

January 2007

**The Role of Agriculture in China's Development:
Past Failures; Present Successes and Future Challenges**

Jikun Huang, Keijiro Otsuka and Scott Rozelle*

Draft 4, Chapter for Brandt and Rawski Book

The Role of Agriculture in China's Development: Past Failures; Present Successes and Future Challenges

The view toward agricultural and rural development in the modern world has changed dramatically in the past several decades. Traditionally, agriculture was thought of an inferior partner in development. Since the size of the sector falls during development, it was logically considered that it could be ignored. Why is that leaders would ever want to invest in a sector that shrinking? Some academics urged policy makers to treat agriculture like a black box from which resources could be costlessly extracted (Lewis, 1954). All investment was supposed to be targeted at the industry and the cities. As a low productivity sector, it did not deserve investment.

Unfortunately, countries that took this path seriously soon found out that while such a strategy may work in the initial years of development, in the longer run it slowed development and often ended up in failure (Timmer, 1998). Neglect of agriculture meant that a large part of the population was left out of the development process. If those in the low productive part of the economy were not invested in, they found it difficult to shift to the developing parts of the economy. Dual economies grew apart. It was found that in many cases, production in agriculture fell and food prices rose. Many households fell into isolated subsistence. When this happened, of course, the stability that is required for growth disappears and development stagnates and can even go into reverse. There are many examples of countries that encountered these difficulties, such as, Argentina, Mexico, Nigeria and even to some extent the Former Soviet Union. In contrast, during the last century nations that grew fast and entered the ranks of developed nations—for example, Japan and Korea—frequently found that heavy investment in agriculture was an integral part of their development strategy.

Today, modern development economists mostly agree that the role of agriculture and rural development is absolutely an integral part to process of nation building and healthy development (Johnston and Mellor, 1961; Johnston, 1970). Agriculture plays five important roles in the development of an economy: a.) supplying high quality labor to factories, constructions sites and the service sector; b.) producing low cost food which will keep wages down for workers in the industrial sector; c.) producing fiber and other crops that can be inputs to production in other parts of the economy; d.) supplying commodities that can be exported and earn foreign exchange which can help finance imports of key technology packages and capital equipment; e.) raising rural incomes.

In a book assessing the development of China during the People's Republic era, it is of interest to know how well agriculture has performed and the role that it has played in the development process. Has China produced food and other commodities that have contributed to China's growth? Has it been successful supplying labor to the off farm sector? How has agriculture contributed to the rise in rural incomes and growth, in general? *In short, one of the overall goals of this chapter is to document the performance*

of the agricultural sector and use the criteria of Johnston and Mellor to assess how well the agricultural sector has done.

This chapter, however, seeks to go further than describing the achievements and shortfalls of China's agricultural economy; we also aim to identify the factors—both domestic policies and economic events as well as foreign initiatives—that have induced the performance that we observe. To create an agricultural economy that can feed the population, supply industry with labor and raw materials, earn foreign exchange and produce income for those who live and work in the sector and allow them to be a part of the nation's structural transformation requires a combination of massive investments and well-managed policy effort. The process can only proceed smoothly if an environment is created within which producers can generate output efficiently and earn a profit that can contribute to household income. Policies are required to facilitate the development of markets or other effective institutions of exchange. Although the sector is expected to contribute to the nation's development and allow for substantial extractions of labor and other resources, large volumes of investment also are needed. Investment in education, training, health and social services are needed to increase the productivity of the labor force when they arrive in the factories. Investment is needed in agriculture to improve productivity to keep food prices low, allow farmers to adopt new technologies and farming practice as markets change, and to raise incomes of those that are still in farming. Investment is needed in technology, land, water and other key inputs that are in short supply. *In this chapter we seek to point out both policies that have facilitated the performance of the agricultural sector and those that have constrained it.*

Such an ambitious set of objectives, of course, means that our work must also be subject to a set of limitations. The main limitation is in terms of the timing of coverage. While scholars have examined the effect of agriculture during Imperial times (Perkins, 1969), the pre-People's Republic era (Brandt, 1989; Rawski, 1989) and the Socialist Period (Lardy, 1983), there has been less of an effort to comprehensively assess agriculture since the onset of the reforms. However, it is our belief that the reforms can only be truly understood in the context of the period of time from which they came. Therefore, although the focus of the work will be mostly on the reform era, there will be a discussion of the period before transition.

The bottom line of our work is that we find that the performance of the agricultural sector differed fundamentally between the pre- and post-reform periods. During the Socialist period, while there were some accomplishments—particularly in the areas of agricultural research and development and irrigation to agricultural productivity, agriculture was unable to play many of its roles. The lack of incentive policies, poor property rights and an absence of markets constrained increases in agricultural output. Although output per person rose slightly, the sector was not even able to provide the nation with 2300 calories per capita per day (a level near the UN-established minimum) and emergency grain imports almost always were needed to meet food deficits through the 1970s. Cotton and edible oil output also rose, but China's industries were still only able to produce to a level that supplied the population with severely rationed cloth and non-grain food commodities. Planning policies also artificially severed linkages between

the rural and urban economies, in essence establishing an agricultural sector with as few points of contact with industry and the entire urban economy as possible. Most damning, incomes per capita were almost the same in the mid-1970s as they were in the mid-1950s. In short, agriculture did not play any of its roles well: it did not (or was not allowed to) supply: a.) labor to the non-agricultural sector; b.) sufficient supplies of food to consumers; c.) abundant raw inputs to industry; d.) export to foreign markets; or e.) income to its own population.

The contrast with the post-reform period could not be more poignant. During the reform era agriculture not only increased food production, producing in excess of 3000 calories per capita per day, China has become a net agricultural exporter of food. The improved incentives and better property rights that were part of the decollectivization movement led to dramatic increases in productivity. Gradually improving domestic markets and agricultural trade liberalization have induced a fundamental shift in the production orientation of many producers, encouraging higher levels of commercialization and increased specialization into many labor-intensive, high-value added crops that China clearly has a comparative advantage in. During this same time China has become a major importer of land-intensive commodities, such as soybeans, cotton, edible oil, sugar and hides. Rural industrialization, rural fiscal policies and general domestic liberalization have also encouraged the creation of strong linkages between the rural and urban economies—through credit markets, markets for commodities and inputs and especially labor markets. Nearly 250 million rural laborers, almost one in two, are now employed in the off farm sector; incomes have risen by more than 5 percent per year for more than two decades. The agricultural sector clearly has played a successful role in supplying labor, food, raw materials, exports and jobs to Chinese economic miracle. Indeed, the role in many areas have been played so well that they are no longer needed—China is so rich in foreign exchange it does not need agriculture for its export earnings. Since the late 1990s the absolute demand for rice and wheat—the traditional staples that so concerned China’s leaders since early Imperial times—is actually falling as consumers with higher incomes, changing preferences and more market-driven choices are opting to consume more meat, fish, fruits and vegetables.

