prices at border (CIF for importable and FOB for exportable);
3) Generation of a database for household food consumption, production, farmgate prices of agricultural products and procurement prices of foods by income group and by region. Our original database is from CNSB and is for 1999. In order to link this unique database with CAPSiM, we estimated a similar household database (that was also disaggregated by income group and region) in 1985 by transforming the 1999 household data. The transformation was made by dividing the 1999 production, consumption and price levels for each subgroup by the changes that occurred at the national level between 1985 and 1999. With this new (estimated) household database in 1985, we then apply CAPSiM to simulate how supply, demand and prices change over time due to the changes in trade (or trade policies);
4) Estimating a set of demand and supply elasticities for the entire period of reform. Income elasticities of demand for various foods decline over time. Appendix Table 3.2 presented income elasticities of demand for foods in rural and urban China in 1986-2000;
5) Separating the impacts of trade from other impacts (see more discussions later);
6) 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 the reform period; and

7) Testing market integration and price transmissions from national to regional and households, and use the findings of these analyses to justify the results of impact studies based on CAPSiM simulations, which assumes a full market integration and price transmission among regions.

Scenario Formulation

Using our new trade analysis framework, we attempt to explain the effects of trade reforms that occurred in the past two decades on the agricultural economy during this time. In other words, our analysis is backward looking. Data limitations prevent us to going back beyond the mid 1980s. The analysis of impacts of WTO accession in 2002 on China's agriculture in the future is somewhat beyond the scope of this study. However, for the completion, the likely impact of China's WTO accession on rural incomes and employment are reported separately in Appendix B.

The reform experience discussed in Chapter II shows two salient characteristics of trade and other policy reforms. First, trade liberalization has been occurring simultaneously with a number of domestic economic reforms and both have affected the performance of agricultural sector. Second, both external and domestic policy reforms have been implemented gradually, but continuously over past two decades. Because of this gradualism, we can think of no obvious policy regimes based on sub-periods of time during the reform era.

Among all agricultural commodities, however, the grain sector, although it also followed gradualism, presented a slightly different reform pattern (a stop and go). As we discussed in Chapter II, in the second half of 1980s, market reform focused mainly on domestic grain procurement that significantly reduced compulsory quota procurement. In the early 1990s, while the reform in grain procurement continued smoothly, the focuses of reform changed to liberalize urban grain selling market. By the middle 1990s when China's grain procurement and sale markets were nearly liberalized, China shifted from heavily taxing to subsidizing grain production through changing its procurement prices. By the late 1990s, China has started to consider the elimination of procurement quota and the payment of subsidies to farmers and traders.

On external policies, while grain trade has been fully operated by the state-owned enterprises (COFCO) since the early 1980s, a significant shift in maize and soybean (soybean is considered as grain in China) trade policy was occurred in the late 1990s (see Chapter II for details). That is, on one hand, soybean has been nearly complete liberalized, but on the other hand, maize protection has increased through export subsidies since 1998. Hence, although we can not identify specific sub-periods that are identified with certain reform regimes for the whole agricultural sector, we simply divide the reform period into three sub-periods largely based on grain economy. They are 1985-1990, 1991-1995 and 1996-2000.

In addition to the time dimension, we need to how break the impacts of trade and other policies on the economy (i.e., production, consumption, and price). When a country is a

complete closed economy, any policy change has no impacts on trade. Trade response is null. When a country is a complete open economy, any change in either external or internal policies has impacts on trade and domestic economy. China's 25-year reform has dramatically changed the way its economy operated, which has moved its economy from a nearly closed economy in the early 1980s to a more market-oriented open one by 2000 (the end year covered in this study). Because the degree of openness of a country's economy determines how external and internal policies have impacts on trade and domestic economy, quantitatively modelling the impacts of trade policy changes on domestic economy and international trade requires changes in response functions of import demand and export supply over time. On the other word, to evaluate the impacts of trade policy changes on trade and domestic economy, we need to estimate import and export functions for each time period, which requires a much more sophisticated methodology and database and is beyond the scope of this study.

Alternatively, we examine the following three key questions: 1) how trade and domestic polices have affected agricultural trades; 2) how trade changes have impacted domestic economy; and 3) how economic changes have been contributed by domestic policy.The trade policies include those policies that have explicit and direct connection with external trade (i.e., tariffs, export subsidies and tax rebates, state trading and other non-tariff barriers, foreign exchange control, etc). Domestic policy have impacts mainly on domestic economy, but may also have indirect impacts on trade as they affect excess demand or supply of agricultural commodities. These policies include domestic policies on research, investment and market development, plus any other "shocks" to the domestic economy (e.g., from income or population).

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:

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

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

where *d* denotes the difference that occurred during the time period; subscript *A* refers to trade policy and *B* refers to domestic policy. . In our analysis, we assume that all changes in any of our outcome variables of interest can be precisely portioned into those due to trade changes and domestic policy (note, domestic policy also has indirect impacts on trade as discussed above).

We will simulate the effect of trade on the economy, by examining the effects of changes in imports or exports. To do so, we let *Xt* be the volume of trade in time *t*. We assume that if leaders in China change their trade policies, 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, we believe that at least during the past 20 years, most of the changes in *X* capture the impacts of trade and trade related policy changes.

Given these assumptions, the impacts of trade changes and trade liberalizing reforms on the economy are fairly easy to analyze with our new 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:

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

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

Scenario I is used to simulate the economy in which trade changed over time. 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 three five-year periods between 1985 and 2000, 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 1985 level during the entire study period (from 1985 to 2000).

To quantify the impact of trade, we can use CAPSiM to simulate separately the economy when the conditions imposed in either condition (3.2) or (3.3). 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:

(3.4) $dY_{At} = dY_t^I - dY_t^{II} = dY_{At}\big|_{dXt = Xt - Xt-1 \neq 0} - dY_{At}\big|_{Xt = Xt-1 \neq 0}$

In other words, equation (3.4) calculates the impacts of trade on Y_t in *t* over *t-1*. If we know the actual changes, we can then use equation (3.1) 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 policy. In other words:

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

In summary, then, to simulate the impacts of trade changes on production, consumption, and price, two scenarios are formulated based on conditions (3.2) and (3.3). To implement these changes, we impose these restrictions on the CAPSiM model. The simulations will then generate the impacts of trade a on price, production and consumption.

Following this logic, in the rest of this chapter, we first explain changes in the levels of agricultural exports and imports for the commodities studied in this project as the results of trade and other policy reforms. Second, the impacts of the changes in the trade on domestic agricultural prices are examined. Finally, the responses of producers and consumers to these prices changes due to trade are analysed. In each sub-section, we also

attempt to explain changes in agricultural production, consumption and prices and the sources of these changes by trade reform and all other factors (of the actual changes). The effect of trade policies can then be netted out.

C. Changes in Agricultural Protection and Trade

The first step in analyzing the impact of trade reform on agricultural production, prices and consumption in China is to understand how protection has changed over time. An aggregate measure of protection (that is, an index that measures the combined distortion from all policies) can be generated by comparing China's domestic prices with international ones. The measure that we use is called the nominal rate of protection (NPR). The analysis in the case of China, however, is a bit more complicated since during the past 20 years as China has reformed, it has had several prices—a quota price; a negotiated price; and a market price. Hence, three different measures can be calculated. Table 3.1 shows the protection of cereals and soybeans when we use the quota, negotiated procurement and wholesale market prices since the early 1980s. Table 3.2 uses only market prices (or the state administered price in the case of cotton) to show the protection of cotton and livestock products during more recent years.

Based on this analysis, it is clear that for most of the early reform period the requirement that farmers submit a mandatory delivery quota of grain and soybean at below market prices has represented a lump-sum tax on farmers and lump sum subsidy to the urban consumers who were able purchase grain from state rationing outlets at below-market value (Table 3.1). Before the middle 1990s the average price farmers received for compulsorily delivered grains and soybean was far below the border price. Although all of China's major crops were affected by the state grain quota procurement policy, wheat, the nation's main imported farm commodity, in most periods received favorable treatment relative to rice. For example, in the early 1990s, its rate of taxation, or negative protection (-14), was less than that for rice (-37—row 4). The same bias appears in the other price categories (columns 5 to 12). The bias is even larger than shown by the within price category comparisons, since a higher proportion of rice production is procured at the low quota procurement price than that for wheat, maize or soybean (Huang, 2001). In the late 1990s, however, there has been a marked change in the rate of protection. Quota prices moved closer to border prices and in some cases (wheat and maize) rose above. Examining China's NPRs based on negotiated procurement and market prices between 1995-99 and 2000-01, except for the case of rice, China's domestic prices have begun to rise above the border price.

Interestingly, the case of livestock is markedly different (Table 3.2). In all period, for all major commodities, pork, beef and chicken, the NPRs are negative. Meat producers have received less they would have if they could have sold their output on domestic and world markets at international prices.

When examining the NPRs for almost all commodities over time, as discussed in an earlier chapter, we can see the experience of China's agricultural trade policy. In the late

1970s and in the early 1980s, the domestic wholesale price of China's four major commodities all far exceeded the world price (measured at China's border—Table 3.1). For example, China's rice market price was 10 percent above the world market price (row 1). The nation's wheat and maize prices exceeded the world price around 90 percent. However, over the next two decades, the protection rate on rice became negative and that for wheat and maize fell to around 30 percent (row 6).

The driving force behind this fall in protection has been the gradual but sustained effort in the implementation of trade liberalization policies over the past two decades (Martin, 2002; Lardy, 1995; Chapter II). Published agricultural tariff rates fell from more than 40% in the early 1990s to only 21% in 2001. Assessed tariff rates have fallen more. During this time period, the intervention by state traders and the use of NTBs also gradually fell (see Chapter II). In the case of some commodities, there has been a sharp rise in the number of trading firms—both exporters and importers. China has tried to gain access to markets outside of China for some commodities. In sum, distortions have declined significantly in the past 20 years, and based on the timing of China's trade policy efforts, much of the falling protection appears 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, the relaxation of real tariff rates at the border and changing quotas (Huang and Chen, 1999; Huang and Rozelle, 2002).

One immediate effect of falling protection has been the shift in trade patterns that China has experienced. For example, except for rice in the late 1980s and pork in recent years, exports of exportable commodities (including, rice, vegetables, pork, poultry and fish) have increased substantially since the late 1980s (Tables 3.3 and 3.4). In contrast, imports of most importable commodities (including, coarse grains, soybean, edible oils, cotton and sugar--except for late 1990s--and milk) have risen over the same period.

Although Tables 3.3 and 3.4 reveal the general trends for each of the commodity groups, in fact, within some of the groups there is heterogeneity among commodities in terms of their trade patterns and that shocks in the economy have also affected imports from time to time. For example, in addition to the rising levels of rice exports, China also imports some rice. The imported rice varieties, however, are different than the exported varieties. Traders import certain high quality varieties, such as Thai Jasmine, that are not available inside China. The quantity of imported rice, however, has been small, averaging less than 0.3 metric million tons (mmt) annually in the 1980s and the early 1990s. The increase in rice imports in the mid-1990s occurred because of rising domestic rice prices and the fear of grain shortages that led to grain export restrictions in 1995 and 1996. Despite these aberrations, however, rice exports show a general rising trend over time, except for the late 1980s. Exports reached a historical high (3.74 mmt) in 1998.

Vegetable, fish and most of livestock commodities also have become the major exportable products from China's agricultural economy. Trade reform has resulted in a large expansion of vegetable (Table 3.3) and fish (Table 3.4). Most of these commodities are being exported to East Asia, Southeast Asia and other international market. Since the

early 1980s, exports of these commodities have nearly doubled every five years. Pork, one of the largest of China's exportable livestock commodities traditionally, expanded steadily from the early 1980s until the mid-1990s. In recent years, however, growing international concern on meat quality and other Sanitary/Phyto-sanitary (SPS) concerns reduced China's pork exports in the late 1990s. Poultry exports, in contrast, grew steadily through the late 1990s. The rising trends made poultry China's top livestock export product. Annual export of poultry reached 0.3-0.4 mmt recently. Interestingly, because of taste preferences inside and outside of China and favorable price ratios, the nation not only exports poultry meat, such as chicken breasts, it also imports significant amount of specialty parts (e.g., chicken feet). Among three main livestock commodities, beef is among the least traded commodities, at least in recent years. In part, the small volume of beef trade is related to the China's livestock structure where beef accounts for less than 5% of the livestock economy in value terms.

At the same time that China has been developing export markets for horticulture, fish and livestock products during the past two decades, it gradually has been increasing imports of a number of crops (Table 3.3). While China has been a net importer of soybean in most years during the past two decades (importing, on average, from 0.5 mmt to 1.3 mmt), soybean became the top ranked imported commodity in China after the mid-1990s. Most of the rise in imports can be traced to external policies that have liberalized soybean trade since the late 1990s (Huang et al., 2003). By 2001, China imported nearly 15 mmt of soybean to meet their increasing domestic demand. Trade liberalization also has affected imports of edible oil. When examining the affect of trade liberalization on imports and the rest of the economy, the trade patterns of soybean and edible oil are particularly important to understand.

Although from a net protection stand pint, maize and cotton appear to be importable commodities, their trade patterns behave differently (Table 3.3). Even though the world market price of maize is lower than that of China, the nation has been a net exporter of maize during most years since the mid-1980s. Unsurprisingly, this can happen only because China has maintained monopoly control over maize imports and exports (Lardy, 1995). The patterns also can be explained by the fact that China's leaders have used export subsidies to increase exports since the late 1990s (Huang and Rozelle, 2002). Export subsidies have increased and reached one third of maize export price in 2001. Because of these heavy interventions, maize is one of the few major crops that have not experienced falling NPRs since 1995.

Although China has also been one of the world's largest wheat importers during the past two decades, the nation has shown a tendency in the past to protect wheat farmers. Annual imported wheat averaged at about 10 mmt before the late 1990s (Table 3.3). Wheat imports, however, have exhibited a sharp cyclical pattern of imports, increasing for three or four years before declining for three or four years. Rozelle and Huang (1998) believe that this pattern closely follows the way leaders intervene into wheat trade and slowed down the growth in domestic demand.

In sum, despite the fact that policy distortions of external trade for some commodities are still high, and in some cases have even increased (or not fallen over time), overall trade liberalization has continued gradually during the past 20 years. In aggregate terms, as we have already shown in Chapter I, Table 1.10, both imports and exports have been rising during past 2 decades. Total trade in the food sector increased more than 3 times between 1985 and 2000 (Table 1.10). Because the share of agricultural commodities that China trades with the rest of the world is so small (especially when we compare the volume of food trade of China with the volume of food that moves through its domestic), we should not be surprised that trade does not have a large impact on domestic prices. As we will show in the discussion below, however, having a small impact on prices does not mean that trade will not affect domestic production and consumption.

D. Price Analysis

Domestic price changes can be driven by many different demand and supply shifters, as was discussed in Chapter II. For example, population rise, income growth, urbanization and food market development have affected food demand in China (Huang and Bouis, 1998; Huang and Rozelle, 1998; Fan et al., 1995). On the supply side, other factors, such as institutional reform, technology change, irrigation expansion, marketing reforms and other policy changes, have affected production (Lin, 1992; Fan, 1991; Huang and Rozelle, 1996; Huang et al., 1995).

To empirically simulate how trade and domestic policies have affected domestic agricultural prices, we use CAPSiM with the data and methodology described above. The results of the simulations are summarized in Tables 3.5 and 3.6 for major commodities. To calculate the figures in the two tables, we use wholesale prices in real 2001 yuan and examine price differences in percentage terms across three sub periods: 1985-1990, 1990-1995 and 1995-2000. As shown in equation 3.1, we decompose the price changes into trade changes and domestic policy in each period.[6]

According to our analysis, the prices for nearly all crop and livestock commodities have exhibited an up and down trends (Tables 3.5 and 3.6). In the case of most commodities, prices increased steadily between the mid-1980s and mid-1990s. After 1995, however, the price for all commodities (except coarse grains) declined.[7]

While the overall trends are the same, the source of the change differs among crops and livestock commodities (Tables 3.5 and 3.6). To show this, we use equation 3.1 to

[6] CAPSiM has all demand equations for all commodities included in the model except for cotton demand as textile industry is not modeled within CAPSiM framework. Consequently, the impacts of reforms on cotton prices were not estimated, the part of impacts of reforms on cotton was estimated through cross-substitutions among crops. Trade in both sweet potato and potato are very insignificant, but we report the results of sweet potato because trade has significant affected maize and other feeds that could have implications for demand for sweetpotato as feed.

[7] The two exceptions are vegetable and sweet potato. The prices of the vegetables have been declining since 1990 as a result of significant and continuous expansion of sown area over time. The of sweet potato declined after the late 1980s due to large shift away demand for sweet potato as food in consumption and increasing substitution of maize for sweet potato as feed in hog production (Huang et al., 2003).

decompose the price changes in each period into the effect from international trade shifts and the impacts from reform of domestic policies. As expected, the fraction of the overall effect that is due to domestic economic reform far exceeds the share of domestic price change due to trade changes (columns 4 and 5). This result is consistent with the fact that the changes in the volume of trade (mainly trade policies but also partial domestic policy) for most of the commodities studied have been more modest than the changes in domestic production and consumption (that have arisen from domestic policies, investments, income changes, and relative price shifts). On average, while the direct impacts of domestic policies account for 95 percent of the change in price, trade only accounts for at most 5 percent (average prices changes are computed from individual price changes with their shares of output as weight) since the changes in trade is also partially due to the domestic policies.