The optimism that can be generated by the achievements over the past 25 years, however, needs to be tempered by the tremendous challenges that China still faces in trying to make the nation into a modern, advanced state. In fact, while we believe that four of the five roles of agriculture (the supply of labor, food, raw materials and exports) have either already succeeded in meeting their objectives or are no longer relevant, the final role—providing the rural population with the income that it needs to increase the general standard of living of the 800 million people that still live in rural areas—has remained elusive and is far from being realized. China’s farm sizes are smaller now than they were 25 years ago. The infrastructure and resource base for agricultural production is fragile in many areas. Further agricultural trade liberalization pose threats to producers in some of China’s more vulnerable areas. The rural-urban income gaps are continuing to widen. There is a hard-core of very poor people that do not have the human capital to participate in the economic opportunities that exist in a country that is growing at 10

percent per year. There still are fundamental barriers that discourage permanent migration of individuals and families from rural to urban areas.

There also are many constraints to development that policy makers face. Some originate outside the agricultural sector—for example, the legacy of the hukou system still raises the cost of permanent migration so high that most rural families can not even dream of moving to the city. Others are part of the agricultural sector itself. For example, poor land rights may be holding back investment into profitable farming ventures, dampening enthusiasm for farm consolidation and preventing rural households from benefiting from the conversion of low productivity farm land into high valued urban uses (which could be used to help families finance their move into a more permanent urban setting). In summary, the real challenge facing the agricultural sector now is whether or not it can modernize—and become a sector that is characterized by both a large number of families being able to move to urban areas (or become part of a urban landscape that grows up around them); and a smaller number of farming families that control sufficiently enough land and other resources to make a decent living in farming. At the very least, farm incomes need to rise enough to provide families an income that will allow them to invest in their children’s human capital and their own social capital so when over the course of the next several decades opportunities for shifting to the non-farm sector.

To meet our overall goals and show in more detail these findings, we will first briefly recount the performance of the Socialist era and seek to understand the agricultural policies and other economic events that led to the outcomes. In the following section, we have two major tasks: first, we will examine performance during the reform era; and, second, we will analyze the importance of the role of policies that have been behind and hindered progress during the 1980s, 1990s and 2000s. While the reform era, as will be argued, has turned agriculture into a growing sector that contributed to the nation’s development, in the final section, we will discuss the limitations of the current set of policies and direction of China’s agricultural growth. This will try to help us put into perspective the achievements and failures and discuss the implications of the state of China’s agriculture and its current direction of development in the light of the development of China’s economy in general.

The Role of Agriculture in China’s Prereform Era: Policy Failure

Socialist policies dominated the 1950s, 1960s and 1970s in China and had a profound and complicated effect on agriculture. In this section, we first review the performance of the agricultural sector, trying to lay out the successes and failures of the sector. Second, we recount the major policies—inside and outside of agriculture—that we believe are responsible for producing the outcomes that were realized during the Socialist period.

Performance during the Socialist Period

The Struggle to Produce Calories

The record on the performance of agriculture in producing food and other raw materials for industry during the Socialist period is mixed and in part depends on the standard against which the sector's performance is being judged. On the one hand aggregate trends show that agriculture played an important role in increasing food availability, especially that of staple grains (Table 1). Between 1952 and 1978, although total sown area increased by 6.3 percent, grain sown area was about steady (it declined by 2.7 percent). Grain yields, in contrast, increased by 91 percent from 1952 to 1978, an annual growth of 2.8 percent. In the aggregate, China's grain production rose by 86 percent, a rise of 2.5 percent per year. Indeed, the growth rate of grain production outpaced that of the population (1.9 percent), meaning that China's agricultural sector increased the number of per capita calorie availability during the Socialist period.

With the rise of sown area, China's producers were able to produce additional amounts of cash crops. For example, the area sown to cotton rose during the Socialist era (Table 1, columns 4 to 6). Yields also rose modestly. In total, the areas planted to cash crops increased by 16 percent during the pre-reform period (1952 to 1978).

While credit has to be given to leaders to increasing the absolute and per capita levels of food and agricultural raw material availability during a time that many other nations in the world were suffering from falling food production, it is hard to argue that agriculture's performance was stellar enough as to be a transformative force of the Socialist-era economy. Throughout the 1950s, 1960s and 1970s, China's consumers remained on strictly rationed diets. Coarse grains—maize, sweet potato, millet and sorghum—made up much of an average citizen's staple food intake. Cooking oil, sugar, meat and vegetables were not available on a daily basis for the typical consumer during many years. Most telling, despite the growth, the average level of consumption in urban areas in the 1970s was still low, only 2328 calories per capita; per capita calories was less for the average rural resident—barely at the UN's average minimum requirement of 2100).

The food production systems at times also were so fragile that it was subject to catastrophic failure as was experienced during the famine of 1959 to 1961 (Ashton et al., 1984). During the three years that followed the failed Great Leap Forward campaign, more than 30 million people starved to death or were not born, most due to malnutrition-related causes. By a large magnitude, this was by far the most severe famine in the history of the world. And, while there were many reasons for the famine, a sharp fall in both agricultural production and food availability were in part to blame (Chang and Wen, 1997).

Food availability, in fact, became such an issue that during the late 1960s and 1970s China began to turn to international markets to supplement domestic production (Table 2). Between 1973 and 1980, China imported on average more than 6 million tons of grain, mostly wheat. During the peak import years, grain accounted for a large percentage (in value terms) of China's imports. Obviously, at a time when China's

planners were trying to jump-start China's industrialization with imported machinery and other technologies, the inability of the agricultural sector to produce enough food for itself (not to mention for foreign exchange earnings from exports) put a drag on the nation's development.

In summary, then, the performance of China's agricultural sector was mixed in two dimensions and failed in a third. Total output did rise and it rose faster than the growth rate of the population. However, in no way can the magnitudes of the rise be interpreted as being sufficient to supply enough food and raw material for a rapidly growing, modernizing economy. China's population was barely getting enough to eat and having sufficient cloth to wear. There was no surplus, no choice and no extra supply for exports that could earn valuable foreign exchange. In fact, the failure of agriculture to carry out its fundamental role is even clearer in the case of trade. China was forced to spend a large share of its scarce foreign exchange just to be able to supply the low quantities of food during the 1970s.

Structural Stagnation

While the story of food availability is mixed, almost everything else about the record of structural change during the first three decades of agricultural development during the People's Republican period is negative. For example, the production structure of cropping showed almost no change at all (Table 1). In 1952 grain accounted for 88 percent of sown area; in 1957, grain was still being sown on 83 percent of the nation's sown area in 1970. During the 1970s, there was even less movement (shifting between 80 and 83 percent). Likewise, there was little change in structure of the agricultural sector, according to a broader definition. The value of the cropping sector as a share of total agricultural output value was 83 percent in 1952 and was still 75 percent in 1970. Between 1975 and 1975 the cropping sector's share remained at 73 percent. Clearly, there is no indication that there was any dynamic in the agricultural sector towards an economy that was producing a set of commodities that were higher valued.