While the pattern over time for all commodities are remarkably similar, the extent of price changes due to domestic reforms and trade vary significantly among commodities (Tables 3.5 and 3.6). For example, for the commodities with only small volumes accounted for by trade (either import and export), such as rice, sweet potato, minor coarse grains, vegetables and all livestock products, although trade liberalization has affected domestic prices, the extent of impacts are much less than the domestic economic reforms (see section G below for more fuller discussion). The story changes, however for some of the commodities that has begun to be actively traded on international markets during the past two decades. For these commodities, trade liberalization has become a major source of domestic price changes. For example, after China significantly reduced tariffs and eliminated non-tariff barriers for soybean after the late 1990s, imports of soybeans surged from less than half MMT in the middle 1990s to more than 10 MMT annually in 1999/2001. Soybean imports reached 14 MMT in 2001, which nearly reached the level of domestic production. The provision of soybean supply from domestic markets since the late 1990s fell sharply with the large fall in price. Indeed, as our analysis shows, soybean price would have declined even more if domestic production had not slowed. The increase in price due to demand increases resulted from income growth has been lower than the price decline due to trade since 1995.

Maize provides the other interesting case to examine the effect of trade policy when leaders decide to continue to offer protection to domestic production. Despite of a positive protection rate for maize, China has exported maize during most of the 1980s and 1990s. For example, China exported 3 to 5 mmt of maize annually before the mid-1990s (Table 3.3). To do so, leaders have had to offer an export subsidy. Rising export subsidies since the late 1990s have actually induced China to increase its presence in international markets. Exports reached nearly 7 mmt in 1999/2001. Table 3.5 shows that maize domestic price would have declined by 46 percent in 1999/2001 over the middle 1990 if China would not provide export subsidy program. Instead it only fell by 31.76 percent.

The direct impacts of domestic policies also can be seen in Tables 3.5 and 3.6. For example, the marketing reforms prior to the mid-1990s (as discussed in Chapter II) have reduced the tax burdens of grain farmers and also reduced the subsidies for food for the

urban consumers. Domestic price rose in both periods of 1985-1990 and 1990-1995 (Table 3.5). The retrenchments in grain market policies, particular re-imposing grain quota procurement system, raised grain production and increase domestic grain stocks substantially (Huang and Rozelle, 1999). Consequently, market responded with falling in price (Table 3.5). For rice, although China increased its export in the late 1990s (Table 3.3), net export increase was only about 1% of production in 2000 over 1995. Trade did help China's rice price to rise by 3.12 percent in 2000 over 1995. Slow down of both farmer income and population growth in the late 1990s depressed domestic demand for rice. Meantime, retrenchment grain marketing policy that also tried to pull price not falling down resulted in oversupply of domestic rice production, which caused a net decline of rice price by about 41 percent in the same period (4rd row, Table 3.5). The same pattern of the impacts of domestic market policy on the prices of wheat and maize were presented (the last column). But in wheat case, China has tried to hold wheat price not falling as much as it could through decline in wheat import.

China's trade reforms have affected livestock prices much less than in the cropping sector (Table 3.6). The relatively light impact occurs mainly because the change in net exports as a share of total domestic production is insignificant. As a result, the changes in domestic prices are largely determined by domestic demand and supply balances. Before the mid-1990s, despite the fact that there was substantial growth in livestock production, the demand growth was even faster—particularly as income and population grew. As a result, market prices rose by about 30% every five year for pork and 40 to 50% for mutton. Poultry price increased much less than other livestock because its production growth was relatively faster.

E. Market Integration and Price Transmission

While important in determining the size of the average price impacts at the national level, the impacts on farmers in different regions depend not only on the average impacts, but also on the size of the area across which it will be felt. This second factor, in turn, is a function of the size and nature of China's market. If large areas of the country are isolated from coastal markets where imports land, then the effects of trade may be circumscribed to restricted parts of the country and should not be expected to have highly adverse impacts on the poor who are largely located in inland areas far from major urban centers. While being isolated from negative shocks is a plus, there is also a cost. Those living in poor, isolated areas also would not benefit from the price rises and opportunities to export. However, if markets exist that link together distant regions with the coast and price changes in one part of the economy quickly ripple through the economy, even though imports are infused into (and exports flow out of) areas concentrated around a few large coastal cities, they could have ramifications for poor households thousands of kilometers away.

To assess how integrated and developed markets in rural China were in our study period, we first describe the data. Then, we test for integration and conduct direct tests of how well prices in different markets move together and if prices are integrated between the market town and China's villages.

Data

The data come from a unique price data set collected by China's State Market Administration Bureau. Nearly 50 sample sites from 15 of China's provinces report prices of agricultural commodities every 10 days. The prices are the average price of transactions that day in the local rural periodic market. We examine rice, maize, and soybean prices from late 1995 to 2000 (except for maize that was only available through 1998). The assessment of market integration before 1996 is based our previous studies for the same commodities (Park et al., 2002). The three crops are produced and consumed in nearly every province in China.

Rice price data are available for 31 markets. Because of quality differences among rice varieties in different regions of China, we look at price integration between markets within four regions, South China (South), the Yangtze Valley (YV), the North China Plain (and Northwest China--NCP) and Northeast China (NE). For the provinces included in the sample, rice prices are available for over 90 percent of the time periods. Prices for maize and soybean data are available for 13 and 20 markets, respectively.[8] Product homogeneity makes it possible to include a broader geographic range of buyers and sellers in a single analysis, and we are able to assess the integration of markets spread out over 1000s of kilometers. We compare these results to results from 1988 to 1995 that were produced with the same sources of data and published in Park et al. (2002).

Price trends

To show how prices change over time and differ across regions, we use maize as an example. Figure 3.1 shows the trends of maize prices in the selected local markets in major producing provinces (Liaoning and and Shandong) and consuming provinces (Guangdong and Sichuan). The data presented Figure 3.1 are maize prices that are reported every 10 days by enumerators that are visiting rural wholesale markets. Although maize prices fluctuate across seasons, they follow a general declining trend between 1995 and 2000. Moreover, the annual price variation has fallen and the price gaps between producing and consuming regions have declined over time. Huang and Rozelle (2002) find that not only maize prices but all other grain prices, including rice, wheat, and soybeans, have moved together across far reaching localities within China. Similar changing trends were also founded for beef and pork (Figures 3.2 and 3.3) though the data presented in Figures 3.2 and 3.3 are in more aggregated level (annual and by province).

Integration tests

[8] Since we use data over time, we need to convert prices to a real basis. Nominal prices from our data set are deflated using monthly consumer price indices calculated and reported by the China National Statistical Bureau. Deflation facilitates transaction cost comparisons across time and allows us to disregard transaction cost increases within periods associated with inflation.

We use cointegration statistics to test market integration. Cointegration statistics measure the proportion of movement in one price that is transmitted to another price during the period of observation. The coefficient on the "causing" price is bounded between 0 and 1, where 0 indicates that there is no impact on the "affected" price variable (and markets are not integrated), and where 1 indicates that markets completely adjust within the analysis period. A coefficient inside the 0-1 intervals indicates that prices adjust only partially within the period of observation (or that markets are integrated but frictions slow down price transmission). Two markets are cointegrated if the coefficient is not different from one at a 5 percent level of significance.

Using the results from the early 1990s as a base line, our current analysis shows that during the late 1990s, China's markets continued along their previous path of maturation, markets in China are remarkably integrated. In the late 1990s, examining the co-movement of prices between pairs of markets in our sample, we see a large increase in the number of integrated markets. In the case of maize, for example, in 89 percent of the cases, prices in one market move at the same time as in another (Table 3.7, column 2). This is up from only 28 percent of the time in the early 1990s. The number of pairs of markets for soybeans, japonica and indica rice show similar increases (rows 2 to 4). The integration of these markets is notable because in many cases, the pairs of market are separated by more than a 1000 kilometers. For example, we find prices in almost all years to be integrated between markets in Shaanxi and Guangdong provinces and between those in Sichuan province and southern Jiangsu.

Despite the significant progress in terms of integrations, our results do also show that there are pairs of markets during different years that are not integrated. For example, in one third of the cases, japonica rice prices moved in one market but did not in another. The case of indica rice trade is even more notable. In the case of more than half the time (and places), prices do not move together in China's indica rice producing and consuming regions. While one explanation for such a result is that there is some kind of institution (policy or infrastructure/communication) breakdown that is creating China's fragmentation, as shown in Park et al. (2002), it is also the case that since every province in China has rice production and consumption, if during a certain year in a certain area, supply in that region is just equal to demand, moderate price movements in another area may not necessarily induce a flow into or out of the region that is in equilibrium. Even with the non-trivial number of cases in the late 1990s in which market prices in pairs of markets do not move together, based on each of the market performance analyses, one must conclude that the impacts of trade on China's agriculture has been experienced across wide regions of the nation from coastal to inland areas in the late 1990s. However, this is only half of the story. While the above analysis demonstrates a remarkable degree of integration between markets on the coast and those inland, such an analysis 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.[9] Our regression analysis clearly shows markets in China are integrated down to the village level (Table 3.8). 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. 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 do 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 Chapter IV. 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 were largely transmitted into different regions except for most remote areas in China.

F. Changes in the Level of Production

In the previous section, our analysis demonstrated the impact of economic and trade reform on trade and domestic prices, and how prices might be transmitted within China. The shift in prices means that the incentives of agricultural producers will change. In this section, we analyze the impacts that trade-induced price shifts will have on production at national level. As before, we decompose the production impacts into trade and domestic

[9] The data for this study were collected in a randomly selected, nearly nationally representative sample of 60 villages in 6 provinces of rural China (henceforth, the China National Rural Survey—CNRS). 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).

policy reforms. Past studies have well documented the impacts of domestic reforms on agricultural production (i.e., McMillan et al., 1989; Lin, 1992; Fan, 1991; Huang and Rozelle, 1996). However, none of these studies has analysed the impacts of trade on domestic production.

Although previous studies have largely been unable to measure the effect of trade liberalization on agricultural production, they have provided useful information for us to formulate some hypotheses that need to be tested empirically—especially about the effect of domestic non-trade reforms. Most previous studies have shown that farmers respond to prices though the responses are gradually and moderate (i.e., deBrauw et al., 2002). Because the impact of trade is mainly on domestic prices, we should expect that they also would have impact on domestic production. More important, previous studies have shown that domestic reforms have had a similar set of effects (i.e., positive or negative) on the production of most if not all commodities. For example, if a policy (e.g., decollectivization) has a positive impact on the production of rice, then typically, there has also been a positive impact on the production of other crops. These cross commodity common effects occur because many domestic policies are not commodity-specific but are applied to the entire agricultural sector.

Unlike sector-wide policies, trade or trade policies are unique in that they frequently change the relative prices of domestic food commodities because the impacts of trade policy differ among commodities. In general, trade liberalization normally stimulates domestic production of sectors that are producing crops in which the nation has a comparative advantage while dampening those in which producers do not have an advantage. As a result, trade policies can lead to different impacts, sometimes negative and sometimes positive. Moreover, because most of the commodities are competing for domestic resources, such as land, labor and capital, cross-commodity substitutions could result in a policy targeting one commodity having an effect on another. However, if the domestic policies with sector-wide effects resulted in impacts on production or consumption with similar results for many competing commodities, then even if the real domestic prices changed significantly (as we show in Tables 3.5 and 3.6), domestic productions might not change as much since the own-price response might be off set by a series of cross commodity substitutions. So, it is possible that although we would expect that domestic reforms may be the major source of production growth and the impacts of trade on domestic prices may be small for many commodities, the effect of trade reforms on domestic production through its pattern of price changes might not necessarily be so small.

Tables 3.7 and 3.8 present the results of our simulations as in equation 3.1. The analyses show that trade has affected domestic production. Overall, as expected, the impacts of trade are smaller than those caused by domestic policy changes. Moreover, the signs of impacts due to trade policy changes and domestic economic reforms are also as expected. The production impacts can be associated with the trade volume and price impacts that are shown in Tables 3.3 to 3.6. For example, the impact on production was positive for all commodities when net imports grew. In contrast, the impact was negative when net exports of the commodity declined.

In general, domestic policy contributed production growth (reduction) more than trade policy reform as domestic policy accounted more of the actual price changes than trade policy. However, it is not always possible to easily understand ex ante the relationships between trade and nontrade policies. The relative effect of nontrade versus trade policies differs among commodities. Specifically, while the impacts of trade on domestic prices are generally lower than those of domestic policy changes (Table 3.5), changes in production for specific commodities due to trade changes are not necessary less than the domestic policy changes (Table 3.7). For example, rice is a typical case. In the rice sector, while trade has changed substantially since the mid-1990s, domestic price rose only by 3.93% (Table 3.5). Despite such a small price impact, the effect of trade policy on production was as high as 2.17% (Table 3.7). While increases in domestic production (due to nontrade shifts in policies) caused rice prices to decline by more than 40% in the same period (Table 3.5), it reduced domestic rice production by less than 1% (Table 3.7). This curious result is almost certainly a function of the fact that domestic policies are almost all sector-wide and production effects of own price shifts are being offset by cross price shifts. In other words, the impacts of price changes on the production of one commodity requires one to consider two separate dimensions: the extent of price change of the own commodity and the extent to which the price of substitute commodities also are changing.

For example, while the trade-induced increase in rice price was much smaller than the rice price declined due to domestic policy change in 1995-2000, the reduction of the prices of its substitute crops, such as soybean (-40.63%) and edible oil crop (-25.14), were far more than rice price increase (Table 3.5). The cross-price substitution effects from soybean and edible oil resulted in a much higher rise in rice production (in terms of both sown area and yield) than its own price effect. These multiple sources of strong trade-induced effects from edible oil and soybean offset the weaker direct effects from increases in wheat, maize and sugar crops prices (Table 3.5--all increase by about 10 to 15% only between 1995 and 2000). On the other hand, although domestic policy led to a fall in rice price of more than 40% between 1995 and 2000, the policy also caused similar rates of decline in wheat, maize and sugar prices (last column of Table 3.5). Vegetable prices also declined during the same period by 13%. Since all crops prices fell as a result of domestic prices, the cross-price substitution effects nearly fully offset the impacts on production of the decline of the rice prices. The increases in the prices of soybean and edible oils due to domestic policies, however, eventually reduce rice production by 0.79% in 1995-2000 (Table 3.7). In summary, rice provides an interesting case study of how trade policies can more effectively promote domestic structural change towards commodities in which a nation has a comparative advantage than domestic policies. Domestic policies are often sector wide.

The differential impacts of trade and nontrade reforms on production also are clearly illustrated in the case of livestock production (Table 3.8). The production of meat and fish grew substantially over the entire reform period. Most of growth has been due to domestic factors (such as the rise in income and increase demand for meat). The impact of international trade on livestock and fish production, however, has been much smaller

and seems to have shifted from positive to negative. While initially puzzling, such a result is consistent with the increase in maize and other feed prices due to rising trade protection in these commodities, as well as changes in meat trade in recent years (Table 3.4). Increases in maize price raise the cost of producing livestock, and given demand held constant, this produces a negative production response by farmers. From the view of trade, although China has comparative advantage in the livestock and fish sectors, recent worldwide concerns about meat-related diseases have resulted in significant reductions of its exports to Russian, Hongkong and Japan. Hence, for the crop sector where diseases and foodsafety concerns are relatively less important than those involved with the meat sector, the impacts of trade policy changes on domestic production have increased over time (Table 3.7). Both of these shifts are consistent with the trade policy reforms that we have discussed in previous chapter.

In summary, on average (and for the whole study period of 1985-2000), our analyses show several salient facts. First, trade liberalization has benefited domestic production of rice and vegetables, but hurt the domestic production of soybean, oil crops and coarse grains; second, increases domestic protection, such as export subsidies and export tax rebates, also has benefited the domestic production of maize, cotton and sugar crops; and third, rising trade barriers against the import of China's meats and other commodities (e.g., the rising protection of maize after middle 1990s) have hurt China's livestock sector. Because the impacts of trade and trade related policy changes differ among commodities and overtime, the effects on output and price of each commodity also vary.

G. Overall impacts on production and expenditures

When examining the overall effects of trade and domestic policies on agricultural production and expenditures, several facts become clear. In contrast to some of the commodity-specific effects that were presented above, the overall effects of trade and domestic policies are fairly modest (Table 3.9). For example, between 1995 and 2000, the output value fell by 10.8 percent. Clearly, in the aggregate, those that are hurt are being offset by those that have gained. While initially puzzling on the declining in output value, such a result is consistent with the fact that the declines in overall agricultural price (Tables 3.5 and 3.6) were much more the increase in output (see Tables 3.7 and 3.8). On the other words, if we measured agricultural output values at the constant prices of agricultural products in 1995, indeed real output of agriculture increased in 1995-2000.

While the overall effect is fairly modest, the impacts of trade policies are even smaller, although they are positive. Although overall agricultural output value has fallen, trade policies have had positive effects on output. Agricultural output expanded by 1.3 percent due to trade policies. Of course, like the overall effect, this is the net effect that is a combination of both positive and negative effects. The effects of domestic policies are much larger (-12.1%).

When examining subset of crops grouped by the nature of the sector's competitiveness and the amount of protection that the sector is receiving, we can see several important features. First, trade impacts have been very large, both negative and positive for two

groups of crops in which China does not have a comparative advantage that have been subjected to aggressive liberalization and protection (Table 3.9, rows 5 to 12). For the crops, such as soybeans and edible oil, sugar and milk, China's leaders have liberalized a lot and the effect of trade policy on domestic prices is large and negative. In contrast, leaders have protected maize, wheat and cotton. In this case, trade policy kept output value 17.9% higher than if leaders did not protect the crops. Hence, from these figures, one can see that while maize producers have benefited greatly from trade policies, soybean producer have not.

Moreover, examining the trends over time, it is clear that the policies towards these crops have changed (rows 5 to 12). In the 1980s, it was soybeans that were being protected. During the 1990s, soybeans have been liberalized more than any other crop. In contrast, trade policy actually hurt maize producers between 1985 and 1995. During the 1990s, however, they have benefited. The political economy of these policy shifts have not been studied and it would be of great interest to try to figure out what motivated leaders to make such policy reversals.

Our data also show that for many other sectors the effect of trade policy has not been substantial. For example, in the case of the sectors in which China has comparative advantage, has faced protection outside China (Table 3.9, rows 13 to 16). As a result, trade policies inside China have had little effect on production. Likewise, when trade is small, such as in the case of sweet potato and eggs, trade policy effects are almost zero.

On demand side, the impacts of domestic policy also dominate the changes on total costs paid for agricultural products. For example, total costs on agricultural on agricultural products increased by 23.4 percent in 1995 over 1990 and declined by 3.2 percent in 2000 over 1995, the trade only caused the costs or expenditure change by 0.3 percent in both period (rows 3-4, Table 3.10). However, as we showed in the impacts on productions, the trade affected agricultural expenditure differed significantly among commodities. For those commodities that China has been liberalizing, the impact of trade could even be large than nontrade policies (rows 5-8). For example, instead of increase 4.9 percent expenditure in 2000 over 1995, the consumers would pay 17.1 percent (11.6+4.9) more than they paid for agricultural products. The reduction in the cost (-18.7 billion, Table 3.10) is much less than the declines in agricultural output value (-48.7 billion yuan, Table 3.9), this is because the consumers responded the decline in the prices of these commodities with increase in their consumptions.

On the other hand, for the sector that China is protecting (i.e., maize, wheat and cotton), the increase in costs to consumers on agricultural products (44.5 billion yuan, Table 3.10) is more than the increase in agricultural output (60.5) as the prices of these commodities rose due to trade the consumers declined their demand for these products.

CHAPTER FOUR: THE IMPACT ON RURAL HOUSEHOLDS

A. Household Types

Regional Variations

Based on geographical location and the level of economic development, China often divides its economy into three regions: West, Central and East.[10] The western region is the least developed area and is characterized by poor infrastructure. About one fifth of China's population lives in the region (Table 4.1). Most provinces in the eastern region are located on the China's eastern coast and most of these regions are endowed with better infrastructure and a higher population density. About half of the nation's population and 40 percent of rural population live in this area. The eastern region is the most developed area. The central region in terms of geography, population and economic development is in between the western and eastern regions.

The average households and individual also vary among the regions. The less developed regions of the west have relative large sizes of family and lower human capital (Table 4.1). On the average, the size of the average family ranged from 4.53 in western China to 4.15 in the eastern part (Table 4.1, row 2). The dependency ratio of family population to the family's labor force also is higher in the less developed area. They are 1.60, 1.53 and 1.50 for western, central and eastern regions (Table 4.1, rows 2 and 3). Human capital is also lower in the west. Out of each 100 randomly selected rural laborer in the west, 18 farmers are illiterate or semi-illiterate (row 5). In eastern China, only 6 out of 100 rural laborers are illiterate. Nearly all of the illiterate in eastern China are more than 60 years old.

Farm size also varies across China's regions. Because all rural households have access to land, the size of farm is small by international standards. For the national as a whole, the average size of farm is 8.8 mu or 0.59 hectare. Since the eastern region has a higher population density, its average farm size is the smallest (only 5.9 mu or 0.39 hectare). Farmers in the central region have more land than the those in the rest of China, but the average size is still less than 0.8 hectare (11.6 mu, Table 4.1). With such small size of farms, households in China have to intensively use their land resources. They use their land both to produce their own staple food and for cash crops for sales into the market.

The nature of China's farming methods and the equitable distribution of land implies that the objective of a minimum household food security could be relatively easier to achieve that in other countries since all households can live on their own household production. Sustainable rises in rural labor productivity and household income, however, will require more than income from the average farm in China. As a result, farm households need to

[10] Western region includes Shaanxi, Gansu, Qinghai, Ningxia, Yunnan, Sichuan, Guizhou, Chongqing, Tibet and Xingjiang. Central region include Shanxi, Inner Mongolia, Jilin, Heilongiang, Anhui, Jiangxi, Henan, Hunan and Hubei; and Eastern region includes Hebei, Liaoning, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi, Hainan, Beijing, Tianjin and Shanghai.

find off farm employments in the off-farm sector. In fact, as seen later in this section, this is indeed what has been happening in rural China since the early 1980s (deBrauw et al., 2002). By 1999, on the average farmer allocated 16.1 percent of his time on off-farm activities (Table 4.1) and earned 45 percent of the family's income from non-agricultural sector (Table 4.2, row 5). Most of the off farm earnings were in the form of wage earning. Because more than 40 percent of rural laborers were employed in some kind of nonfarm job in the late 1990s, many of off-farm jobs are part-time, although full-time off-farming employment through regional migration has been increasing (deBrauw et al., 2003; Zhao, 1999).

Despite the increasing rate of nonfarm employment, there is significant regional variation of economic activities and sources of income. Income levels in the eastern region are twice as high as those in the west (Table 4.2, row 1). Eastern farmers also earned more income from the non-agricultural sector (58%) than from agriculture (42%). In contrast, the average farmer in the west earned 62% from agriculture in 1999.

Income variation among regions also means that the patterns of spending by farmers also differ. Western farmers, on average, spent nearly 60% of their total living expenditure on food. In contrast, less than 50% of the budget share of farmers in the east is spent on food (Table 4.2, row 8). Among the 34.12 million under China's national poverty line, about half of them are located in the west. The poverty incidence rate (7.3%) is about twice as high as the national average (3.7--Table 4.2). In the eastern region, the poverty incidence was only 1.3% in 1999.

Variation Among Income Groups within China's Regions

Studies on regional inequity, in general, and poverty and household food security, in particular, have received great attention by both policy makers and scholars in the literature (Nyberg and Rozelle, 1999; World Bank, 1997; 2000). However, the variations among farmers within a region are even much large and surprisingly there is very little study in this area. In order to show the variations among farmers in terms of their income levels, we divide our entire sample of more than 67,000 households surveyed by China's National Statistical Bureau in 1999 into 11 groups for each region (Western, Central and Eastern). Their household characteristics, earnings, production and consumption levels are examined in the rest of this and subsequent chapters.

Even within regions, there is a lot of heterogeneity among income categories in China. Table 4.3 shows rural household characteristics by income groups for each region in 1999. Table 4.4 presents the variations of rural household income and expenditure among income groups in each region. Although the results are consistent with the findings observed at aggregated regional level, the variations among income groups are much larger than the differences among the average of 3 regions (previous section). For example, the poor in each region have a much higher dependency ratio than those in the rich categories. The dependency ratio for the poorest of the poor (income group 1) in the western region was 1.85 in 1999, significantly lower than either the average for the region (1.60) or for the richest farmers (1.43--Table 4.3, row 4).

Even wider variations are found among households within regions when examining human capital and access to off farm employment. For example, in 1999 annual per capita income in group 1 of the western region was 356 yuan (more than 40% below the national absolutely poverty line--625 yuan). Nearly 30% of the farmers were illiterate, a level about 3 times higher than that of farmers in the richest group (group 11 in Table 4.3). In the western region, even when poor farmers received education, they dropped out, on average, much earlier. About 39% only completed primary school (row 7).

The differences in human capital also seem to have had an impact on the access of farmer in different regions to off-farm employment (deBrauw et al., 2002; World Bank, 2000). Table 4.3 also provides this evidence. For example, the poorest of the poor (group 1) in the western region spent only 3.7% of their time on off-farm activities (row 5). The corresponding group in the east spent more than 17% of their time on off-farm activities. Individuals in the east in the richest group (group 11, bottom row) spent 37.8% of their time on off-farm activities.

In Table 4.2 we show there are large income inequities among regions. Table 4.4 shows that the income disparities among income groups within a region are even greater. The income of the richest farmers (group 11) is about 8 times higher than the bottom 10% in the western region (groups 1 and 2). It actually is 11 times greater than that for group 1 and 6.7 times for the group 2--Table 4.4, row 1). Similar patterns are found within the central and eastern regions.

The sources of income help identify some of the reasons for the discrepancies. When examining the components of total income, wage income contributes more to the variation than other sources of income. For example, poor farmers earn much less of a fraction of their income from wages and other off-farm activities. If they earned as much as richer farmers, the differences among the income groups would be much lower. Table 4.2 shows that the income for poor farmers also depends more on agriculture than do richer farmers. The share of agricultural income in total income ranged from 70-76% in the group 1 in all regions; in contrast, the share was only 25% in group 11.

Both total expenditures and food expenditure also are closely associated with income levels. Farmers, as should be expected, actually spent more than their earnings in 1999. This means that they were either receiving transfers from the government, their relatives or friends or were dissaving. Farmers with average income levels less than 600 yuan spent about 60 to 80% of their total expenditure on food. In contrast, farmers with per capita income of more than 2500 spent less than half of their total expenditures on food. These rich farmers also had positive savings. From these comparisons, we can deduce that increases in income for the poor could dramatically improve food security for poor households.

Household Agricultural Production

While we examined the impacts of trade reform and other domestic policy changes on the national production and total agricultural output values in Chapter III, the aggregated effects could cover up important effects on different sets of farmers in different regions. This is especially true if the structure of household production varies significantly among farmers that in the different income groups. In order to assess the impacts of trade reform and other policies on household's agricultural production and household food security, we first describe the structure of agricultural production for the income categories in the three regions.

Theoretically, the impact at the aggregated national level should be the sum of individual farmers or each group of farmers in each region. However, it was empirically impossible to achieve this in this study for the following reasons. First, the database used in our aggregate national analysis with CAPSiM is based on national statistics. In several key areas, CCAP researchers had to carry out a series of field surveys to correct for errors and omission in China's officially reported statistics. For example, we adjusted for the systematic over-reporting of livestock and fish productions. We also corrected consumption data for food consumed away from the home. As a result, we believe that the national production data in CAPSiM's database (CAPSiM's food balance sheet) is more accurate than CNSB's official data. At the least, our data is consistent in terms of the match between production and consumption in each year and over time.

Our data also in some places is admittedly incomplete. For example, the national production data published in China's yearbooks includes production by individual households (more than 95% for most commodities) and state/collective farming (around 5%, on average). In contrast, our household analysis is based on CNSB's household income, expenditure and agricultural production surveys. These data do not include production from state farmers and that from agricultural enterprises.

Besides coverage shortcoming, it is also difficult to aggregate up from individual household averages to the regional and national level. In some categories of variables, it is impossible to match the national level data. Another problem is that we lack precise information on household distributions for the 33 income groups in the study in the population. Instead, we assume that we can allocate each region's rural population to the farmers under 33 income groups by a weight equal to the weight used in 33 income categories. When we do so, in some case we can generate aggregated statistics that are from 10-20% different than national data.

Finally, differences between the ways that production and consumption are measured for CAPSiM database and for the household surveys could be the other problem. For example, in our CAPSiM model, we measure grain for both production and consumption in milled form. Grain in China's household surveys are measured in unmilled form (e.g., rice is measured as paddy). It is possible that our conversions from unmilled to milled is not precisely correct.

Due to the above problems, instead of generating a consistent database that links the two sources of data, we use as much data as can be taken from the household data and reclassify into the categories that are needed for the CAPSiM model. We use national data, when household data do not provide the right variables. In some cases, variables from the household actually are split between two categories in the CAPSiM database.

While there are a number of shortcomings, we do not believe that they should materially affect our analysis. In fact, because data from the household surveys, on average, are probably more reliable, the quality of the analysis may be better. Overall, the largest effect of using household data on the analysis depends on how different the starting points in the baselines are. The initial levels and composition of production and consumption matter a lot in determining the size of the impacts over time.

Given above discussions, now we present the structure of household agricultural production by income group in China (weighted by the number of households surveyed by NSBC) and in each of 3 regions. Tables 4.5 and 4.6 summarize farm household per capita production and consumption for 11 income groups for the whole nation. The following three tables provide similar information for each region. Several interesting patterns of agricultural productions and food consumption among income groups are identified.

With our data, we can create a profile of the average household in 1999 (Table 4.5, column 1). For China as a whole, rice is dominant crop. Per capita production of the average farm was 243 kg (in paddy form, or about 170 kg in milled rice, 243x0.7). Maize surpassed wheat as the second most important crops in the late 1990s. Vegetables have also become increasingly important, having the highest output simply because it is measured in fresh weight. Among China's livestock commodities, pork dominates all others. The average household produces about 1 hog (37 kilograms x 4.25 persons/family) a year. After pork, in order of importance, China's farmers produce fish, eggs and poultry.

However, the national production figures hide many interesting regional and income-based features of China's agriculture. Not all farmers in China are rice producers. For example, the poor produce much more maize than other crops (Table 4.5, row 3). Cotton also is important for the poor (the poorest of poor produces almost the same level of the average farmer in China--Table 4.5, row 6). From this, we can understand why China's leaders may have actually helped the poor when they have increased protection of maize and cotton in recent years. In addition, we expect that liberalization of maize and cotton in the future would have a relatively large impact on the income of the poor.

In contrast, rice is clearly a rich household's crop and this, among other things, make richer farmers produce more than their poorer counter parts. For example, the richest of the rich (group 11) produces about five times more rice than the poorest of poor (group 1). Despite the fact that farm sizes are similar (in fact, the poorest of poor have the more arable land), per capita agricultural output for the poorest (group 1) is only about half of the national average. The poor produce less than 30% of the rich (Table 4.5, bottom

three rows). Interestingly, although the richer households have higher off farm income, household production also is strongly related to farm household income for nearly all commodities. The only exceptions are maize and cotton. From this it is clear that increasing agricultural production and land productivity of the poor is one of essential means to increase their income.

Not only do production patterns vary across space and income groupings, consumption patterns also diverge among farmers that belong to different income categories. For example, farm households in the poorest group (group 1) consume less than half the quantity of rice (63 kg) of the average household (Table 4.6, row 1). Poorer farmers, in contrast, consume much more maize and other coarse grains than the richer ones. Interestingly, wheat consumption varies very little among income groups. The poorest consume 75 kg (Table 4.6), which equals about the average of what each produces (84 kg--Table 4.5). Beside maize, coarse grains, wheat and beef and sheep meat, the food consumption of the poorest consumers (2^{nd} column) is only about half to two third of that of the average farmers (1^{st} column). Consumption of the poor in most food categories is around one third of that of the richest farmers (last column).

Comparing Tables 4.5 and 4.6 reveals that at the national level, farmers in various income groups produce more than they consumed for almost all commodities. The level of marketing, however, is higher as farmers move from the lower income categories to the higher ones. Such a pattern implies that any reforms that increase the general price level of food prices will benefit all farmers. Since rich farmers market more, they will benefit more.

While most production and consumption patterns that we have observed by income category for the nation (in Tables 4.5 and 4.6) also appear in each region, a close analysis of production and consumption by region reveals some key differences. For example, in China's western region (a poorest region), wheat, maize and cotton, three of the commodities that China has protected despite having less of comparative advantage in, dominate the production of rice and other commodities in terms of output values for the farmers in lower income categories (first part of Table 4.7). Moreover, since these commodities are mostly marketed, they represent a major source of agricultural cash income to poor farmers. The reliance on these crops suggests that future trade liberalization of the commodities will affect poor farmers since it will invariably lead to lower prices. On the other hand, China's recent protection of domestic maize and cotton should be expected to have benefited the poor in the west. Liberalization on soybean and edible oil crops market will have less negative impacts on the poor in the region. In contrast, the poor might not have benefited as much from past (and future) trade liberalization since the production of its more competitive agricultural commodities (e.g., rice, horticulture, livestock and fish) is much smaller in the west than in the rest of China. For this reason, this part of China's trade liberalization may not have benefited the poorest of poor in China's poor western region. Except for wheat, maize, cotton, edible oil and pork, the poor is only produces what they consume (on average for each group—as seen by comparing the group's production and consumption levels in Table 4.7).

In central China, maize has becomes a single most important crop in terms of production. Per capita maize production was 255 kg in 1999 (Table 4.8, row 3). In addition, sweet potato and other coarse grains were ranked as the second most important crops in the region. Soybean and edible oil are also more important in this region than in the other two regions. Since the poor depends more on these commodities for their income earnings than the richer (at least, in the relative terms), liberalization that affects these crops will have a relatively large affect on farm households in central China. Eastern China, in contrast, has a more diversified agriculture than either the western and central region. Eastern households also produce more competitive crops. Even in the east, however, the poor's income depends largely on maize, sugar and pork (Table 4.9).

Across commodities, relative importance of animal product is similar among region except for fish. In eastern China, since most of the provinces are on the coast, per capita fish production was 14.1 kg in 1999, much higher than in central China (4.3 kg--Tables 4.8 and 4.9). Fish production was only 1.5 kg in the west (Table 4.7). Regardless of the region, the poor produces insignificant amounts.

B. Changes in Incomes and Expenditures

In this environment of rapid changes in trade and domestic policies and the evolution of the economy, income and expenditure trends for the average household and for the poor show rapid improvements in earnings and standards of living. In terms of income, per capita earnings have risen by more than 1000 yuan, or 81 percent, between 1985 and 2000 (Table 4.10, columns 1 and 2). Interestingly, in the early years, (1980 to 1995), the poor, while improving markedly in absolute terms were still falling behind their richer counterparts (column 3). And the real per capita index was declined from 100 to 98 between 1985 and 1990. Despite the income of the poor grew faster after 1990, the index of the poor has never caught up to the average. The faster growth in recent year shows the combined effect of poverty policy, protectionism (see above section for protection of maize and cotton, two of the important crops grown by the poor) and the rise in off farm income (see next section).

The rise of income has led to almost equally fast rates of growth of expenditures (Table 4.10, columns 4 to 6). Although per capita living expenditure followed a similar pattern as income, its slightly lower growth rate means that savings has increased. Interestingly, an increasing part of the rise in expenditures has begun to shift from food to non-food. When this is happening, it means that there almost certainly has been a rise in food nutrition and in the general standard of living.