Perhaps of greatest importance, income per capita of rural farmers and other metrics of wealth also showed the stagnation of the agricultural sector. Despite the rise in grain output, earnings per capita in the 1970s were almost the same as they were in the mid-1950s (Lardy, 1983). Housing showed almost no improvement during the 1960s and 1970s (CNSB, 1999). Per capita levels of rural consumption even by 1978—nearly 30 years after the start of the Socialist era—of almost every food in an absolute sense were low—only 1.1 kilograms of edible oil and 6.4 kilogram of meat (Huang and Bouis, 2001). The poverty rate was between 30 and 40 percent, depending on the definition of the poverty line.

Finally, the stagnation of income, given (even modest) rising output, suggests that productivity growth was low. Although data sources do not facilitate rigorous analysis of total factor productivity, there appears to be a complete absence of productivity gain or allocative efficiency increase. In fact, the work of Stone and Rozelle (1995) and Wen (1993) support just such a conclusion. Using aggregate data, both papers end up

concluding that total factor productivity growth between 1950 and 1978 was either zero or close to zero.

Based on this analysis, it is clear that China's agriculture played only a minor transformative role in the nation's development during the Socialist Era. It was not providing labor to the off farm sector; it was not generating foreign exchange; it was not creating linkages to the rest of the economy. In fact, it was at most playing only minor roles in increasing the availability of food and raw materials for industry. And, as we have seen, it was doing this with a relatively low degree of efficiency and effectiveness.

Socialist Policies and Institutions: The Basis for Agriculture's Poor Performance

The Socialist period (and, in fact, earlier) began much differently in the early 1950s than it ended in the late 1970s. Soon after 1949 work groups at the direction of the central and local government directed the largest and one of the most comprehensive land reforms in the history of the world (Perkins, 1994). Taking land mostly from landlords and rich farmers—sometimes by violence and almost never with compensation—land was divided among all of China's rural households. With very few exceptions every farm household in China was given a plot of land. In some places, land was divided evenly, distributed on the basis of population; in other areas more complicated criteria were used that essentially left some households with larger land holdings, although there households often had obligations to sell a larger share of their production to the state.

While there is no real research linking the rise of output in the early 1950s to the incentives that were embodied in the new land holding arrangements, even if there had been, by the mid-1950s the Socialist leadership was already developed that threatening the incentives embodied in private land ownership (Lardy, 1983). After the early 1950s farmers were organized into collectives and then communes, eliminating the household farm in China. The process, once started, did not happen at once, but between 1954 and 1958 farmers in most regions of the countries moved from mutual assistance teams/cooperatives to collectives to communes. There is some debate that initially farmers and their leaders had some choice about whether to collectivize or not (Lin, 1998). Our own interviews with village leaders who still remembered the days prior to collectivization can not find one person that would characterize the collectivization movement as volunteer. But, whether the decision to pool farm tools and cooperate during planting and harvest was volunteer or not, what is clear is that when Mao decided that the country would form into communes in 1957, there was no choice whatsoever.

The main negative effect of the communization movement was one of absence of incentives. The basic problem was that individual families were not the residual claimant of production and decision making was left to collective leadership that was not doing all of the work (Putterman, 1993). Instead, farm workers were assigned points based on tasks which were difficult to monitor. While there is a debate over the extent to which the collectives were able to motivate farmers to exert effort and attempt to increase the efficiency of production on their farms (Dong and Dow, 1993; Lin and Yang, 2000; Chang and Wen, 1995), most scholars believe that poor incentives arising from free

riding and the inability to monitor agricultural labor undermined the incentives in agriculture. When not being supervised, the large gap between private plots and collective fields show that farm workers would shirk when working for the collective and divert inputs onto their own plots (Meade, 2000). The failure to raise productivity during the Socialist era, almost certainly is due in a large part to the poor incentives that were embodied in the collectivized farming institutions (especially given the rapid rise during the first years of reform—see next section)

Pricing and Marketing Agricultural Commodities and Inputs

While the organization of production may have had a major role in the poor performance of the cropping and livestock sectors, Socialist era pricing policy also did little to either encourage the efficient production or allocation goods and services. Prices were fixed by the state (Sicular, 1988b). Between 1962 and 1978, the price of grain remained almost unchanged, being adjusted only three times, rising by a total of less than 20 percent. Input prices played mainly an accounting function as shortages kept most producers from having access to the quantities that they demanded.

Marketing institutions also did not encourage the development of agriculture; there was little competition and marketing officials did not have an incentive to search out low cost or quality producers. Prior to the reform period, domestic and international marketing of agricultural products was handled mostly by a complex set of government institutions (Sicular, 1988; Huang and David, 1995). Marketing of these products was monopolized by the state which determined both the producer and consumer prices. Moreover, production was carried out based on (mostly) planned acreage, target volume, quality and variety of production. Even the ratio between home consumption and marketed surplus was stipulated. Hence, it is easy to see how the nature of marketing institutions also dampened enthusiasm for production and allowed the state to be able to carry out its pricing policy.

Of course, the system also served to indirectly help—at least in the short run—the state's effort at forced industrialization by keeping down the price of staples in order to allow the state to keep wages low. Except for the amount used for the farm-households' home consumption for food, feed, and seeds, almost all production was procured only by the state at quota prices for a specified (compulsory) amount (Sicular, 1988b). After the early 1960s, the state also procured any surplus production beyond the quota and home consumption at a somewhat higher above-quota price to provide an incentive to increase production. The incentives, however, were targeted at collective leaders and not the farmers on whose effort labor depended.

To suppress the demand for agricultural products that were in short supply (and priced low), marketing policy also exercised tight control over food marketing in urban areas. Staple products were sold by government agencies to urban consumers and rural households in grain deficit regions at ration prices upon presentation of coupons. These coupons were distributed on a per capita basis depending on age, type of employment, and other determinants of caloric requirements.

Non Agricultural Policies and Institutions and Agriculture Stagnation

Hukou System. China's approach to planning and its placement of the rural economy into the unplanned sector also had a dramatic effect on the nature of employment and China's structural stagnation (Lyons, 1987). Because China's agricultural sector was so large and undeveloped (and because of its pro-urban/industrial policies), leaders decided to make a sharp distinction between those that lived in rural and those that live in urban areas. Agriculture became part of the collective sector. In return for shipments of fertilizer and small amounts of capital and other inputs, the agricultural sector was expected to supply food and non-food commodities to the urban-industrial parts of the economy. All of the rest of the needs of the collective agricultural sector were supposed to be taken care of by the leadership of the collective with its own resources. Farmers were not allowed to freely move out of their collectives. The scope and magnitude of the housing, educational, health, welfare and other services between rural and urban widened throughout the Socialist period. Without a doubt the hukou policies and other restrictions keeping rural areas from moving into manufacturing and service provision artificially limited the structural change that took place during the Socialist era and undoubtedly suppressed incomes and productivity.