Although there are many reasons for this rise in income and expenditures, access to markets certainly has helped and they have changed over time in a way consistent with general income trends. For example, farmers have begun to purchase more of their food on the market (Huang and Rozelle, 1998). Although the production to consumption ratios for almost all major commodities (except fish) and all income categories exceed 1 (that is household produce more than they consume—Table 1.14, rows 6 to 10), households have begun to buy increasingly more of their goods in markets (Rozelle,

Huang and Bezinger, 2003). Farmers not only use traditional marketing venues, such as periodic markets and government-sponsored outlets (that have been privatized in recent years), there are increasing numbers of private traders and private stores that are beginning to sell food commodities and other daily use products into rural areas. During field work in rural areas, even in most poor remote areas, there are many traders that are involved in food marketing, both buying and selling.

Part of the reason that food markets have emerged in rural China is that demand for food is still strong. Although rural consumers demand less meat and other non-staple foods, they demand much more grain than the urban consumers. On average, however, the share of food expenditure in total expenditures is still much higher than the food expenditure shares of their counterpart in the urban area. During the early 1980s, villagers spent about 60 percent of their total outlays on food. The share has fallen over time, but is still about 50 percent (Table 1.10). The patterns of change across China's regions, however, portend more changes in the future (previous tables). Although rural consumers in poorer provinces in the western regions spend nearly 60 percent of their income on food, those in the eastern provinces spend less then 50 percent. To the extent that this continues, demand for food, at least relative to non food commodities will become less important.

C. Impacts of Trade and Other Policies on Agricultural Output Values and Income

From Tables 4.11 we can see that at the national aggregate levels, the overall impact is small (column 4). The main reason is that there are offsetting effects. Although the average household lost 68 yuan per capita from the liberalization of the importable sector in 1995-2000, they gained it back from protecting maize, wheat and cotton (84 yuan) and by liberalizing the exportable sector (15.7 yuan). Taken together, per capita gained 29.7 yuan or average household gained 126.23 yuan (29.7 yuan/person x 4.25 person/households).

The absolute level is not only small, the percentage (column 5) of the overall effect (column 1) is also small. For example, only 1.9 percent of the change in overall output is due to trade. While different sectors are larger (e.g., 47 yuan for importable that was liberalized), they also are offsetting.

A similar story is found when examining the effects by income category (Table 4.12). The aggregate impacts are similar for the poor and the richer (on average about 30 yuan—row 3). However, since the absolute amount is almost the same and it is positive, in relative terms, it is a large percent rise for the poor when compared to either production or income. Like the average case, although the aggregate impact is small, by commodity the impacts are large because farmers grow different crop mixes and respond to price changes.

Because trade impacts are more commodity specific, and because different farmers in different income groups grow different sets of crops, they have more sharp regional and income class-specific impacts (Tables 4.13 to 4.16). This also means that they affect

equity. In the case of China, while both eastern and western regions have benefited from trade policy, liberalization has hurt producers in central China primarily because the region is the largest producer of soybean and edible oil, two of the sets of commodities that are most hurt by liberalization (see table 4.13). Although the government also has used trade policy to protect maize, and producers in central China gain from this protection (as the farmer in central China also are the largest producers of maize), the gain from the rising protection is less than loss in other sectors. These findings also imply that central China will face an even large challenge after China joins the WTO (because under its WTO agreement, it is scheduled to gradually liberalize its maize sector).

Interestingly, during recent years, the poor have gained more in rising production (at least in a relative sense) as the richer producers (Tables 4.14 to 4.16). Therefore, trade policy has contributed to household-level food security. At least in percentage terms (of agricultural income), nearly all the gains have come from the nation's protection of maize, cotton and wheat (mainly maize). While overall the poor have gained, trade policy has not been completely poor pro. In fact, the poor also lost substantially since they also were large producers of soybeans and edible oils. Since the poor enjoyed gains that essentially were from higher protection, in the future as the nation liberalizes trade further (especially maize, cotton and wheat), the poor might face big challenges. Because the protection of this sector is not likely to last for long and the poor currently allocate a large share of their land to crops in which China has less of a comparative advantage, there is a role for government. In particular, the government is needed to help these farmers in shifting their production more towards crops in which China has a clearer comparative advantage. In the meantime, China also needs to reduce the negative impact from trade by raising domestic production through productivity-enhancing investments.

It should also be noted that the poor have gained (or lost) less than the rich for each sector because despite having farms that are of a similar size, their land produces less than that of the richer producers. It could be that the lower production is due to inferior land and climate resources. It could also be that poorer producers have access to fewer inputs. If so, the clear policy implications are that the government needs to provide ways for farmers to access better technology, water control and credit.

D. Rural Labor and Off-farm Employment

Since economic and political reforms began in China just over twenty years ago, it has experienced rapid economic growth (Naughton, 1995). The expansion of the rural economy has driven a large part of this growth (Putterman, 1992; Perkins, 1994). In turn, rural labor markets have changed dramatically over the past twenty years and significantly contributed to the success of the rural economy and household food security (Solinger, 2000; Chen, Zhao, and Li, 1995; World Bank, 2001). Most observers of China agree that the success of rural labor in raising rural incomes and productivity can account for a significant part of rise in rural welfare (Parrish, Zhe, and Li, 1995; Rozelle, 1995).

The rise of rural labor markets, however, transcends its role in providing rural residents with a means to raise their incomes (Todaro, 1976; Stark, 1976) and ability to buy foods. For China to successfully modernize, the nation must rely on rural labor markets to facilitate the shift from a largely rural population to an urban one. Without well-functioning labor markets, the economy cannot be transformed from agricultural to industrial. Hence, it would seem that more important than assessing how well they have contributed to per capita rural incomes and food security is the question of whether or not rural labor markets have emerged in a way that will allow them to more effectively facilitate the transformation of China.

In the rest of this sub-section, we will estimate of the nation's aggregate off-farm participation rates, comparing, after five years of relatively slow economic growth (between 1995 and 2000), how rural labor has fared relative to its performance in the mid-1990s (a period after five years of rapid economic growth). Second, we will decompose the growth in off-farm employment, examining what segments of the rural labor force, particularly the poor, are growing and where each segment is growing at.

Data

The main data for this study were collected in a randomly selected, nearly nationally representative sample of 60 villages in 6 provinces of rural China (henceforth "Household Data."[11] 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, and twenty randomly selected households, both those with their residency permits (*hukou*) in the village and those without, were surveyed per village. A total of 1199 households were surveyed.

The survey gathered detailed information on household demographic characteristics, wealth, agricultural production, non-farm activities, and investment. Several parts of the household survey were designed to learn about migration from the household and other labor market participation across time. For roughly half of the households surveyed (610 out of 1199), a twenty-year employment history form was completed for each household member and each child of the household head, some of whom were no longer considered household members. In total, the survey divided off-farm jobs into four types: migrant wage earners (henceforth, migrants); self-employed migrants; wage earners; and local self employed. We also asked about the extent of the participation of each member, in each year, in the household's on-farm activities. As a supplement to this household data set, we also collected 215 villages community level data set that traced labor allocation and movement in 1988 and 1995.

[11] The provinces are Hebei, Liaoning, Shaanxi, Zhejiang, Hubei, and Sichuan. The data collection effort involved students from the Center for Chinese Agricultural Policy, Renmin University, and China Agricultural University and was led by Loren Brandt of the University of Toronto, Scott Rozelle of the University of California, and Linxiu Zhang of the Center for Chinese Agricultural Policy, Chinese Academy of Sciences.

The data show the off-farm labor force expanded steadily between 1981 and 1995. From around 15 percent in 1981, our survey estimates that in 1995, 32 percent of the rural labor force found some employment off-farm (Figure 4.1, Panel A). By assuming that neighboring provinces similar to those surveyed have identical rates of off-farm labor participation, we estimate that off-farm rural employment rose from less than 40 million in 1981 to more than 150 million farmers in 1995, a growth in off-farm employment of more than 100 million. Although based on a relatively small sample, these numbers demonstrate the consistency of our data with much larger national studies by the State Statistical Bureau (SSB, 1996) and our own 1995 national village survey. Our estimate in 1995 is almost the same as both SSB's estimate of the non-farm labor force (31 percent) and our own estimates of rural off-farm employment calculated from estimates of village leaders of the participation in the off-farm sector of their villagers (34 percent—Rozelle et al., 1999).[12]

Despite the Asian Financial Crisis, China's own structural reforms, and a general slowing of economic growth in the late 1990s, our data show that rural off-farm employment growth continued expanding between 1995 and 2000 (Figure 4.1, Panel A). By 2000, 41 percent of rural individuals participated in off-farm work, a rise of 9 percent in the late 1990s. If so, our data imply that more than 200 million rural individuals worked off the farm in 2000, a rise of more than 50 million workers in the last 5 years of the 1990s. If employment generation and the ability to create jobs during a period of relatively slow growth are indicative of a healthy labor market, then China's labor markets would have to be given a high mark for maintaining rural incomes.

An examination of disaggregated trends provides an initial basis for demonstrating that China's labor markets may be doing more than just providing off-farm income for rural workers. Trends by job type clearly show that the focus of workers over the past 20 years has shifted from rural to urban destinations (Figure 4.2, Panel A). In 1981, most rural individuals (nearly 85 percent) not only spent all of their time in farming, but those who worked off the farm were almost three times as likely to live at home and work in or close to the village (7 percent were local self employed; 4.2 percent were wage earners) than to work out of the village (less than 1 percent were self employed migrants; less then 4 percent were migrants). By 2000, almost as many off farm workers were living away from home (more than 85 percent in cities or suburban villages of major metropolitan areas) as in the village. Migrants composed both the largest and fastest growing component of the rural labor force.

[12] Our data are also consistent with the estimates of SSB in the late 1980s and Parrish's study (Parrish, Zhe, and Li, 1995) in the early 1990s. For example, our data set estimates that 20 percent of the rural labor force worked off-farm in 1988. This figure nearly agrees with the State Statistical Bureau estimates for that year, 21 percent. Our 1993 labor force participation rate, 29 percent, is only three percentage points higher than the best guess made by Parrish, Zhe, and Li's national study, a difference that, in part, can be explained by Parrish's slightly broader definition of off-farm labor.

The off-farm employments are seen to be accelerating in richer areas (Figure 4.3). Off-farm participation rates in the richest province in our sample, Zhejiang (Panel A), are both historically higher and have grown faster than those in other provinces (Panels B and C). In Zhejiang, by 1990 total off-farm labor participation neared 40 percent (above the average of the rest of the country with Zhejiang excluded in 2000). By 2000, the off-farm participation rates of rural residents across all of Zhejiang (including its poorest southern and western counties) had grown to nearly 65 percent. In Sichuan and Hubei, two poorer provinces, off-farm participation started at a much lower rate in 1981 and grew slowly until 1990. In the 1990s, however, as migration has emerged as the most dominant type of labor activity, labor participation rates have accelerated. If these trends are indicative of what growth in China will be in the future as long as the overall economy continues to grow, then we may see continued strong growth, and even an acceleration, in the coming years.

The rise in labor markets has already begun to have a positive impact on increasing off-farm participation rates of women (Figure 4.1 and 4.2). Although women have participated at rates far below those of men throughout the entire 20-year sample period, since the early 1990s, participation rates have risen (Figure 4.1, Panels B and C). In the 1980s, consistent with the findings from our national community survey-based study reported in Rozelle et al., 1999, the participation rates of men (more than 25 percent in 1981) far exceeded those of women (less than 5 percent). Moreover, despite these low initial levels of involvement in the off-farm sector, the growth of participation rates of women remained below those of men in the 1980s. In the 1990s, however, the rate of growth of participation of women has risen faster relative to men.

The rising participation rates of women have been driven by the entry by women into all job categories, although the most striking absolute gains have come in migration (Figure 4.2, Panels B and C). Throughout the entire 1980s decade, less than 1 percent of women left their homes to work for a wage or become engaged in self-employed activities. Since 1990, however, the rate of growth has been higher than any category of job types for either men or women. By 2000, nearly 6 percent of the female labor force was working as a wage earning migrant and nearly 3 percent was working as a self employed migrant. One interpretation of this rise in the participation of women is that as labor markets have become more competitive, the scope for managers to exercise their discriminatory preferences has declined, thus opening up new employment opportunities for those who previously had not been able to participate. Multi-variate analysis in Rozelle et al. (2001) are consistent with these results.

Drawing on a community level data set that we collected in 1996, there is also a shift to greater education is even more significant (Table 4.17). In 1988, 61 percent of migrants nationwide had at least a middle school education. By 1995, the national average climbed to 64 percent. The percent of high school-educated migrants nationwide rose from 7 to 8 percent between 1988 and 1995. Although rural men generally have higher levels of education than rural women, the education of male and female migrants is roughly equivalent. Male migrants are slightly more likely than women to have either a

high school or elementary education which suggests that the range of opportunities for male migrants is wider.

In the 2000 household data set, the propensity of more educated to enter the migrant and local off-farm wage sector is confirmed. Multi-variate analysis shows that in the 1980s, for each additional year of education, the probability of becoming a migrant rises by 10 percent and the probability of working in a local wage earning job rises by 6 percent. By the 1990s, the probability of becoming a migrant rises by 18 percent for each year of additional education and the probability of finding and off-farm job rises by 17 percent. The participation in formal training and apprenticeship programs also has a large and significant effect in increasing the participation in all forms of labor market activity. To the extent that we would expect well-functioning labor markets to give more employment opportunities to those with higher levels of human capital, during the whole reform period, labor markets appear to have been playing some role.

Drawing on our earlier community level data set, the destinations of migrants, both men and women, also changed between 1988 and 1995 and differ from region to region (Rozelle et al., 1999). In coastal areas such as Zhejiang, more migrants stay within their home county than in other areas. Migrants from inland provinces move outside of their own provinces more frequently than others. Surprisingly, most migration destinations were short and medium distance, except in Sichuan and Hubei in 1995.

The number of long distance migrants, especially women, has risen sharply (Table 4.18). Nationwide, the proportion of migrant men moving to remote destinations rose from 28 to 42 percent between 1988 and 1995; the proportion of women rose from 7 to 41 percent. Some areas had exceptionally high levels of outmigration. The proportion of men migrating to destinations outside the province increased from 61 to 74 percent in Sichuan and from 14 to 46 percent in Hubei. If these figures are relatively accurate estimates of provincial migration, one of every seven male laborers from Sichuan works outside of the province. The proportion of women in the long distance labor market rose sharply in all survey provinces except Shandong. In Zhejiang, for example, few women left for work in Shanghai or Fujian in 1988. By 1995, 17 percent left Zhejiang in search of wage work. Over half of the female migrants from Hubei and Sichuan left their home provinces.

While China's success at generating off-farm work opportunities for its rural workers is well known, what is less well known is that many of the new jobs are in rural areas and go to workers from other villages. In 1988, only about 1 percent of the rural labor force found employment in another rural village (Table 4.19, row 9, column 4). By 1995, 5 percent of rural workers were employed in a rural village outside of their home village (column 1).

The increase in the size of the rural labor force, the rapid rise in the proportion of rural workers who leave their home village for work, and the increasing share of those workers heading to other rural villages have contributed to the expansion in rural-to-rural labor movement. Rural-to-rural movement represents the fastest growing off-farm

employment sector in rural China, with an annual growth rate of 27 percent compared to 13 percent growth in local employment and 9 percent growth in rural-to-urban movement (Table 4.19, rows 3, 6 and 9, column 7). Growth in rural-to-rural migration was especially high at 38 percent annually (row 11). We estimate that there were 12.9 million rural-to-rural migrants in 1995 up from 2 million in 1988.[13] An additional 9.8 million rural workers in 1995 commuted to other villages, up from 3 million in 1988. The 22.7 million workers who found non-agricultural employment through rural-to-rural labor movement (12.9 plus 9.8) make China's development unprecedented. We are unaware of a development experience in any other country where the rural sector has offered industrial jobs to such a large group of mobile workers.[14]

Specialization of another type—the emergence of specialized modes of production in different villages across China's geographical landscape—also may have been facilitated by the emergence of labor markets. Drawing on our community level survey, we find that a distinct pattern of the distribution of economic activity has emerged (Figure 4.5).[15] When ranking the sample villages in terms of average income per capita and dividing them into four distinct groupings, we find that full-time farming is the dominant form of economic activity in the poorest of the poor villages (the poorest 10 percent of the sample) and is far more common (relative to other economic activities, such as migration, the running of micro-enterprises, or the running of large, complex manufacturing firms) than the role of the full time farmer in the better off villages —Panel I). In contrast, most of migration is occurring in villages in the lower-middle income categories (that is in villages that are in the 90^{th} to 50^{th} percentile in terms of their average income per capita--Panel II). Likewise, (upper) middle-income villages (those in the 50^{th} to 10^{th} percentile) have relatively specialized in micro-enterprise operation, and have participated in migration to a much lower extent. Finally, large scale manufacturing dominates the economies of the richest 10 percent of China's villages.

Nearly the exact same pattern of regional specialization in employment and economic activity can be found when dividing villages into groups according to their "distance" from a major metropolitan region (Figure 4.6). For this illustration, we use measures of Core-Periphery Zones first used by Skinner (1995).[16] Those in the periphery (CPZ 6 and 7) are mostly engaged in full-time agriculture, especially when measured relative to other economic activities. In contrast, those in CPZ 5, rural residents that live in villages in areas that are fairly--but not extremely--remote, are those who have a propensity to migrate. As villages move closer to the core, the intensity of micro-enterprises and large

[13] These estimates come from the percentage of rural labor going into villages (estimated by the survey) multiplied by China's total rural labor force as published by the State Statistical Bureau (SSB). The SSB reports 403 million rural workers in 1988 and 446 million in 1995.
[14] See Lohmar and Rozelle (2000) for more details on the rural to rural labor force.
[15] These figures are from Mohapatra (2001).
[16] In Skinner (1994), the author argues that in analyzing spatial data provinces are not the appropriate unit of analysis. To rectify this problem, Skinner has assigned both core-periphery zones indices (CPZ) to every county in China. A CPZ measure is assigned to each county using a macro-regional index of highly correlated variables, such as electricity use, meat output, and age structure. A measure of 1 to 3 means that the village is in a county that is in the immediate vicinity (suburb) of one of China's main 7 major metropolitan regions (e.g., Beijing, Shanghai, Guangzhou, Wuhan, Chengdu, etc.). A measure of 7 means that it is in a periphery county that is most "remote" from the metropolitan core.

manufacturing firms arise. A very large proportion (more than 67 percent) of manufacturing firms occur in CPZ 3 or 4.

Summary of Rural Labor Market Findings

In summary, then we have provide evidence showing how labor markets clearly are acting in a way consistent with an economy that is in transition from agriculture to non-agriculture and a population that is shifting from rural to urban. Our descriptive analysis illustrates that labor markets have a.) allowed migration to become the dominant form of off-farm activity; b.) expanded fastest in economies or areas that are relatively well-off; and c.) increasingly drafted workers from sub-sectors of the population, for example, women, that earlier had been excluded from participation. Rural workers also showed signs of specialization especially when examined by education. Better educated workers work much less on the farm than older workers in 2000. Finally, our data also show that workers are moving further from home and developing ties in other rural areas.

When we talk about the impact of a rise in manufacturing in rural areas on farmers' income and food security due to liberalization, we can see that these will have an impact on some, but not necessarily all, rural residents. First order impacts would be felt by those in the richest villages and in villages nearest the core, since these areas, based on their historic ability to manufacture and export these goods, should be able to expand production. However, rural migrants, or those in the lower middle income, more remote regions, might also benefit, since they are ones who are providing a lot of the labor in the richer, more centrally located villages. However, we would not expect first order or immediate benefits to those in middle-income or the most remote villages.

PART FIVE: IMPACT ON FOOD SECURITY

I. National Food Security

By any measure, China's food security has improved. In Chapter I, we showed that from many indicators on food security, the situation is improving in China. Although China accounts for about 15% of the world's 800 million undernourished people, the fraction of undernourished people in the economy as a whole is much smaller in China than in many less developed countries (Table 5.1). In 2000, the level of protein and fat consumption far exceed the average nutrient availability in countries with a per capita GNP comparable to China's (Table 5.1). For example, per capita dietary energy supply in China reached 3040 kcal per day in the late 1990s (1997-99), and this was about 25 percent higher than the levels in India and Thailand. Although per capita availability of dietary energy per day was already higher than those in India and Thailand by about 340-500 kcal in the early 1990s, its rate of increase (by 12 percent between the early and late 1990s), the growth was much higher than those in India (2.5 percent) and Thailand (9.5 percent--Table 5.1).

Per capita supply and sources of calories, protein and fat per day from the early 1960 to the late 1990s presented in Chapter I provide even more evidence for rising food security in China since the early 1980 (Table 1.11). Comparison between per capita food supply in Table 1.11 with the per capita cereal food (staple food) consumption Table 5.2 shows that the improved national food security has mainly come from the rapid growth of supply and consumption of non-stable foods since the early 1980s. Because per capita consumption of cereal grains were already very high by the early 1980s, although average income elasticity of cereal grains was still positive (but small) for both rural and urban consumers, increase in grain consumption due to income growth was offset by decrease in its consumption as food market rapidly developed, the later increased varieties of non-staple foods available in the markets (Huang and Rozelle, 1998). The growth in non-staple food consumption such as meat, vegetables, edible oils, and other foods has been substantial (See Tables 1.12 and 1.13 in Chapter I and tables to be presented in the rest of this chapter).

But even with grain sector, grain food balance sheet also shows that during the past two decades, cereal grain production has risen by 37 percent (row 3). Driven almost all by yields, the rise in production has come with sown area constant (rows 1 and 2). Between the early 1980s and late 1990s, consumption in China rose by 30 percent. While fast, this has been less than the rate of production rise. With production rising faster than consumption, China, the nation with the world's largest population became grain self sufficient in 1995 (bottom row). The annual production of food (in tons) exceeded the annual consumption that year and for every year since then. The self-sufficiency level rose to 104.1 percent in the late 1990s. During this time, China also was a net exporter of food (row 5).

Table 5.2 also shows that in the past two decades about one fifth of increase in grain production was to meet increase in demand for cereal grain as food (mainly to meet the increase in total population). With reducing the supply press on food grain demand, China has been able to release a large share of its own produced grains (mainly maize) for feed use. The shares of grain as feed use in total grain consumption nearly doubled (from 14 percent in the early 1980s to 27 percent in the late 1990s, Table 5.2), which implies that more than 70 percent of the growth in grain production was allocated to feed use.

Many different factors, including domestic policies, have helped China improve its food security of the past 20 years. The rise in yields undoubtedly may have contributed as much as anything. As discussed above and as shown in the literature, China's domestic policy has played a major role. Decollectivization, new agricultural technologies, irrigation investments, and rising access to inputs have all helped provide the incentives and materials for raising production per fixed unit of land (Lin, 1992; Fan, 1991; Huang and Rozelle, 1996). With the equal distribution of land that characterized China, the higher yields have meant that the incomes of farmers have risen from increased quantities of output.

Rising rural incomes, in addition to lower prices, also facilitated the rise of incomes of all of China's rural population, which has facilitated the increasing total consumption and falling poverty levels. And, as the case of production, many nontrade factors have facilitated the rise of incomes. Improving labor markets and access to off farm income has been the single largest driver of rural incomes. Moreover, with the break down of constraints that limit migration, even the poor rural residents living in areas that are less well-endowed have been able to improve their access to food. Consumers have benefited from lower prices. The real price of food is much lower than it was in the early 1980s. Improved markets also have provided the conduits for shifting production to market and then facilitating the movement of other foods and nonfood goods back to rural areas.

Although we argue that most of the rises in food availability and ability to purchase food have been aided greatly by nontrade domestic policies, trade has played an important in several ways. Most directly China's trade policy through its general opening to the outside world has played an important role. In the early 1980s, when supply fell short of demand, China turned in part of world markets. But, during those times, it took a great deal of China's trade resources to meet its need (Table 5.3). For example, in 1980s, 15 percent of imports were for food (column 1). To pay for these imports, China had to export other agricultural products (16 percent of total exports). Even when in 1985 when the percentage of total imports that were for food had fallen, China needed 59 percent of its foreign exchange reserves to pay for food imports (column 2). The nation had barely begun to see its exports exceed imports. In short, in the early 1980s, importing food was a difficult task that required trading off what was imported according to how much was exported. The nation was foreign exchange short and sizeable imports would hurt its ability to import other goods. If there was a serious shortage, China had the means to import, but it was difficult to do.

By the late 1990s, China had strengthened its ability to import food from several perspectives (Table 5.3, columns 4 to 6). Food, as a share of total imports, had fallen. Total exports far exceeded imports and by the late 1990s China had accumulated the second largest foreign exchange reserves (after Japan). Although food imports rose (from 3 billion in 1980s to 6 to 8 billion in the late 1990s), China only needed about 5 percent of its foreign exchange earnings to pay for them. Hence, imports were playing a bigger role in supplementing national food supply. Its relative cost to the economy, however, was substantially lower.

The significant devaluation of domestic currency, gradual releasing control of the foreign exchange, decentralization of trade, and implementation of export tax rebate (see Chapter III for details) improved China's trade environment, such contributed the exports of many agricultural goods and have affected production. As we have seen, the relative prices of horticulture and livestock commodities (and rice) have been positively affected by trade in the past, and our analysis showed that as a result, production rose. In other words, the liberalization of trade for some products had a direct and positive effect on food availability. At the same time, the nation's leaders raised protection on two crops, maize and cotton, and did not liberalize wheat (as much as other crops). Our analysis shows that because of this, maize and cotton prices rose and this led to greater volumes of production. Interestingly, since the shares of maize and cotton produced in poorer areas are relatively higher than richer areas, these policies not only helped increase production in poor areas, they helped increase the income of the poor and reduce poverty.

At the same time, however, the liberalization of other crops has affected food availability in a complex way. For example, in the case of soybeans, edible oils and sugar, trade policies have led to reduced producer prices and induced farmers to, ceteris paribus, reduce output. The more liberal import policies, however, has facilitated the inflow of food through rising imports of such crops.

Drawing the link between the performance of the agricultural sector and national food security is complex because rural households are both producers and consumers. We have discussed previous the impact of trade on production in Chapter IV (Table 4.12). In the Tables 5.4 to 5.7, we show how trade changes and domestic policies have affected food consumption of the *average household* in rural (Tables 5.4 and 5.5) and urban China (Tables 5.6 and 5.7). The information in these tables differs from those in Chapter III, Table 3.10, which discuss how agricultural trade (and their price impacts) affect *total* consumer expenditure, not just those on *food*. Because we are interested in the impact of food consumption of the poor, which will be discussed in the next section, we do not discuss Tables 5.4 to 5.7 in depth.

Tables 5.4-5.7 show that although food demands have been mainly driven by domestic economic forces such as population and income growth, food market development, price changes due to non-trade policies, etc, the changes on trade also have affected food consumption. In general, the impacts of trade changes on the consumption of foods from crops are large than meat. This is because the changes in livestock trade were much less

than in the change of the trade in crop sector. Over entire period of 1985-2000, trade changes had a small positive impact on crop food consumption and small negative meat consumption. However, the impacts changed over time. The patterns of food consumption changes for all foods are consistent with the price changes that were presented in Chapter III. That is, whenever the trade induced the increase (decrease) in a commodity price, its consumption fell (rose). Liberalizing soybean and edible crop sector led a decline in the domestic prices of oilseeds and oil in the late 1990s, the consumption of soybean and edible oils increased in the same period, while protecting maize directly raised the domestic price of maize and indirectly increased meat prices, therefore, the impacts of trade policy change in the late 1990s had a negative impact on the food consumptions of maize and meats (Tables 4.5-4.7).

II. Household Food Security

Because the impacts of trade and nontrade policies on agricultural production have been extensively discussed in Chapter 4 and on per capita food consumption for represented rural and urban household were also briefly presented the previous section, in this section, our focuses are the corresponding impacts of the same policies on household food consumptions expenditures for average rural household and by region and income group.

A. Impacts on Household Food Consumptions

Using the information on trade- and domestic policy-induced changes in food consumption (Tables 5.4 to 5.7), food price (Table 3.5 and 3.6) and household characteristics presented in Chapter 4, we can analyze the impacts of trade and domestic policy changes on farm household food consumption expenditure (Tables 5.8). This table shows us how much per capita food consumption expenditure actually changed between 1985 and 2000 for all foods (total—rows 1 to 4) and then for the different types of food categories (e.g., liberalized importable sector—rows 5 to 8; protected importable sector—rows 9 to 12; exportable sector—rows 13 to 16; and other crops—rows 17 to 20) for average rural household. The changes are then calculated for how much was due to trade in percentage changes over time (column 3); value terms (column 4); and the impact of trade in value terms as a percent of food consumption expenditure (column 5). In a similar way, we generate Tables 5.9-5.13 for the selected income groups, by region and for the selected income groups of each region.

For average rural household, per capita food consumption expenditure increased by 11.2 percent in 1985-1990 and 14.4 percent in 1990-1995, but declined by 17.9 percent in 1995-2000 (Table 5.8, column 2). Most of the change has been come from domestic policies because the impacts of trade were much small than the actual changes (comparing columns 2 and 3). The trade impact on food consumption expenditure was negative in 1985-1990, which was due to mainly due to a significant increase in wheat import in the late 1980s (Table 3.5 in Chapter 3). However, since the early 1990s and particular after the middle 1990s, reduction in expenditure in liberalizing importable

sector has been less than the rise of expenditure in protected importable sector. The impact of trade on food expenditure has been positive since the early 1990s. Because increase in the food expenditure could be caused by both changes in food prices and food consumptions, in order to access whether rural consumers gain or loss from trade changes, we decompose the growth in total food expenditure (G_E) into the growth due to overall price (G_P) and consumption (G_C) by the following measure:

$$G_{Et} = G_{Ct} + G_{Pt} + G_{Ct} G_{Pt}, \qquad \text{and}$$

$$G_{Pt} = \bullet_i (C_{it} P_{it-1} / C_{it-1} P_{it-1})$$

Our study shows that the overall food price changes due to trade changes were much less than the total food expenditure changes, which implies that the real food consumption has increased due to trade policy since early 1990s. For example, based on the above formulas, we compute the trade changes resulted in overall food price increased by 1.74 percent in 1995-2000, while food expenditure increased by 1.9 percent in the same period, which implies the real food consumption was raised slightly by 0.16 percent.

Table 5.9 provides information in the impact of trade on total food consumption expenditure and also for different categories of goods in yuan (rows 1 to 15) and impacts as a percentage of food expenditures (rows 16 to 30) for the poorest of the poor (group 1—column 1); the group 2 poor (column 2); the median group 6 (column 3); and a wealthier group (group 9—column 4).

Table 5.9 shows the similar story as that in the Table 5.8, but a striking feature is that the impacts of trade policy on total food consumption for farmers in different income categories are very similar. Moreover, although the increase in the real food consumption is very small, if we analyze the impacts of food consumption while comparing it to Table 4.12, this table provides the impact of trade policies on agricultural production for the same categories (same households), we can generate more interesting results. Taken together, we can begin to understand the "net cash" impact in yuan (in addition to impact on real consumption of food) of trade policies.

Based on this analytical framework, we can make several substantive observations about the effect of trade liberalization on household welfare. First, the large trade policy-induced shifts in food expenditures have a close relationship to trade policy-induced shifts in agricultural production. Because trade impacts in our analytical framework affect households mainly through price changes, relatively large trade-induced price changes in one direction (e.g., positive through a price rise) have an income effect in the same direction (higher prices lead to higher agricultural incomes).[17] Given that all of our households (especially the poor) have positive income elasticities for food, the shift in food expenditures due to trade generally move in the same direction as trade policy-induced shifts in agricultural production (for large shifts in prices). For example, the

[17] There are also cross price effects. As a result if the price shifts are small, the income effect will be small and direct and cross price effects may offset it. In this case, it is possible that trade policy-induced shifts in food expenditure move in a different direction than trade policy-induced shift in agricultural production.

effect of trade shifts on agricultural production between 1995 and 2000 for all products for the poorest of the poor (32.3 yuan—column 1, row 3, Table 4.12) exceeds the effect on household food consumption (18.2—column 1, row 3, Table 5.9). The same is true for all other large shifts in prices (compare, for example, all columns in row 3, 6 and 9 in Table 4.12 with the corresponding figures in Table 5.9).

Second, the effect on rural residents as producers typically is larger than the effect on them as consumers. Production side shifts (both positive and negative) are larger than shifts in expenditures because while the rural resident as producer enjoys (suffers) all of the gain (loss) from the price rise (fall), the rural resident as consumer only is affected by a fraction since much of the output is sold to consumers in the city. This is most poignantly shown by examining the differences in the relative production-expenditure shifts between food crops (e.g., rice—row 3 in Tables 4.12 and 5.9) and a feed crop (e.g., maize—row 9 in Tables 4.12 and 5.9). Since a larger fraction of the output is consumed for rice, the gap between the trade policy-induced effect on production and expenditure is less. For example, the poorest rural resident gains less overall in the case of rice (e.g., 32.3 as a producer, but only 18.2 as a consumer—since although the household is using its higher income to consume more rice, the rice is higher priced due to trade policies) than when compared to the situation of maize (in which case, the maize producer gains 73.7 yuan and but only 18.9 yuan as a consumer, since so little of the maize is directly consumed as food).

In addition, we find that the largest net gains (that is the difference between production and food expenditures) are found in the case of the protected importable sector. Because of this, the poorest of the poor (group 1) and the group 2 poor are found to have benefited greatly from trade policy, especially in relative terms. In fact, if one takes the difference between agricultural production value and expenditure (and subtracts out a part of the output amount to account for inputs used—say 40 percent of output value), it can be seen that the poorest of the poor gain by around 2 to 3 percent of average household income for the poorest of the poor. At the same time, the group 9 households benefit by about the same amount in absolute terms, but because their income is so much higher in percentage terms it is less than one percent.

When examining the differences in the impacts during the late 1990s for households in all income levels, it is also obvious that the type of crop a household grew greatly affected the nature of the impact of trade policy. Those farmers that grew crops that belonged to the protected imported sector (e.g., maize) or the exportable sector (e.g., horticulture crops) gained on average. Those the cultivated crops in the liberalized importable sector (e.g., soybeans) lost.

Finally, our data analysis also shows that the trade effects on crop type are more important than the region of the country in terms of expenditure impacts (Table 5.10). In other words, when examining our data by region, we find that there are only slight differences among the regions (rows 1 to 3, column 4). The western region gains in food expenditures (20.5) are only slightly more than those in the central (17.4) and eastern regions (16.8). Interestingly, however, the gains in agricultural production differ more by

region for the average household (from -4.3 to 50.3--Table 4.13, rows 1 to 3, column 4). In this case, the rich gain the most. The differences in these effects must be traced to the differences in cropping patterns and food expenditure patterns. Evidently, because markets are fairly well integrated, all consumers in China (those in the east, center and west) consume a basket of goods that is more similar than their production baskets. The farm households in the center of the country obviously cultivated a crop mix that has been hurt more by trade liberalization.

When examining the data by year and region, by commodity type and by income group (Tables 5.11 to 5.13), a similar pattern emerges. Our data show us that it is the producers in the relatively richer income groups in the central region are the ones that are suffering the most severe negative trade induced effects (4.15, row 3, column 4).