Trade Policy. Two key policies also worked against agriculture in the Socialist era. First, agricultural trade in the prereform era was also subject to the plan (Huang and Chen, 1999; Lardy, 2001). In essence, it was a tool that was to be used to supplement the plan. Given the nation's commitment to self-sufficiency in all areas of the economy, imports were to be used only for procuring those products—most of which were machinery and other productive investments—that could not be manufactured domestically and which would help facilitate meeting the plan. Almost all trade was made through eight state-owned trading firms. In the 1970s, the agricultural state trading firm monopolized nearly all food imports and exports. Hence, it was not in the nature of the institutional structure of the state trade apparatus that would allow the specialization in labor-intensive export crops which could be offset by imports of land-intensive staple crops. Agriculture trade was primarily looked upon as a means to generate foreign exchange. The exchange rate was clearly stacked against encouraging agricultural exports (Huang and Chen, 1999). Since the exchange rates were overvalued, even if it had been a free trade regime, imports would have been cheap (hurting agriculture by depressing prices) and exports would have been expensive (suppressing demand in foreign markets and keeping prices low inside China).

Summary: Socialist Agriculture; Policy-driven Disaster

After nearly 30 years of development, China's agriculture was a mess. It was not really playing any of its roles effectively. Although output was up, it was only due to the enormous investment of some central and local government funds and mostly corvee labor financed mostly by the sweat of farmers. Productivity was stagnant. Incomes were stagnant. There was no structural shift towards a more productive, higher efficiency sector. The population was locked into agriculture. The most dismal finding of the

analysis of the Socialist era is, of course, is that this dismal performance was due mostly to more than two decades of the implementation of Socialist policies—both inside and outside of the agricultural sector. The organization of production, pricing system and marketing institutions provided no incentives. Perhaps most inimical were the external policies that trapped the rural population in a system that designated them as second class citizens and did not give them their fair share of investment, services or opportunities. In short, the agricultural and non-agricultural policy environment undermined the role that agriculture plays in a healthy modern economy.

When analyzed this way, the shift of the new government under Deng Xiaoping should actually come as no surprise. With the economies of East Asia, and especially those of Taiwan, Hong Kong and Singapore, developing rapidly with higher and higher incomes of their citizens, leaders in China must have felt enormous pressures to begin to back off of the policy regime that had pushed them into the productivity trap that characterized the economy in the mid-1970s. Moreover, the rural economy gave leaders the most natural laboratory within which to experiment. Its performance was so bad, even new failed policies could not make farmers much worse off. The isolated nature of the rural economy—due to its status as part of the unplanned economy—also made it attractive; the leaders could make mistakes without directly impacting the heart of the Socialist experiment in China’s industrialized, urban areas. In short, the failed policies led to a failed agricultural sector which encouraged national leaders to choose the rural economy as the starting point for their at most vaguely-defined experiment in Reformism.

The Role of Agriculture in China’s Transition Era: Current Successes

In this section, we follow two main themes. First, we describe the performance of the agricultural sector and examine the role that it has begun to play since the onset of the Reform era in the late 1970s. Second, we will examine in greater depth the policy initiatives—inside and outside of agriculture—that have helped launch and guide China’s agricultural transition. We examine the reform strategy by looking at its various components, their implementation and the objectives of and rational for each reform component.

Agriculture in the Transition Era—Performance

In this section we seek to examine that effect of transition era policies and other events on the performance of the sector. We do so by first examining the effects generally. Next, we look at effects on a sector by sector basis. In the final section, we review the findings and draw conclusions about the role the agriculture played in China’s development during the transition era.

The Revival of Agriculture and Solving China’s Grain Problem

The ups and downs that characterized the performance of agriculture in the pre-reform period disappeared after 1978. Whatever metric of success that there was in

agricultural production in China during the 1950s, 1960s and 1970s was surpassed during the reform era and agriculture finally began to carry out its various roles in the development process. Compared to the early and mid-1970s when the value of gross domestic product of agriculture rose by 2.7 percent annually, the annual growth rate more than tripled to 8.2 percent during the initial Reform period, 1978 to 1984 (Table 3, row 1). Although during the later reform periods (1985 to 1995; and 1995 to 2000) the annual growth rates have slowed (around 4 percent or so in real terms), these are still extraordinarily high rates of agricultural growth over such a sustained time period.

At least in the early reform period, output growth—driven by increases in yields—was experienced in all subsectors of agriculture. Between 1978 and 1984, grain production, in general, increased by 4.7 percent per year (Table 3, rows 2 to 4). Production rose for each of the major grains—rice, wheat and maize (rows 5 to 13). While sown area did not change during this time, yields for grains in general more doubled between the late part of the pre-reform era and the early reform period (row 4). During the early reform period, the growth of yields of all major grain crops (rows 7, 10 and 13) exceeded the growth of yields during the early and mid-1970s.

The success of agriculture in playing its role of supplying high-quality, inexpensive food can be illustrated by an examination of grain prices in China. During the Reform era, with the exception of price spikes in 1988 and 1995 the real price of rice, wheat and maize has fallen. When using a regression approach to measure the trends, grain prices have fallen in real terms between 33 percent (maize) to 45 percent (wheat) between the late 1970s and early 2000s. Coupled with rising incomes, falling grain prices have reduced the share of the consumption budget that accounted for by grain from nearly 40 percent in the late 1970s to about 14 percent for rural households in 2004. In urban area, grain accounted for more than 20 percent of total expenditure in the late 1970s and it has been less than 3 percent since 2003.

Beyond Grain: The Transformation of the Agricultural Sector

Far more fundamental than rises in output and yields of the grain sector, China's agricultural economy has steadily been remaking itself from a grain first sector to one that is producing higher valued cash crops, horticultural goods and livestock/aquaculture products. Like the grain sector, cash crops, in general, and specific crops, such as cotton, edible oils and vegetables and fruit, also grew rapidly in the early reform period when compared to the 1970s (Table 3, rows 14 to 21). Unlike grain (with the exception of land-intensive staples, such as cotton), the growth of non-grain sector continued throughout the reform era. Hence, in the case of many commodity groups the high growth rates, which have exceeded those of grains during almost the entire Reform era, are continuing to accelerate or at least maintain the high rate of growth. Clearly, the agricultural sector is playing a major role in providing more than subsistence; it is

supplying oilseeds for the edible oil sector; horticultural products for retail food sector and cotton for the textile sector.¹

The rise in some sectors has been so fast that it almost defies description. For example, between 1990 and 2004 the increase in vegetable production capacity has been so fast that China as a nation is adding the equivalent of the production capacity of California (the world's most productive vegetable basket) every two years. When compared on the basis of the share of cultivated area dedicated to fruit orchards, the share in China (over 5 percent) is more than double the share of the next closest major agricultural nation (including the US, the EU, Japan, India).