In the aggregate, however, we believe that trade policies have helped in food security. As we saw above, richer farmers have in net terms have benefited the most. They are the ones who are producing the crops that China has a comparative advantage in and these are the crops that have seen their price rise from more relaxed trade rules. The poor have also benefited, but whether it was a conscious decision or not by officials, their interventions into maize and cotton markets have aided the poor.

PART SIX: MAIN FINDINGS

With the work contained in the five chapters, we hope that we can answer three key questions. During the past two decades, what economic and trade policy reforms have China introduced? What has been the impact of specific reforms on production and trade? And, how has domestic food security at the national and household levels been affected by the reform process? According to our analysis, we believe that we have shown the following key findings.

Food security has been one of the central goals of China's agricultural policy. Since the early 1980s, domestic reforms to boost agricultural growth and farm income have covered nearly every aspects of the economy, started from land reform and then gradually move to both input and output markets, from agricultural sector specific policy to macro economy policy. The reforms have resulted in significant impacts on its economy. China has been able not only to increase its ability to feed its growing population with the extremely limited natural resources, but also developed itself as one of major food and agricultural exporters in the world recently. Per capita availability of food, household food security, and nutrition have all improved significantly. Increased domestic production is almost solely responsible for increased per capita food availability.

China's experience demonstrates the importance of technological development, institutional change, price and market liberalization, rural economic development and other conducive policies in improving agricultural productivity, farmer income, and food security in a nation with limited land and other natural resources. Technology has been the engine of China's agricultural economy growth. Institutional arrangement and government food policies also played important role in China's food production and availability of food for the whole society. Rural enterprise development and off-farm employment play a substantial role in China's economy and farmer's income and household food security. Broad participation in strong rural economic growth brought about a tremendous reduction in absolute poverty in China.

External reforms in general have paralleled those in domestic reform. Through nearly 20 years reform, China's foreign trade regime has gradually changed from a highly centralized, planned and import substitution regime to a more decentralized, market-oriented and export promotion regime.

Reform and trade liberalization in China's external sector has proceeded gradually. Gradual trade liberalization as the reforms in the other sectors of China's economy has its logic. In the initial stage, reformers only implemented measures that provided incentives to sets of corporations and institutions. As the experience gained from the reform grows and the objectives of trade could be achieved through alternative settings of institutions and policies, trade liberalization has been processed smoothly since the late 1980s. However, in the late 1990s, China also used various means to protect some of its crops such as maize and cotton.

Even though domestic policies have been relatively more important, trade reforms did have impacts on China's domestic agricultural production and food security. The nature

of impacts of trade and nontrade domestic policies, however, differs. Domestic reforms have boosted the growth in all sectors. They also have increased food security primarily by increasing food availability (at both the national and household levels). Because of rising output, there also has been a large, negative price effect that has benefited consumers, both rural and urban consumers (and, particularly the urban poor). In contrast, trade liberalization has had both positive and negative impacts. Although there has been less of an impact on aggregate production and consumptions, trade policy reforms have had powerful structural change impacts, moving a country towards sectors in which it has a comparative advantage. As such, trade policies have been useful in improving allocative efficiency and making the sector more competitive.

Because trade impacts are more commodity specific, they have more sharp regional and crop-specific impacts. This also means that they affect equity. Because China's agricultural markets has been highly integrated since the middle 1990s, any impacts (either positive or negative) could be largely transmitted to the farmers in different regions. The analyses based on regional data show that while both eastern and western regions have benefited from trade policy, liberalization has hurt producers in central China primarily because the region is the largest producer of soybean and edible oil, two of the sets of commodities that are most hurt by liberalization. Although the government also has used trade policy to protect maize, and producers in central China gain from this protection (as the farmer in central China also are the largest producers of maize), the gains from the rising protection are less than loss in other sectors. These findings also imply that central China will face an even large challenge after China joins the WTO (because under its WTO agreement, it is scheduled to gradually liberalize its maize sector).

Interestingly, during recent years, the poor have gained more in rising production (at least in a relative sense) as the richer producers. Therefore, trade liberalization has contributed to household-level food security. At least in percentage terms (of agricultural income), nearly all the gains have come from the nation's protection of maize, cotton and wheat (mainly maize). While overall the poor have gained, trade policy has not been completely poor pro. In fact, the poor also lost substantially since they also were large producers of soybeans and edible oils. Since the poor enjoyed gains that essentially were from higher protection, in the future as the nation liberalizes trade further (especially maize, cotton and wheat), the poor might face big challenges. Because the protection of this sector is not likely to last for long and the poor currently allocate a large share of their land to crops in which China has less of a comparative advantage, there is a role for government. In particular, the government is needed to help these farmers in shifting their production more towards crops in which China has a clearer comparative advantage. In the meantime, China also needs to reduce the negative impact from trade by raising domestic production through productivity-enhancing investments.

The poor have gained less than the rich also because despite having farms that are of a similar size, their land produces less than that of the richer producers. It could be that the lower production is due to inferior land and climate resources. It could also be that poorer producers have access to fewer inputs. If so, the clear policy implications are that

the government needs to provide ways for farmers to access better technology, water control and credit.

For China to have trade liberalization end up having a positive overall effect, they need to not only open up their markets, they need other countries to open up their markets for China's products. So far in the aftermath of WTO, China has not been able to gain as much as it thought it would in the increased exports of horticulture and livestock commodities. In addition, developing countries, like China, need to heavily invest in quality and food safety to better meet international standards.

The impact on agriculture, however, is only part of the story. Trade liberalization and domestic reforms have also affect the access of households to non farm employment and the wage they earn for being in the off farm market. In general, China has gained a lot from trade liberalization. Rising exports of manufacturing goods have been produced in factories that hire a lot of rural labor. These factories have also had spillovers that have helped make domestic factories more productive and increase the demand for labor. In country like China, raising the demand for off farm labor is probably the most important thing that can happen in the economy. So far, the success has been unparelled. The nation needs to keep promoting policies that facilitate investment and allows rural households to move to these jobs without constraints.

In final summary, trade liberalization has had both a positive and negative impact on agricultural production. There has been more of a negative impact on those in central China. Those in the eastern part of the country have benefited the most; while those in the west have benefited but somewhat less. Interestingly, the recent protection enjoyed by the maize and cotton sectors has helped the poor, which resulted in the more benefit of the poor than the rich in relative term (relative to their production level) from overall trade policy changes (both liberalization and protection) However, the overall impact would be much less if China had not protected its maize, cotton and wheat commodities. If they liberalize them, the poor and producers in central China will face even greater challenges. However, policies which force farmers to shift into crops in which they have a comparative advantage in the long run make for a healthier and more competitive economy. Both agricultural structural change and the rise in off-farm employment will drive growth in China's future. Overall effects in the future will depend on trade policies, but will also depend on other nontrade national policies and the liberalization of the rest of the economies in the rest of the world.

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APPENDIX A:

A FRAMEWORK FOR IMPACTS OF AGRICULTURAL TRADE AND RELATED REFORMS ON DOMESTIC FOOD SECURITY IN CHINA

The main objective of this appendix is to present an analytical framework that has been developed and used in this study. This appendix is organized as follows. Section I provides an overview of the analytical framework. Section II presents China's Agricultural Policy Analysis and Simulation Model (CAPSiM), a sector-wide partial equilibrium model with consistently restricted matrices of demand and supply systems. Section III describes how the model links with the household sub-models that trace the implications of agricultural trade and trade related reforms to various categories of households in different areas, or the effects of various policies and external shocks on production and consumption of agricultural commodities at farm levels for each region.

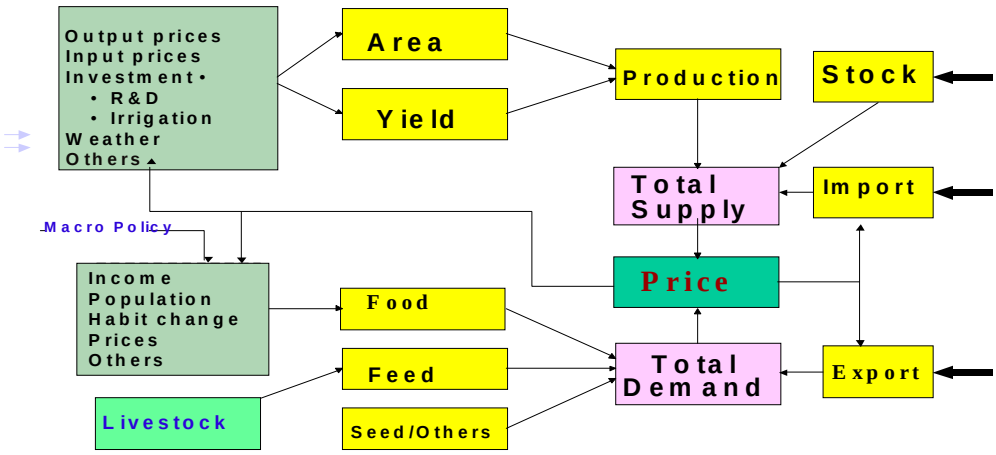
I. General Framework

The qualitative analysis of the impacts of agricultural trade and related reforms on domestic food security is implemented in an integrated analytical framework that links the national markets with individual groups of farmers in each region. This integrated analytical framework includes three major components: a national partial equilibrium model, price transmission, and household response model for various groups of farmers by region.

The national partial equilibrium model (CAPSIM) simulates the impacts of various policy changes and external shocks to national market on agricultural production, stock changes, consumption, trade and agricultural prices. The policies that can be analyzed in this model include productivity enhanced investment policy such as agricultural research and irrigation investments (both are transferred into stock variables – research stock and irrigation stock), the efforts in environmental protection (ie., erosion and salinity control), population control policy (rural-urban migration or urbanization and family planning), macro economic policy (i.e., foreign exchange rate), agricultural protection (i.e., tariff and non tariff distortion), and so on. Prices can be determined endogenously or exogenously. Impacts of natural disasters and other exogenous shocks can also be simulated, which are introduced into the model exogenously.

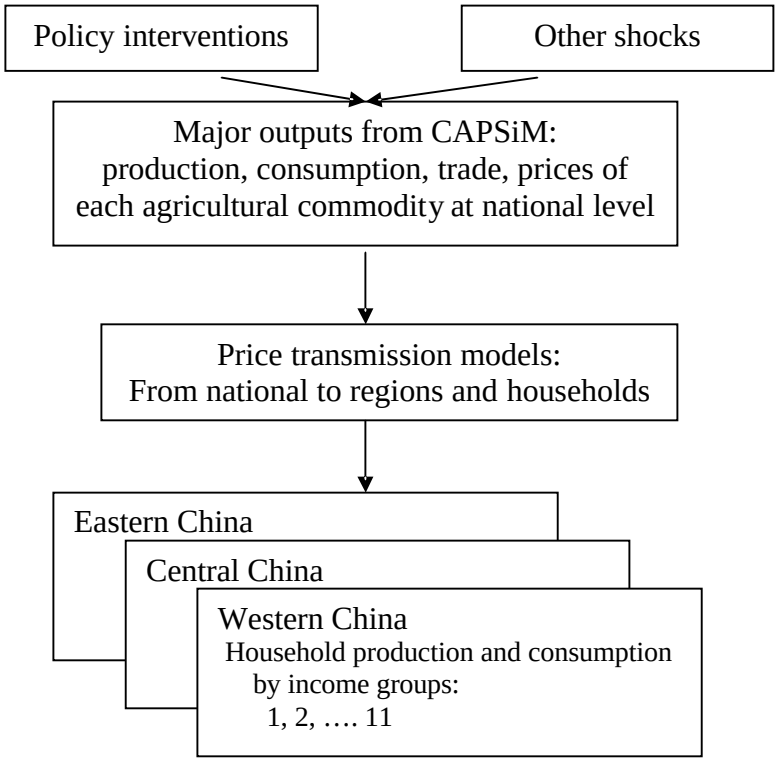
Appendix Figure 1 provides an overview of one individual crop in CAPSiM. For each crop, a total supply is composed of three sub-models, namely import, stock change and domestic production. Domestic production is modelled separately by area and yield equations, they are the function of output and input prices, supply shifters such as investment of R&D and irrigation, climate shocks, erosion and salinity control, and others. The total demand for each commodity includes export demand, demands for food and feed, seed use, industrial demand and others (i.e., post-harvest loss and loss in the food marketing and processing). Food demand is determined by a completed demand system with imposition of adding up, homogeneity and symmetric conditions on demand elasticity matrix for both rural and urban. Impacts of urbanization and food market development in rural area are examined explicitly in the model. Feed demand sub-model

for each crop automatically links with livestock and fish sub-models. The model structure of livestock and fish sector for each commodity has a similar structure as the crop model. The equilibrium for all commodities are solved simultaneously. Details of model specifications and method to solve the equilibrium are presented in the next section.



Appendix Figure 1: Overview of Individual Crop in CAPSiM

Appendix Figure 2: Overall Analytical Framework



To examine agricultural trade liberalization on household food security, in this study we measure it as the impacts on household food production and consumption, ideally the national impacts derived from CAPSiM should be transmitted into the households in each region through a price transmission model and household supply and demand response models as showed in Appendix Figure 1. However, the studies of price transmission and household response (for each group of farmers in each region) are far beyond of the scopes of this project. Although current CAPSiM has developed modules for this kind of study, the analysis needs to incorporate a number of assumptions on how the impacts on national level would be transmitted into various households. The works on price household supply and demand responses for each group of households by region are undertaking. But our market integration analyses presented in Chapter III clearly show that the price changes in on one market have been largely transmitted to other markets since the middle 1990s. To simplify analysis, we assume that the proportional changes of prices at national level were equalled to the proportional changes of prices in each region. While this assumption might not be too strong for the period of 1995-2000, the impact analyses based on the same assumption for the period before 1995 might over-state the impacts of trade in inland areas.

II. China's Agricultural Policy Simulation and Projection Model (CAPSiM)

The model includes production, demand, import and export, storage change, and market cleaning sub-models. The specifications of each sub-model are defined bellow. Note, in the following discussion, any variables with ^ representing the percentage changes, for example, $\hat{X}$ = dX/X.

2.1 Domestic Production

2.1.1 Crop Production

Area:

$\log A_{it} = a^{A}_{i0} + \Sigma_j b^{A}_{ij}(\log p^{S}_{jt})$, and with the following restrictions

$\Sigma_j b^{A}_{ij} = 0$ for all i

$b^{A}_{ij} W_{it} = b^{A}_{ji} W_{jt}$ for all i, j

***Yield*:**

$\log Y_{it} = a^{Y}_{i0} + \Sigma_j b^{Y}_{ij}(\log p^{S}_{jt}) + c_i \log R_{it} + k_i \log I_t + g_i \log Z^{Erosion}_{t} + h_i \log Z^{Salinity}_{t}$

$\Sigma_j b^{Y}_{ij} = 0$

Production:

$Q_{it} = A_{it} * Y_{it}$

$$\hat{Q}_{it}^{S} = \hat{A}_{it} + \hat{Y}_{it} + (Z^{A1}{}_{i(t-1)} + Z^{A2}{}_{it} + Z^{A3}{}_{it} + Z^{Y1}{}_{it} + Z^{Y2}{}_{it})$$

Where:

A	: crop harvested area;
Q	: total production;
Z^{A1}	: area changes due to climate shocks
Z^{A2}	: area changes due to policy not included in the model
Z^{A3}	: area changes due to other external factors
P^{S}	: prices of output received by farmers or the prices of input paid by farmers;
Y	: crop yield;
W	: individual crop area shares in the crop areas;
R	: stock of crop technology;
I	: irrigation stock;
$Z^{erosion}$	: ratio of erosion area to total land area;
$Z^{salinity}$	: ratio of salinity area to cultivate area;
Z^{Y1}	: yield changes due to climate shocks
Z^{Y2}	: yield changes due to other factors not included in the model
i	: index crop
j	: index both crop outputs and inputs

a^{A} , b^{A}, a^{Y}, b^{Y}, c, k, g, and h are the area or yield supply response parameters (elasticities).

In order to be consistent with the theoretical restrictions, the following conditions are imposed:

$b^{A}_{ij} = b^{A}_{ji} * A_j / A_i$;

$(dA_i/dp_j^{S})/(dA_j/dp_i^{S}) = p_i^{S}/p_j^{S}$; and

$$\sum_j b_{ij}^{A} = 0.$$

2.1.2 Animal Product Supply Responses

$$\log q_{it} = a^{q}_{i0} + \bullet_j b^{q}_{ij} (\log p^{S}_{jt})$$

$$\hat{q}_{it} = \hat{q}_{it} \mid_{without\_shocks} + Z^{q1}{}_{it} + Z^{q2}{}_{it}$$

$\Sigma_j b^{q}_{ij} = 0$, for all i (homogeneity).

Where:

q	: livestock production;

Z^{q1} : change in production due to disease shocks
Z^{q2} : change in production due to other shocks
i : index animal products (i.e., pork, beef, mutton, poultry, egg, milk, and fish et al.);
j : index animal products (i.e., pork, beef, mutton, poultry, egg, milk, fish et al.) and input factors (i.e., maize, other feed, and labor et al.) in animal production.

a^q and b^q are the animal product supply response elasticities.

Production by Mode

$$q_{ikt} = \bullet_{ikt}\ q_{it}$$

$$\bullet_{ikt} = \bullet_{ik(t-1)} + \bullet_{ik}$$

$$\bullet_k \bullet_{ikt} = 1$$

Where
q : livestock production;
• : share of each production mode;
$\bullet_{ik}$: annual change in •;
i : index animal products: pork, beef, mutton, poultry, egg, milk, and fish; and
K : index production mode, including: backyard, specialized household, and intensive commercial production.

2.2 Domestic Demand

2.2.1 Food Demand

$$\log d^R_{it} = a^{RD}_{i0} + \bullet_j b^R_{ij}(\log p^D_{jt}) + e^R_i \log Y^R_t + m_i \log Z^{MKT}_t$$

$$\log d^U_{it} = a^{UD}_{i0} + \bullet_j b^U_{ij}(\log p^D_{jt}) + e^U_i \log Y^U_t$$

$$d_{it} = \bullet^R_t d^R_{it} + \bullet^U_t d^U_{it}$$

$$D^{Food}_{it} = d_{it} * Pop_t$$

Where:
d^R, d^U : per capita food demand in rural and urban, respectively;
d : per capita food demand in national level;
D^{Food} : national total food demand;
p^D : consumer price;
Y^R, Y^U : per capita income in rural and urban, respectively.
Z^{MKT} : food market development index;
b^R, b^U : price elasticity matrix of food demand in rural and urban, respectively.

e^R, e^U : income elasticities of food demand in rural and urban, respectively.
m : market development elasticity of food demand in rural;
$\bullet^R$, $\bullet^U$: rural and urban shares in the total population;
Pop : total population;
i and j : index food, including: rice, wheat, maize, sweet potato, potato, other coarse grain, soybean, sugar, oil, fruit, vegetable, pork, beef, mutton, poultry, egg, milk, fish and other food.

Demand restrictions:

For both rural and urban demand model, the following parameter restrictions hold:

Homogeneity: $\bullet_j b_{ij} + e_i = 0$, for all i;

Symmetric: $b_{ij} = W_j * (b_{ji} / W_i + e_{ji})$, if i>j;

Engel aggregation or Cournot condition: $\sum_i b_{ij}^R * W_i + W_j = 1$.

2.2.2 Total Feed Demand

$$D^{Feed}_{jt} = \bullet_k(1 + \bullet_{jkt})\bullet_{jk}\bullet_{jkt}q_{jt}$$

$$\bullet_{jkt} = \bullet_{jk(t-1)} + \bullet_{jk}$$

$$D^{Feed}_{t} = \bullet_j D^{Feed}_{jt}$$

$$D^{Feed}_{it} = \bullet_i f_{it} D^{Feed}_{t}$$

$$f_{it} = (1 + r_f)^t f_{i(t-1)}$$

Where:
q : livestock production;
D^{feed} : total feed demand;
$\bullet$: feed/meat ratio;
$\bullet$: efficient gain in feeding livestock;
f : grain i's share of total feed grain;
r_f : annual growth rate of f;
i : index individual grain and other feed, including: rice, wheat, maize, sweet potato, other coarse grain, and soybean;
j : index meat products, including: pork, beef, mutton, poultry, egg, milk, and fish;
k : index production mode, including: backyard, specialized household, and commercial intensive (company) production.

2.2.3 Other Demand

$$D^{Seed}_{it} = (1 + \bullet^{S}_{t})\, d^{Seed}_{i(t-1)} A_{it}$$

$$D^{Ind}_{it} = (1 + \bullet^{I}_{it})\, D^{ind}_{i(t-1)}$$

$$D^{Waste}_{it} = (1 + \bullet^{W}_{it})\, d^{Waste}_{i(t-1)} Q_{it}$$

Where A and Q are the same as those defined in (1.1) (crop area and total production), others are:

D^{seed} : total seed use;
D^{ind} : industrial use;
D^{waste} : post-harvest loss;
d^{Seed} : seed use (kg) per hectare;
d^{Waste} : waste (loss) as share of production;
$\bullet^{S}$: annual growth rate of seed use per hectare;
$\bullet^{I}$: annual growth rate of industrial use;
$\bullet^{W}$: annual growth rate of post-harvest loss;
i : index individual commodities, including: rice, wheat, maize, sweet potato, potato, other coarse grain, soybean, cotton, oil crop, sugar crop, vegetable, and other crops.

2.2.4 Total Crop Product Demand

$$D_{it} = D^{Food}_{it} + D^{Feed}_{it} + D^{Seed}_{it} + D^{Ind}_{it} + D^{Waste}_{it}$$

Where:

D : total demand;
i : index individual grains, including: rice, wheat, maize, sweet potato, potato, other coarse grain, soybean, cotton, rapeseed, sugar crop, and other crops.

The others are defined in the previous equations.

2.3 Stock

$$B_{it} / D_{it} = B_{i(t-1)} / D_{i(t-1)} + lp^{D}_{it}$$

Where:

B : stock;
l : marginal change in grain stock due to grain price change.

The others are defined in the previous equations.

2.4 Trade

After estimating the changes in production of and demand for agriculture products by using the models given above, we can get the percentage changes in import and export by decomposition equation derived from constant elasticity of substitution (CES) mechanism, in response to the percentage changes in their prices domestically and abroad.

Consider the two components case, where the elasticity of substitution is defined as the percentage changes in the ratio of the two cost-minimizing component demands, given a 1 percent change in the inverse of their price ration:

$$\sigma \equiv (\hat{q}_1 / \hat{q}_2)/(\hat{p}_2 / \hat{p}_1).$$

For larger values of σ, the rate of change in the quantity ratio exceeds the rate of change in the price ratio and the cost share of the component that becomes more expensive actually falls. Expressing the above equation in percentage change form, we obtain:

$$(\hat{q}_1 - \hat{q}_2) = s(\hat{p}_2 - \hat{p}_1).$$

CES functional form gives the following relationship between the changes in quantities demanded of components and the composite good:

$$\hat{q} = q_1\hat{q}_1 + (1-q_1)\hat{q}_2,$$

where θ_1 is the cost share of component 1 and $(1-\theta_1)$ is the cost share of component 2. Solving for $\hat{q}_2$ gives:

$$\hat{q}_2 = (\hat{q} - q_1\hat{q}_1)/(1-q_1),$$

which may be substituted into $(\hat{q}_1 - \hat{q}_2) = s(\hat{p}_2 - \hat{p}_1).$ to yield:

$$\hat{q}_1 = (1-q_1)s(\hat{p}_2 - \hat{p}_1) + \hat{q}.$$

Note that this conditional demand equation is homogeneous of degree zero in price, and the compensated cross-price elasticity of demand is equal to $(1-\theta_1)\sigma$.

CES functional form also gives the following relationship between the changes in prices of components and the composite good:

$$\hat{p} = q_1\hat{p}_1 + (1-q_1)\hat{p}_2.$$

First we solve for $\hat{p}_2$ as a function of $\hat{p}_1$ and $\hat{p}$, then substitute this to $\hat{q}_1 = (1-q_1)s(\hat{p}_2 - \hat{p}_1) + \hat{q}.$ to obtain:

$$\hat{q}_1 = s(\hat{p} - \hat{p}_1) + \hat{q}.$$

Note that *the form of the above equation is unchanged when the number of components* increases *beyond two*. This equation decomposes the change in the derived demand, $\hat{q}_1$, into two parts. The first is the substitution effect. It is the product of the constant elasticity of substitution and the percentage changes in the ration of the composite price to the price of component 1. The second is the expansion effect. Owing to constant return to scale, this is simply an equi-proportionate relationship between composite and component.

In the trade model, FOB and CIF prices are first exchanged into domestic currency. After that, they are transformed into domestic market prices at the national level by deducting producer subsidy expenditure. Then, the percentage changes in the quantities imported and exported are given in the form of equation $\hat{q}_1 = \mathsf{s}(\hat{p} - \hat{p}_1) + \hat{q}$. In this equation, the percentage changes in composite quantity and price are the percentage change in total quantity demanded and weighed averages percentage changes in producer price, consumer price, import price and export price by using their cost share in the last year as weights, respectively. The elasticity of substitution $\sigma = 2.2$ (FAO).[18]

$$\hat{X}_{it}^{import} = \mathsf{s}(\hat{p}_{it} - \hat{p}_{it}^{import}) + \hat{q}_{it}$$

$$\hat{X}_{it}^{export} = -\mathsf{s}(\hat{p}_{it} - \hat{p}_{it}^{export}) - \hat{q}_{it}$$

$$X^{netimport}_{it} = X^{import}_{it} - X^{export}_{it}$$

$$p^{import}_{it} = p^{ib}_{it}(1 + PSE^{import}_{it})$$

$$p^{export}_{it} = p^{xb}_{it}(1 + PSE^{export}_{it})$$

$$p^{ib}_{it} = XR_t p^{cif}_{it}$$

$$p^{xb}_{it} = XR_t p^{fob}_{it}$$

Where:

X^{import}: Import.
X^{export}: Export.
$X^{netimport}$: Net import.
XR: Exchange rate.
p^{rural}: Rural consumer price.
p^{cif}: CIF price.
p^{fob}: FOB price
PSE: Producer subsidy expenditure.
i: index individual grain, including: rice, wheat, maize, sweet potato, potato, other coarse grain, soybean, sugar, pork, beef, mutton, poultry, egg, and fish.

[18] CIF price and FOB price are subject to changes in the prices of traded commodities in world market which are estimated based on projection of world market prices made by World Bank. Exchange rate is given in Appendix 1 Table 1.

2.5 Market Clearing

$X^{netimport}_{it} + S_{it} = D_{it} + B_{it} - B_{i(t-1)}$

Where

S	: total domestic production, $S = Q^S$ for crop, S = q for animal products;
D	: total domestic demand;
$B_t - B_{t-1}$	: stock changes;
i	: index individual commodities (i.e., rice, wheat, maize, sweet potato, potato, other coarse grain, soybean, cotton, oil crop, sugar crop, vegetable, fruit, pork, beef, mutton, poultry, egg, and fish, et al.).

Prices can be either endogenously or exogenously determined in the above model. Supply equations, which include area and yield for various crops and production of animal products, allow producers response to own and cross price changes, shifts in agricultural technology, changes in irrigation stock, environmental stress (e.g., erosion and salinity areas), and other exogenous shocks such as climate, disease and non price policies, etc..

Demand equations, which are projected separately by urban and rural, allow consumers response to own and cross prices changes, shifts in income and market development as well as other demand shocks.

The total change in supply for different commodity between periods is projected by first order derivative of equations under sub-section (2.1.1) for crops and sub-section (2.1.2) for animal products. It can be stated in terms of its components as follows:

$$\frac{\Delta S_{it}}{S_{i(t-1)}} = \eta_{si}\frac{\Delta P_{it}}{P_{i(t-1)}} + \sum_{j\neq i}\eta_{sj}\frac{\Delta P_{jt}}{P_{j(t-1)}} + \delta c_i\frac{\Delta R_t}{R_{t-1}} + \delta k_i\frac{\Delta I_t}{I_{t-1}} + \delta g_i\frac{\Delta Z_t^{Erosion}}{Z_{t-1}^{Erosion}} + \delta h_i\frac{\Delta Z_t^{Salinity}}{Z_{t-1}^{Salinity}}$$

Where all variables are defined in the previous equations except for:

S = total domestic production, $S = Q^S$ for crop, S = q for animal products;

- η_{si} = own price elasticity of i^{th} commodity (derived from area and yield elasticities for crops);
- η_{sj} = cross price elasticity of i^{th} commodity (derived from area and yield elasticities for crops);
- δ = 1 for crops and 0 for animal products;

In a similar way, total change in demand for different commodities between periods is derived by first order derivative of equations under sub-section (2.2.1):

$$\frac{\Delta D_{it}}{D_{i(t-1)}} = \varepsilon_{di} \frac{\Delta P_{it}}{P_{i(t-1)}} + \sum_{j \neq i} \varepsilon_{dj} \frac{\Delta P_{jt}}{P_{j(t-1)}} + e_i \frac{\Delta Y_t}{Y_{t-1}} + dm_i \frac{\Delta Z_t^{MKT}}{Z_{t-1}^{MKT}}$$

Where all variables are defined in the previous equations except for:

D_{it} = domestic demand curve for i^{th} commodity;

- ε_{di} = own price elasticity of demand for i^{th} commodity (weighted rural and urban elasticities);
- ε_{dj} = cross price elasticity of demand for i^{th} commodity (weighted rural and urban elasticities);
- = 1 for rural, 0 for urban.

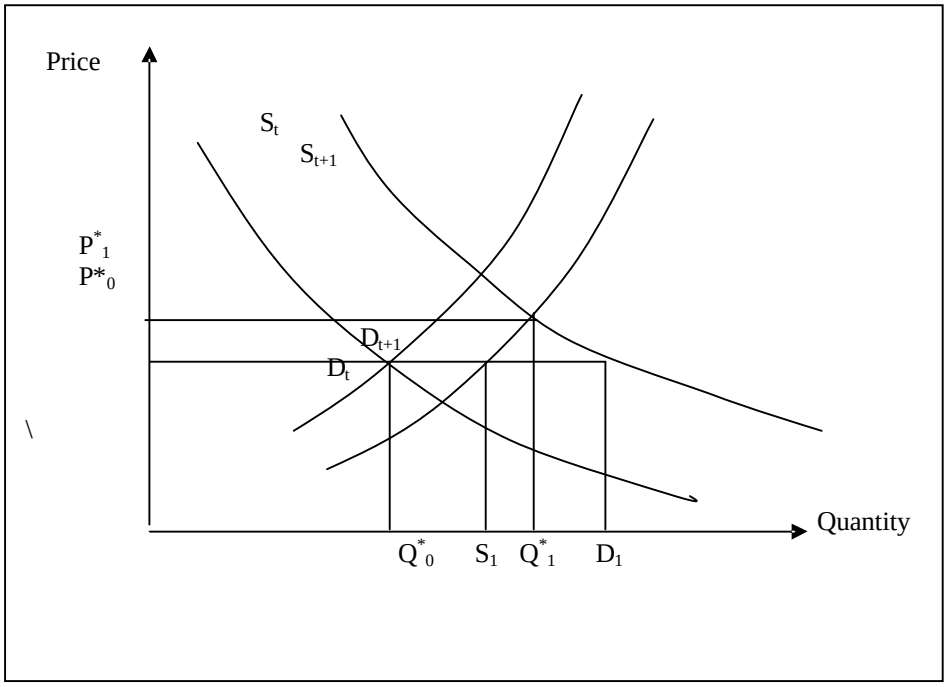


Figure 3. Price Determination and Market Cleaning.

Figure 3 graphically illustrates price determination in period *t+1*. Finding the equilibrium values, P_1^* and Q_1^*, require knowing S_1 and D_1. Recall from the equations on sub-section (2.1.1, 2.1.2, and 2.2.1) above that for the i^{th} commodity, when $\Delta P_{it} = 0$, the followings are evident:

$$\frac{\Delta S_t \mid_{\Delta P_{it}=0}}{Q^*_{t-1}} = \sum_{j \neq i} \eta_{sj} \frac{\Delta P_{jt}}{P^*_{j(t-1)}} + \delta c_i \frac{\Delta R_t}{R_{t-1}} + \delta k_i \frac{\Delta I_t}{I_{t-1}} + \delta g_i \frac{\Delta Z_t^{Erosion}}{Z_{t-1}^{Erosion}} + \delta h_i \frac{\Delta Z_t^{Salinity}}{Z_{t-1}^{Salinity}}$$

$$\frac{\Delta D_t \mid_{\Delta P_{it}=0}}{Q^*_{t-1}} = \sum_{j \neq i} \chi_{dj} \frac{\Delta P_{jt}}{\Delta P^*_{j(t-1)}} + e_i \frac{\Delta Y_t}{Y_{t-1}} + \delta m_i \frac{\Delta Z_t^{MKT}}{Z_{t-1}^{MKT}}$$

With the above changes, Fig. 3 shows S_1 and D_1 can be estimated as follows:

$$S_1 = Q^*_0[1 + \sum_{j \neq i} \eta_{sj} \frac{\Delta P_{j1}}{P^*_{j0}} + \delta c_i \frac{\Delta R_1}{R_0} + \delta k_i \frac{\Delta I_1}{I^*_0} + \delta g_i \frac{\Delta Z_1^{Erosion}}{Z_0^{Erosion}} + \delta h_i \frac{\Delta Z_1^{Salinity}}{Z_0^{Salinity}}]$$

$$D_1 = Q^*_0[1 + \sum_{j \neq i} \chi_{dj} \frac{\Delta P_{j1}}{P^*_{j0}} + e_i \frac{\Delta Y_1}{Y_0} + \delta m_i \frac{\Delta Z_1^{MKT}}{Z_0^{MKT}}]$$

Note that the equations for S_1 and D_1 simply add Q_o^* and the changes in demand or supply attributed to shifters, i.e. variables other than own price which is held constant at P_o^*. Once S_1 and D_1 are known, the equilibrium values are solved in an exactly identical process as before using the analogous equations:

$$\Delta P_1 = \frac{P^*_o(D_1 - S_1)}{(S_1\eta_s - D_1\chi_d)} \quad such\ that \quad P^*_1 = P^*_o + \Delta P_1$$

$$Q^*_1 = D_1[1 + \chi_d \frac{\Delta P_1}{P^*_o}] = S_1[1 + \eta_s \frac{\Delta P_1}{P^*_o}]$$

From hereon, the cycle of calculations repeats in a recursive, dynamic fashion for the entire simulation period.

III. Linkage with the Households

Household characteristics and price transmission are two critical data and parameters that are needed to link the results from the national model to the individual households. In this study, we divide China into 11 groups with different income levels in each of three regions (Eastern China, Central China and Western China). Household information includes per capita production and consumption of major agricultural commodities and source of income.

Empirical estimates of the price transmission from the national to local and farm levels are required to transmit the changes in the national agricultural prices into each region and each group of households. Our market integration analyses showed that China's agricultural markets were highly integrated, particular after the middle 1990s (see Chapter III). To simplify the analyses, we assume that the price changes in national level

are fully transmitted to the local levels. Of course, we should take caution when we discuss the results for the period before 1995.