China also is moving rapidly away from a crop-first agriculture. The rise of livestock and fishery sectors outpaces the cropping sector, in general, and most of the subcategories of cropping (Table 3, rows 22 and 23). Livestock production rose 9.1 percent in the early reform period and has continued to grow at between 6.5 to 8.8 percent since 1985. The fisheries subsector is the fastest growing component of agriculture, rising more than 10 percent per year during the Reform era. The rapid and continuous rise in livestock and fisheries has steadily eroded the predominance of cropping (Table 4).

Moving Off the Farm

The Reform-era has brought even more fundamental, transformative changes when looking at a picture of the rural economy based on a definition that is broader than agriculture. While the average annual growth of agriculture (as seen above) averaged about 5 percent throughout the entire reform period, the growth rate of the economy as a whole and of the industrial and service sectors were faster (Table 5, rows 1 to 4). In fact, since 1985, the growth of industry and service sector has been two to three times faster than agriculture. Because of the differences in the sectoral growth rates, agriculture's share of GDP has fallen from 40 percent in 1970 to 16 percent in 2000 (Table 6, rows 1 to 3). Projection models of the economy predict that by 2008 the share of agriculture will fall under 10 percent. These figures highlight the ironic feature of agricultural development; the more transformative role that agriculture plays means that the pace of development will rise and the importance of agriculture will fall.

The shifts in the economy can also be seen in employment (Table 6, rows 4 to 7). Agriculture employed 81 percent of labor in 1970. By 2000, however, as the industrial and service sectors grew in importance, the share of employment in agriculture fell to below 50 percent. By 1995, more than 150 million farmers were working off the farm (Rozelle et al., 1999). By 2000, the number rose to more than 200 million (Rozelle et al., 2000). Clearly from the figures on the economic structure of the economy—both from an output and employment perspective, agriculture is performing in a way that is consistent

¹ The fall in cotton production during the later reform period has more to do with pest infestations than lack of incentives. Since the late 1990s, there has been a revival of the cotton sector, production wise as the advent of insect resistant, genetically modified cotton has overcome this problem (Huang et al., 2002).

with the beginning of the transformation of China's overall economy—from agriculture to industry and from rural to urban (Rozelle et al., 1999; Nyberg and Rozelle, 1999).

Other Changes

Agricultural Trade Liberalization. While so much has been made of China's accession to the WTO as a turning point in its relationship with the world, in fact China's open door policy started much earlier (Huang et al., 1999). In the process, China has turned itself from a hermit country into one of the world's great trading nations, including in the area of agricultural trade. From 1980 to 2000, the total value of China's agricultural trade grew by about 6.0% on an annual basis. Since 2000, it has more than doubled, making China the fourth largest importer of agricultural commodities in the world (Gale, 2006). However, China is more than an importer, since the reforms, in almost every year the level of agricultural exports has exceeded that of imports (Huang et al., 1999).

Perhaps more remarkably, is the shift in the composition of trade that China has experienced over the past 25 years. According to custom statistics, the net exports of *land-intensive bulk commodities*, such as grains, oilseeds and sugar crops, have fallen; exports of higher-valued, more *labor-intensive products*, such as horticultural and animal products (including aquaculture) have risen. In other words, China's has begun to export those commodities in which it has a comparative advantage and import those in which it does not have an advantage. Disaggregated, crop-specific trade trends also show the same sharp shifts (Anderson et al., 2004).

The Production and Marketing Environment. After more than 25 years of reform one of the most striking differences in the nature of agriculture is the role of government and local leaders in the production and marketing process. As suggested above, local (commune and brigade) officials and bureaucrats in government supply and marketing agencies were deeply involved with all aspects of pre- and post-harvest decisions during the Socialist era. In the immediate years after reform, there was some change, but perhaps more than anything, the continued intervention into production (e.g., through schemes of unified management) and marketing (e.g., through the grain and cotton procurement systems) remained a characteristic of early reform agriculture (Sicular, 1988b; 1995). By 2005, however, the situation had changed dramatically. Indeed, one of the most notable features of China's agricultural economy today (with several exceptions) is the absence of government involvement.

One of the most conspicuous trends in production is for households to have smaller and smaller farm sizes. Between 1980 and 2000, the average size of land controlled by the household has actually fallen, from 0.71 to 0.55 hectare. Moreover, while the rate of growth of production and marketing cooperatives (called Farmer Professional Associations—FPAs) has risen in recent years, few villages and few farmers (percentage-wise) belong. According to Shen et al. (2005), only seven percent of villages have FPAs. And, of the villages that have FPAs, only about one-third of farmers belong. As a result, in all of China, only about 2 percent of farmers belong to cooperatives, a

level of participation that is far below almost all other East Asian nations (and many Western nations during their development years), where participation rates were almost 100 percent. From this point of view, farm organizations have not begun the transition to larger, more modern farms. As will be seen, likely this is due to the nature of China's property rights in cultivated land.

Restriction on land ownership aside, China today may have one of the least distorted, domestic agricultural economies in the world. In a recent survey done by the Center for Chinese agricultural economy, with the exception of farmers that were renting village-owned orchards that had been planted in the 1980s and early 1990s, in 100 percent of the responses, the farmer said that he/she made the planting decision and was not compelled by local officials (Rozelle et al., 2006). In another survey of randomly selected households in eight provinces, every farmer in the survey stated that they purchased all of their chemical fertilizer on their own and that local officials had no role in the transaction (Zhang et al., 2005). All purchases were made from private vendors.

On the procurement side, whereas it used to be that government parastatals were responsible for purchasing the output of China's farms, today, a large majority of sales of grains and oilseeds and fiber crops and literally all purchases of horticulture and livestock products are to small, private traders (Wang et al., 2006). Indeed, even with the rise of supermarkets and processing firms that are catering to the retail needs of the urban population, a recent survey discovered that almost all purchases of fruit, vegetables, nuts and livestock products are by the *first buyers*, individual entrepreneurs who are trading on their own account (Table 7). Even by the second link in the marketing chain (*second buyer*), private traders are still handling most of the produce.

The existence of millions of small traders that are competing with virtually no regulation has meant that China's markets have become integrated and efficient. Park et al., (2002), Huang et al. (2004) and Rozelle and Huang (2004; 2005) find that prices are transmitted across space and over time as efficiently and at levels of integration that meet or exceed those of the United States. Input prices for fertilizer are equally well integrated (Qiao et al., 2003). Indeed, statistical analysis demonstrates that even farmers in remote, poor villages are integrated into national markets (Huang and Rozelle, forthcoming).

Impact of Market Liberalization and Specialization. Although few authors have attempted to quantify the gains from market liberalization, in the few papers that do exist, it is found that farmers have been gaining from increased allocative efficiency. For example, in deBrauw et al. (2004) it is shown that there is a positive effect of increasing marketization on productivity. Lin (1991) and Huang and Rozelle (1996) finds a similar results. In all three of these papers, the authors conjecture (without an empirical basis) that the gains are due in part to increasing specialization.

In order to try to understand whether or not specialization has occurred since the mid-1990s when markets began to emerge and integrate, in 2004 we conducted a national representative survey of 400 communities. In the survey of community leaders we asked the following question: Are farmers in your village specializing in any particular crop or

livestock commodity? The question was asked about 1995 and 2004. If the respondent answered affirmatively, we asked for the commodity in which they were specializing. If the farmers in the community were specializing in a cropping activity, we asked for the area sown to the speciality commodity.

The results of our survey show that indeed specialization has been occurring in China's agricultural sector. Between 1995 and 2004, the percentage of villages that are specializing in an agricultural commodity has increased sharply and has done so in every province (Table 8, columns 1 and 2). On average, throughout our sample from across China, 30 percent of China's villages are specializing, up from 21 percent in 1995. When examining the composition of the output of villages that are specializing, it is clear that the rise in the demand for horticulture and other speciality products is what is driving the specialization. In our sample, fully 60 percent of those villages that are specializing are producing either fruits (28%) or vegetables (13%) or other cash crops (28%--e.g., sugar cane, tobacco and cotton). There also are villages that are specializing in livestock commodities, oil seed crops, forest products and other commodities.

Productivity Trends and Rural Incomes.

While it is possible that agricultural productivity trends tell a somewhat different story of how transition affects agricultural performance than for the case of output (as was the case in the prereform period), this is not the case in reform China. First, as seen in Table 2, output per unit of land (or yields) all rose sharply. In addition, for the entire reform period, trends in agricultural labor productivity, measured as output per farm worker, parallel those of yield.

Moreover, it is also possible that partial and more complete measures of productivity move in opposite directions (as it did in the prereform period), most of the evidence from the literature shows that, in fact, total factor productivity (TFP) trends move largely in the same direction as the partial measures. Several series of TFP estimates have been produced for China's agriculture (McMillan et al., 1989; Fan, 1991; Lin, 1992; Wen, 1993; Huang and Rozelle, 1996; Fan, 1997; Jin et al., 2002). The studies uniformly demonstrate that in the first years after reform (1978 to 1984), comprehensive measures of productivity (either constructed TFP indices or their regression-based equivalents) rose by 5 to 10 percent per year. Although Wen (1993) worries that TFP quit growing in the post-reform period (1985 to 1989), Fan (1997) and Jin et al. (2002) demonstrate that during the 1990s, TFP continues to rise at a rate of around 2 percent per year. In other works, the estimates of TFP changes in China show that measures of TFP generally move in a manner consistent with the partial ones. Moreover, rates of TFP rise of 2 percent annually are certain not low in international context.

In part due to rising productivity, and perhaps even more due to the increasing efficiency associated with specialization, shifting to the production of more higher value crops and livestock commodities and the expansion of off farm work, rural incomes during the reforms have steadily increased (Table 9). Between 1980 and 2000, average

rural per capita incomes have risen (in real terms) from 771 to 2347 yuan. This annual rise (6 percent) is remarkable and is as high as the growth rates experienced in Japan and Korea during their take-off years. Hence, it seems surprising the amount of attention given to the rural income problem by the media; the problem, however, no doubt is rooted in the relative rise between the rural and the urban that both started from a higher base and rose faster than rural incomes.

The inequality between rural and urban also has a parallel with the rural economy, between those that began relatively rich and those that began the period relatively poor. The growth rate rural per capita income of those in the richest decile is higher than average, more than 8 percent annually. In contrast, although incomes are rising (at 3 percent annually), the rates of increase are far lower than the richest, meaning in relative terms the poorest of the rural poor are falling behind.

Importantly, although rises in income (and income inequality) are clearly related closely with the ability of rural households to gain access to off farm employment (Riskin and Khan, 2001), agriculture has been shown to play an inequality mitigating role. Two factors are responsible for this (Rozelle, 1996). First, agricultural income is distributed more evenly to begin with. Second, the poor are proportionately more involved in agriculture. Because of these two characteristics, it has been shown that increases in agriculture income lead to a lower Gini coefficient and other measures of inequality.

Overall Observation on Agriculture's Performance during the Reform-era

In summary, whereas the Socialist era saw little transformation, during the transition period China's agricultural sector has changed dramatically. Although the sector grew, its fall in the importance in the overall economy in both terms of output value and employment characterize modern growth. The structure of the sector itself also is changing, diversifying out of coarse grains into fine grains, out of staple grains into higher valued crops, and out of cropping into livestock and aquaculture. Trade patterns are also changing more in line with China's comparative advantage. Although the most dramatic changes have taken place most rapidly among the richer households, change is also occurring among the poor.

Building the Institutional Base and Policy Strategy of Reform: The Enabling Factors

Unlike in the transitional economies in Europe, leaders in China did not move to dismantle the planned economy in the initial stages of reform in favor of liberalized markets (Rozelle and Swinnen, 2004). Policymakers only began to shift their focus to market liberalization in 1985, after decollectivization was complete. Even then, liberalization was start and stop (Sicular, 1995). Lin, Cai, and Li (1996) argue that leaders were mainly afraid of the disruption that would occur if the institutions through which leaders controlled the main goods in the food economy (such as grain, fertilizer, and meat products) were eliminated without the institutions in place that work to support more efficient market exchange. Throughout, leaders also were investing and changing

the rules by which domestic producers and consumer interfaced with the external economy.

Price Policy Changes

The administration of prices by the Socialist planning apparatus is one of the most distinguishing characteristics of pre-transition countries. As seen in the previous section, leaders allowed subsets of goods to be traded out of the plan, for most high priority commodities—which almost always included food and fiber—China’s planning ministries allocated goods and services mostly on the basis of quantity-based plans. Prices mostly served accounting functions.

Although early in the reforms China’s leaders had no concrete plan to liberalize markets, they did take steps to change the incentives faced by producers that were embodied in the prices that producers received for their marketed surplus. Hence, perhaps one of the least appreciated moves of the early reformers was their bold decision to administratively increase the price of farm goods that were to be received by farmers (Lardy, 1983; Sicular, 1988b). Between 1978 and 1983, in a number of separate actions, planners in China increased the above quota price, the payment farmers received for voluntary sales beyond the mandatory deliveries, by 41 percent for grain and by around 50 percent for cash crops (Sicular, 1988b). According to the State Statistical Bureau’s data, the relative price of grain to fertilizer rose by more than 60 percent during the first 3 years after reform. During the early reform years, the rise in above-quota price represented a higher output price at the margin to farmers, since until 1984, state-run procurement stations regularly purchased all grain sold by farmers at the above-quota price as long as they had already fulfilled their mandatory marketing delivery quota which was purchased at a state-set quota price, which for the case of rice, for example, was 50 percent below the above-quota price (Sicular, 1995).