APPENDIX B:

THE IMPACT OF CHINA'S WTO ACCESSION ON RURAL INCOMES AND EMPLOYMENT

In this Appendix, we discuss some of the impacts that China's WTO accession may have had on the rural economy. To do so, we will proceed as follows. First, we discuss the various different impacts that China can expect from future liberalization. Next, we will examine the different factors that will tend to minimize the impacts—in both the short and long runs. Finally, we will analyze how each may affect the different sectors of the rural economy.

Impacts

In this subsection, we briefly review the various effects that liberalization policies may have on the rural economy. First, we examine the direct negative and positive effects. Next, we raise the possibility of longer run secondary or indirect effects.

Direct, Negative Effects. There is much discussion inside and outside of China about the negative impacts that China's WTO accession will have on the rural economy. Most of the discussion focuses on the effects that will arise from the fact that the prices of many of China's agricultural commodities in crop sector are above world market prices. It is almost certain that many of China's domestic producers of a number of its major commodities, such as wheat, maize, cotton, and soybean, will suffer income declines from lower prices. Given the vast areas of China over which these crops are grown (see Chapter 4) and the potentially large gaps in prices between domestic and international prices, it is possible that complete liberalization would have a very large impact on the producers of these crops inside China given the impacts of trade that have examined in the previous chapters. Moreover, these pressures should expect to be fairly sustained over time. Even if prices in the world rose temporarily if China were to dramatically increase imports, an action that would dampen imports, there is probably enough flexibility in world cropping systems for wheat, maize, cotton, and soybeans, that foreign producers would respond with greater production and in the medium-run there would be vast quantities of the products at relatively low prices ready to enter China's market.

Workers in some sectors also will be affected negatively by the reduction in employment and wages. In Park (2001), there is a discussion of the fact that a number of sectors will become less competitive after liberalization. In these sectors, falling demand for labor and downward pressure on wages will hurt the interests of rural workers. To the extent that most of the sectors that are most vulnerable are in the urban sector, a sector that is dominated by fairly high-paid urban workers, the largest negative, direct employment effects will likely fall upon urban workers, not those from rural areas. However, there are rural workers in these enterprises, too. And, although the direct competition between urban and rural workers is fairly limited, there could not help but be some additional competition for rural workers in certain sectors from laid off urban workers who are searching for new work and/or self-employed business opportunities. In total, then, there should be limited negative impact of liberalization policies on the employment and wages of a subset of rural workers.

Direct, Positive Effects. The direct, positive effects will mainly occur as mirror images to the negative ones. The largest positive impact of liberalization measures almost certainly will come from the rise in the demand for rural employment due to the increased demand for China's product overseas and the more relaxed investment environment inside China, and the rise in the demand for horticulture, livestock, fish and processed foods in the rest of world. If China's access to export market increases, many of the sectors that most likely will be the largest beneficiaries will be those labor-intensive firms that hire large volumes of workers from rural areas.

The rise of employment in the off-farm sector would also expect to have upward pressure on wages, although the gradual emergence of China's rural labor markets may be making employment available to enough new workers in the coming years that the new increases in the supply of workers could be big enough to offset any rise in wages do to the higher demand for labor from the export sector. As seen, during the late 1980s to mid-1990s, rising demand for labor led to the hiring of more than 50 million workers. Instead of leading to higher wages, however, the entry of new workers facilitated by the breakdown of traditional barriers was more than enough to offset the demand effect. Real rural wages between 1988 and 1995 were almost flat (Rozelle, Zhang, and Hughart, 2000). Given the past record on improvements in the off-farm labor market, and given the fact that 300 million workers are still in the agricultural sector without jobs off the farm, there seems almost certainly to be scope for continued development of China's rural labor markets in such a way that additional supplies may be more than enough to offset any rise in wages. Of course, if the labor markets would be emerging even without liberalization, the additional supplies of labor may have entered the labor markets even without the new rise in export sector demand. If that were the case, without liberalization real rural wages would either fall more (or increase less) than if there were no liberalization-induced demand increases.

Overlooked by many observers, liberalization policies may have a positive effect on certain key subsectors of agriculture. For most of the past decade, China has exported more agricultural commodities in value terms than it has imported. As shown in the previous chapters, most of the exports have been labor intensive, horticulture, livestock and other processed products. Many of the products have been shipped to other Asian economies, though increasing quantities have been going to the US. To the extent that liberalization helps China's access to markets in other countries for products in which it is able to export, agricultural producers of these commodities will benefit by higher prices and more export opportunities.

Liberalization policies may also help China remove or reduce barriers to many of its agricultural imports that have been erected by foreign countries (such as Japen, Korea, and the US) in recent years, if becoming part of the WTO gives China a way to appeal the unfavorable decisions of bilateral trade dispute settlements. Currently, Japan has banned the import of 4 commodities from China including garlic and jute products for tatami manufacturing. The US has taken trade actions in its Federal Trade Commission (and is taking more at an accelerating rate) against a number of commodities, such as garlic, honey, apple juice concentrate, shrimp and crayfish, tomato paste, etc. Korea is

undertaking similar actions. In almost all cases, China is being accused of dumping, or selling commodities on international markets at a price that is less than its cost of production. In many cases, it appears that China's producers are not being subsidized either directly or indirectly and are merely the world's low cost producer. But, because the actions are in the country of the importer and rely on mobilizing considerable financial and legal (and political) resources for defending themselves, in almost all cases, China has lost. In most cases, high countervailing tariffs have been placed on the commodities, effectively eliminating them from that market. Because China was not in the WTO, there was no appeal, even when the results of the actions are clearly being done for trade protectionist reasons and have no economic basis. If liberalization gives China the right of appeal, then such cases may be reduced or at least give them some recourse.

Less selectively, almost all agricultural producers will benefit from the falling tariffs and reduced trade barriers for key agricultural inputs, especially chemical fertilizers, pesticides, and seeds. Currently, state trading, licensing, and tariffs have protected domestic fertilizer and chemical pesticide markets. Prices for some chemical fertilizers and certain high quality pesticides are above world market prices. If liberalization policies were successful in reducing these price and quantitative barriers, farmers could reap substantial benefits.

Falling non-tariff barriers could also aid agricultural producers get access to better technology and higher quality agricultural inputs. For example, currently China requires that no more than 20 percent of chemical pesticides can be imported. China's farmers have repeatedly expressed their high demand for foreign produced pesticides, pesticides that are frequently more effective and safer for both the applier and the ultimate consumer. Quantitative restrictions and barriers to distribution have forced the price to rise in a number of markets and made the products completely unattainable in others. Similar restrictions keep parent stock of chicks for the broiler industry from being imported. Breeding stock can be imported, but only after extreme quarantine regulations are met, actions that limit their use.

Indirect Effects. There are a number ways that liberalization policies could benefit China's rural economy. We explore three. First, there are many foreign countries that might be induced into investing into the agricultural inputs sector or importing more once liberalization policies are in place. Second, in response to the legal and accounting regulations that liberalization policies will force China to put into place to meet their trade agreement obligations may also spill over and stimulate investment and increase competition and efficiency in China's domestic markets. Third, we examine the impact of making China's markets more connected to global markets when producers are in sectors undergoing rapid technological change.

Currently, there are many explicit and implicit barriers keeping foreign agricultural input firms from investing in China. Rozelle, Pray, and Huang (2000) delineate a number of the most restrictive measures. For example, manufacturers of pesticides are required to produce the active ingredients inside China. Since many trade secrets are embodied in

this process, a number of firms are hesitant about investing for fear that their product's manufacturing process could be stolen. In the late 1990s, the experience of one large US manufacturer confirmed the worst fears of the industry. After less than six months after the beginning of production in a new factory, a number of copy-cat factories began to produce the exact same chemical pesticides and were selling them at a price below the break-even point of the FDI factory.

Great potential gains could be acquired by farmers if restrictions on multi-national seed companies were eliminated. For years, a number of international seed producers have been experimenting with their new varieties in China. According to many of their reports, their new varieties could produce important new gains in yields. Yet, regulations require that the foreign partner can not own more than 50 percent of the firm. A number of restrictions on the import of seed stock and parent varieties also limits the flexibility of firms to get around other barriers in the industry.

More general improvements to the economy that may accompany liberalization could also have dramatic positive effects on agricultural producers and rural industries. Currently, restrictions on wholesaling have kept a small number of large state-owned firms in control of the wholesale industry. Their buying and distribution practices often either purposely or inadvertently kept the products of foreign firms out of the market, and kept them from producers. Smaller rural industries also were forced to do their own marketing, limiting the expansion of their production capabilities. If liberalization allows for the entry of foreign firms into the wholesaling industry, or at least encourages domestic firms to innovate and become more open, then all those in rural industry and agriculture stand to benefit. Similar positive effects could arise if liberalization induces the development of better and more regular legal and accounting practices.

Opening agricultural markets to global competition may also have one other benefit, especially for producers that are producing products for export and for those producing crops that are undergoing rapid technological change. Currently, when producers adopt new technologies there are two countervailing effects. Costs fall (or output rises with costs fixed) that lead to positive efficiency gains. However, because China's economy is closed to the world, as supply expands, the price of the commodity falls. Except for the case of the early adopters in the first year or two after the extension of the technology, in the longer run, some or all of the benefit from the fall in costs are negated by the fall in the price of the domestic good. If China's markets were open to the world, however, their domestic demand curve would become more elastic and the negative effects of prices would be dampened.

Summary. In summary, there are potentially very large positive and very large negative effects of liberalization policies. If agricultural markets were completely opened, the large gap between the world market price and China's domestic price and the vast production potential of other countries in the case of certain major commodities, could potentially have large negative price effects on China's producers. It is exactly these negative effects that some people in China are worried could lead to a destablization of the countryside. On the other hand, leaders are hoping that rural laborers will gain even

more from the projected rise in China's exports and other economic activity as the nation enters the WTO. Moreover, China is a large country with a complex economy, and these negative effects on agricultural producers will not be universal. Some agricultural producers stand to gain. Likewise, however, not all workers and industrialists in all sectors will gain directly from liberalization in the manufacturing and service sector. There are also a number of indirect effects on agricultural producers and workers from rural areas, many of which promise to provide positive benefits in the short, medium and longer run; in some cases, though, there may be negative indirect effects.

Buffering Effects

In the above discussion, we reviewed the potential positive and negative impacts of liberalization on those who are in the rural economy—both those engaged in agriculture and those that rely on the rural industrial and service sectors. In the rest of this appendix, as we argued in the ex post study that there will be impacts of trade liberalization on domestic economy, but there are at least three factors—policy safeguards, high transaction costs, and household responses--that will serve to buffer the effects of future liberalization policies on many who live in rural areas in China.

Policy Safeguards. Even in the most radical set of conditions at the peak year (currently specified as 2004) under which China enters the WTO, there are provisions that will allow the nation to protect its rural sector—both under the letter of the agreement and by actions that it should be expected to take. Under the current accession agreement (See Colby, 2001, Box Table 1), China's TRQ levels are set at modest enough levels and the above quota tariff rates are set at high enough rates that if leaders believed its rural sector was being seriously hurt after its entry into the WTO that it could minimize any damage, either real or perceived. For example, after bringing in imports up to its TRQ level (e.g., 9.636 million tons for wheat), China's leaders could legally assess a tariff of 65 percent on any additional imports. At such high tariff levels, China's wheat producers almost certainly would be shielded from any other competition from international producers for many years since according to almost any set of predictions, there are almost no conceivable scenarios under which China's domestic price would rise by more than 50 percent of the world price for a long period of time—especially if China continues to commit itself to carry through with its ambitious set of "green-light" investments in water control, rural roads, and agricultural research and extension. The same would be true for almost all other commodities. Of course, there would be pressure to continue to liberalize in the next round of world liberalization negotiations, but, if the effects were damaging enough (or were perceived to be damaging enough), China's leaders would almost certainly not agree to any further concessions, at least not without large enough gains in other parts of the agreement that they thought they would adequately be able to take other measures (e.g., delinked producer payments) with which they could offset the negative impact.

Moreover, even under the current agreement, if leaders truly perceived large parts of the rural sector were being hurt, China should also be expected to able to find interpretations

of existing rules to provide them with a measure of protection.[19] International agreements are never specified in comprehensive enough terms that a determined government can not find ways to limit the impact of many of the liberalization provisions. One of the best examples of this has been the way in which Korea implemented its TRQ agreements. By putting the TRG rice import quantities "out to bid," most of the TRQ imports that have entered the country have been extremely low quality because the right to import was given to the lowest bidder. In effect, this action, which Korean leaders can still claim to be in adherence to their liberalization commitments, also serves to provide almost complete protection to its farmers. China, a country that is equally as good in executing policies in ways that help its leaders meet national goals, should be expected to look and probably find ways to limit the impact of policies if they were thought to be damaging.

High Transaction Costs and Isolated Regional Markets. One of the greatest uncertainties regarding the question about how large an impact of liberalization will have on China's rural economy, especially its agricultural producers, is how much below world market prices are prices faced by China's agricultural producers. In other words, if liberalization policies were to partially or fully open China's markets, how much would domestic prices fall? In our opinion, there is almost no solid empirical basis for answering such a question. Surprisingly, given its importance, most of the current work done on the degree of protection is not very detailed. Most of the comparisons are done on the basis of a comparison a single national price and a single world market price. Almost no adjustments are done to account for quality differences between imported domestically traded products. Little thought has been put into accounting for regional differences among China's major producing regions. Also, many comparisons are done between China's farmgate and border prices, when it is know that transaction costs inside China are relatively high.

To the extent that there are high transaction costs inside China and to the extent that certain domestic markets are isolated from others in the country—especially those inland areas that are isolated from port regions where imports land—it could be that the impact of TIL policies are not evenly distributed. In previous work done on China's agricultural markets (Rozelle et al., 2000), it was found that in general China's markets are fairly integrated. However, this conclusion should be qualified. First, although there has been a large improvement, this previous work still found large parts of the country, especially poorer areas, were not completely integrated. According to our community level data, farmers in poor areas not only market only a small portion of their output (mostly maize), they sell into local markets (for feed) that are not necessarily integrated into national markets. Moreover, even in the integrated regions, the transaction costs of moving commodities between producing and consuming regions are high; when measured on a

[19] We are not arguing in this section that China will or is planning to implement policies in this way. In fact, there are many in the government who believe (maybe rightly so) that such policies, although inflicting some costs on some rural residents, will benefit China in the long run as it will help move the economy towards a direction that is more efficient. In this paragraph, we are merely raising the possibility about what might happen if China truly believed its interests were being harmed or its stability disturbed.

cost per kilometer per ton, the cost of moving bulk commodities in China are nearly five times as great as in the US (Rozelle et al., 2000).

If these studies of integration and transaction costs are representative of China's markets, in general, the effects of liberalization policies on producers in those areas will be greatly attenuated. According to a study by Taylor (1998) of the impact of NAFTA on Mexican farmers in border regions and those in more remote regions that faced high transaction costs for marketing their output and buying inputs varied dramatically. In fact, Taylor finds that NAFTA has had little impact on those in the poorest areas mainly because they have been insulated from the changes by high transaction costs. Before NAFTA since most of the their economic activities were all with others in their own village or township, the prices that they were facing and selling for were determined locally and were not affected by what happened far away in the nation's border areas. Moreover, because farm households in poorer areas are operating in economies that are characterized by poor, incomplete or absent markets for many factors, such as land and on-farm labor, even when they do interact with commodity or input markets, if there are changes in these prices, some of the impact of the prices are "absorbed" by changes in the shadow value of the un-marketed household resources, such as its land or labor (see Singh, Squire and Strauss, 1986, for a complete analytical description of the exact mechanism). For example, part of the fall in agricultural prices could affect the shadow value of land, which while "real" is unrealized since the household is not able to (or is not willing to) sell or rent the land in any case. Such impacts, rather than having their full effect fall on family nutrition or consumption, often end up mainly affecting the farmer's valuation of leisure or un-marketed land. That is not to say, liberalization policies do not affect welfare in these areas; they do. However, the complicated ways in which farmers in these economies respond to changes in prices and marketing opportunities usually mean the effects are much smaller than they would be on households that live and work in completely commercialized economies.

Household Responses. While in the previous section, we argue that there are many households in China that may be substantially isolated from the effects of liberalization policies by virtue of the fact that they live and reside in economies characterized by high transaction costs and incomplete markets, there are many households that live in areas that are highly integrated into the rest of the economy. For these households, there will be little comfort in their knowing that others in poorer areas are not feeling the effects of liberalization policies, if these policies are bringing significant negative impacts. In other words, there will still be a large number of households that will suffer the adverse consequences of liberalization.

However, because of the ability of households to respond, even though there may be large negative effects in the initial period, the costs may diminish over time. For example, in the case of NAFTA's impact on Mexico, farmers in some of the border areas found their maize crop to be unprofitable in the first years after the onset of the implementation of the free trade policies. Undoubtedly, their incomes fell substantially. These farmers, however, did not stand still and continue to produce at a loss. Instead, they responded and adopted new technologies and made investments that allowed them to

take advantage of positive opportunities that arose in the wake of the free trade agreement. There are many cases in which farmers in Northern Mexico invested heavily—sometimes in partnership with US growers—in fruit and vegetable production since protections for the US markets also fell. In many cases, profits after an initial investment period were higher for these Mexican farmers than before when they were producing for the protected domestic maize market. We are sure not all farmers came out better. But, because of the ability of farmers to respond, their losses in subsequent years can be substantially lower than the initial year.

Hence, in China the magnitude and severity of the negative impact of liberalization policies on agricultural production will depend in part in how well households are able to respond. The rapidity with which the rural economy has evolved in the past when facing changes in the external environment (such as how they responded to the fiscal reforms in the 1980s with the rise of TVEs; the marketing responses to grain reforms in the early 1990s; and the restructuring of ownership patterns in response to banking reforms in the late 1990s). Liberalization policies themselves may help the rural economy respond even faster if they promote more liberalized credit, better property rights, the rise of wholesaling networks, and encourage foreign direct investment.