The important contribution of China’s pricing policy is the timing and breadth of the policy change. The first major price rise occurred in 1979, almost at the same time when reformers were deciding to decollectivize. However, given the leadership’s decision to gradually implement the Household Responsibility System (HRS—discussed below), beginning first in the poorest areas of China, the price increases immediately affected all farmers, both those in areas that had been decollectivized and those that had not. By 1981, the time of the second major price increase, according to Lin (1992), less than half of China’s farmers had been allowed to dismantle their communes. Hence, as long as there was some, albeit weak, link between the output price and production, the plan-based price rise would have led to increases in China’s farm output.

As during the prereform period, during the early transition era, input prices – especially that of fertilizer – were still mostly controlled by the state’s monopoly agricultural inputs supply corporation in China (Stone, 1988; 1993). Although in short supply, the governments in both countries controlled the price of fertilizer and other inputs (such as pesticides, diesel fuel, and electricity) as well as their distribution (Solinger, 1984). Farmers, through their collective leadership, received low-priced fertilizer from the state, but almost all of it was inframarginal. In other words, the

government-supplied, subsidized fertilizer was not sufficient to meet the needs of most farmers. Producers in early reform periods typically purchased additional fertilizer from the state at a higher price (Ye and Rozelle, 1994). Hence, unlike other transition and developing countries, at the margin, farmers in China were not able to purchase fertilizer prices at highly subsidized rates. In fact, according to Huang and Chen (1999), during the 1980s the real price of China's fertilizer was above the international price. Although China's leader administratively raised the price of fertilizer somewhat under rising foreign exchange and budgetary pressures in the mid-1980s, the rise was not large enough to eliminate the positive incentives created by higher output prices (World Bank, 1997).²

Empirical studies on China confirm a strong impact of these price changes on output during the first years of transition (Lin, 1992; Fan, 1991; Huang and Rozelle, 1996; Fan and Pardey, 1997). Lin (1992) finds that 15 percent of output growth during the first six years of reform came from the rise in relative prices. Huang and Rozelle's (1996) decomposition exercise for rice demonstrates that about 10 percent of the output between 1978 and 1984 came from the price effects.

Institutional Reforms

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.

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.

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.

² To the extent that access to fertilizer improves during the reform (Stone, 1988), the shadow prices of fertilizer would also have fallen, which would also encourage higher output.

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 (Deininger and Jin, 2005). 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.

The Effect of Property Rights Reform on Performance. There is little doubt that the changes in incentives resulting from property rights reforms triggered strong growth in both output and productivity. In the most definitive study on the subject, Lin (1992) estimates that China's HRS accounted for 42 to 46 percent of the total rise in output during the early reform period (1978 to 1984). Fan (1991) and Huang and Rozelle (1996) find that even after accounting for technological change, institutional change during the late 1970s and early 1980s contributed about 30 percent of output growth.

Empirical researchers also have documented impacts that go beyond output. McMillan et al. (1989) document that the early reforms in China also raised total factor productivity, accounting for 90 percent of the rise (23 percent) between 1978 and 1984. Jin et al. (2002) show that the reforms had a large effect on productivity, contributing greatly to a rise in TFP that exceeds 7 percent annually. In addition, a number of researchers have suggested that the rises in surplus in the agricultural sector created by HRS triggered a number of subsequent growth dynamics, providing labor for rural industry's take-off in the mid-1980s (McKinnon, 1993), fuelling the nation's overall industrialization drive later in the reforms, and creating demand for the products of firms in other parts of the economy (Qian and Xu, 1998).

After the first decade of transition, however, the direct effects of property rights reforms in China were exhausted. deBrauw et al. (2004) show how the absence of property rights reforms accounts for much of the deceleration of cropping output in the late 1990s. It is for this reason that China's leaders accelerated investment in more traditional investments in the 1990s.

Input Marketing Policies

The reforms in fertilizer, seed and other input markets follow China's gradual reform strategy (Rozelle and Swinnen, 2004). 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 was gradually implemented, starting with machinery, pesticide, and farm films. The meaningful liberalization of strategically important inputs, such as fertilizer, occurred mostly in the early 1990s. The reform of the seed industry did not begin until the late 1990s.

Domestic Output Market Liberalization Policies

In addition to pricing changes and decollectivization, another major task of reformers is to create more efficient institutions of exchange. Markets—whether classic competitive ones or some workable substitute—increase efficiency by facilitating transactions among agents to allow specialization and trade and by providing information through a pricing mechanism to producers and consumers about the relative scarcity of resources. But markets, in order to function efficiently, require supporting institutions to ensure competition, define and enforce property rights and contracts, ensure access to credit and finance and provide information (McMillan, 1997). These institutions were almost completely absent in China during the Socialist era. Instead, China's central and provincial planning agencies directed production and other economic transactions and their directives served to enforce contracts involving exchanges among various agents in the chain. Market liberalization requires the elimination of planning, but to do so successively requires the process to be executed in a way that will allow producers to continue to have access to inputs and marketing channels while the necessary market-supporting institutions are emerging. In this section we show how China's leaders gradually liberalized markets. We focus, in particular, on three issues: the process of market liberalization; the enforcement of exchange contracts; and how well reformers or some alternative institutions were able to guarantee access to input and output markets during transition.

Unlike reformers in other Socialist nations, leaders in China did not dismantle the planned economy in the initial stages of reform in favor of liberalized markets (Rozelle, 1996). Sicular (1988a; 1988b; 1995), Perkins (1994) and Lin (1992) all discuss how China's leadership had little intention of letting the market play anything but a minor supplemental guidance role in the early reforms period in the early 1980s. In fact, the major changes to agricultural commerce in the early 1980s almost exclusively centered on increasing the purchase prices of crops (Sicular, 1988b; Watson, 1994). In this way, the decision to raise prices (discussed above), however, should *not* be considered as a move to liberalize markets since planners in the Ministry of Commerce made the changes administratively and the price changes mostly were executed by the national network of grain procurement stations acting under direction of the State Grain Bureau.

An examination of policies and the extent of marketing activity in the early 1980s illustrate the limited extent of changes in the marketing environment of China's food economy before 1985. It is true that reformers did allow farmers increased discretion to produce and market crops in 10 planning categories, such as vegetables, fruits, and coarse grains. Moreover, by 1984, the state only claimed control over 12 commodities, including rice, wheat, maize, soybeans, peanuts, rapeseed, and several other cash crops (Sicular, 1988b). However, while this may seem to represent a significant move towards

liberalization, —the crops that remained almost entirely under the planning authority of the government still accounted for more than 95 percent of sown area in 1984. Hence, by state policy and practice, the output and marketing of almost all sown area was still directly influenced by China's planners.

Reforms proceeded with equal caution when reducing restrictions on free market trade. The decision to permit the reestablishment of free markets came in 1979, but only initially allowed farmers to trade vegetables and a limited number of other crops and livestock products within the boundaries of their own county. Reformers did gradually reduce restrictions on the distance over which trade could occur from 1980 to 1984, but as Sicular (1988b) and Skinner (1985) point out, the predominant marketing venue during the early 1980s was mainly local rural periodic markets. Farmers also did begin to sell their produce in urban settings, but free markets in the cities only began to appear in 1982 and 1983. In addition to being small and infrequent, traders could not engage in the marketing of China's monopolized commodities that were still under strict control of the state procurement stations.

The record of the expansion of rural and urban markets confirms the hypothesis that market liberalization had not yet begun by the early 1980s. Although agricultural commodity markets were allowed to emerge during the 1980s, their number and size made them a small player in China's food economy. In 1984, the state procurement network still purchased more than 95 percent of marketed grain and more than 99 percent of the marketed cotton (Sicular, 1995). In all of China's urban areas, there were only 2000 markets in 1980, a number that rose only to 6000 by 1984 (deBrauw et al., 2004). In Beijing in the early 1980s, there were only about 50 markets transacting around 1 million yuan of commerce per market per year. Each market site would have had to serve, on average, about 200,000 Beijing residents, each transacting only 5 yuan of business for the entire year. In other words, it would have been impossible for such a weak marketing infrastructure at that time to even come close to meeting the food needs of urban consumers.

After 1985, however, market liberalization began in earnest. Changes to the procurement system, further reductions in restrictions to trading of commodities, moves to commercialize the state grain trading system, and calls for the expansion of market construction in rural and urban areas led to a surge in market-oriented activity (Sicular, 1995). For example, in 1980, there were only 241,000 private and semi-private trading enterprises registered with the State Markets Bureau; by 1990, there were more than 5.2 million (deBrauw et al., 2002). Between 1980 and 1990, the per capita volume of transactions of commerce in Beijing urban food markets rose almost 200 times. Private traders handled more than 30 percent of China's grain by 1990, and more than half of the rest was bought and sold by commercialized state grain trading companies, many of which had begun to behave as private traders (Rozelle et al., 1999; 2000).

Even after the start of liberalization in output in 1985, the process was still partial and executed in a start and stop manner (Sicular, 1995). For example, after the initial commercialization of the grain bureau, when grain prices rose in 1988, leaders halted the

grain reforms and allowed provincial leaders to intervene in the flow of grain into and out of their provinces. The policies were relaxed again in the early 1990s and retightened in the mid-1990s. Another round of liberalization and retrenchment occurred in the last 1990s.

Despite its start and stop nature, 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. The share of negotiated procurement at market price increased from 3% only in 1985 to 6% in 1985 and 12% in 1990.

Technology and Water Infrastructure Development

Agricultural research and plant breeding in China during the reform era is still 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. Although there have been several private domestic and joint venture investments into agricultural research and development, policies still discriminate against them.

While effective during the Socialist era, China's agricultural research system entered the 1980s and 1990s overburdened with a staff that is poorly trained. One of the world's most decentralized systems, the nature of the system also promotes duplication of research effort and discourages investments into basic research. As a consequence, 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.

The investment by the state in water control—both irrigation and flood control—swamps the amount invested into agricultural research. As noted above, in the 1950s to the 1970s most of the state’s effort was focused on building dams and canal networks, often with the input of corvee labor from farmers. After the 1970s, greater focus was put on increasing the use of China’s massive groundwater resources (Wang et al., 2005a). By 2005, China had more tubewells than any country in the world, except possibly for India. Although initially investment was put up by local governments with aid from county and provincial water bureaus, by the 1990s the government was encouraging the huge shift in ownership that was occurring as pump sets and wells and other irrigation equipment went largely into the hands of private farming families (Wang et al., 1995b). At the same time, private water markets (whereby farmers pump water from their own well and sell it to other farmers in the village) were also encouraged. The main policy initiative after the mid-1990s in the surface water sector was management reform (with the goal of trying to make water use more efficient).

Trade policy

In addition to important changes in foreign exchange policy (changes that saw the nation’s current depreciated steeply and become more accessible to traders during the 1980s and 1990s), there have been a number of other fundamental reforms to China’s 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 (Rosen et al., 2004).

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.

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).

Given the changes made prior to the nation's accession to the WTO, it is not surprising that, while it was a major event in China (and it will have an effect on many sectors), in its most basic terms it is really a continuation of previous policies. Hence, the commitments embodied in China's WTO accession agreement in the agricultural sector—market access, domestic support and export subsidies—are essential exactly what China was doing in the 1990s.

Trade and Poverty. In the same way that the forces of development have generated progress and problems, the nation's efforts at pushing ambitious agricultural trade liberalization policies has had both positive and negative consequences (Anderson et al., 2004). Research has shown that on average the nation's accession to WTO will help rural residents and improve incomes. In fact, according to Anderson et al. (2004), China stands to gain more than almost any other country in the world from more liberalized trade agreements, such as those being discussed during the Doha round of the WTO negotiations.

In any trade agreement, however, there will be both winners and losers. The nature of China's agricultural economy—its competitiveness and extent of marketization means that since households in most parts of China are fairly well integrated into national markets, the effects of trade liberalization that start at China's ports—both those that raise and lower domestic prices—are transmitted rapidly throughout the economy. Households that are producing competitive products will generally gain from liberalization while those that are producing uncompetitive ones will hurt.

Huang et al. (2006) recently have studied the effect of WTO and future trade liberalization on China's farmers. According to their analysis, the subset of all farmers that get hurt from trade liberalization is small. And, it is quite specific. In particular, *poor* maize, cotton and wheat producing areas in the Central and Western parts of the nation are the ones that have been hurt. Farmers in most of the rest of China will gain.

In assessing the reasons for these adverse effects, research shows that there are several determining factors. First, households in these poor areas—due to lower social capital—are less likely to be diversified into the off farm sector. Thus, while richer households are able to offset the loss from trade liberalization with their gains that come from their participation in the off farm sector, some poorer households are less able to do

so (although the rise in migration is making this less of an issue). Second, farmers in poor areas often are growing the crops that are uncompetitive—maize, cotton and wheat. They are less likely to be growing crops in which China has a comparative advantage—horticulture crops and aquaculture products. Finally, because farmers in poorer areas have less physical and human capital than those in richer areas, they often have more difficulties in shifting from those crops that are hurt by trade liberalization into those that benefit.

Concluding Thoughts on China's Transition Era Agricultural Policies

The scope of China's policy efforts during the transition era is impressive. Policy shifts were made in pricing, the organization of production, marketing, investments, technology and trade. Although the rate of invest has risen during the reforms China is still underinvesting in agriculture compared to other countries. Taxes—both those that are explicit and those implicit in pricing and trade policies—also have fallen. Although China certainly did not reach the point during the transition era that it began to heavily subsidize the agricultural economy in a way that characterizes its neighbors in East Asia, it appears to be heading in the direction noted by Timmer (1997) in which developing nations a certain point begin to turn from a period of extraction from agriculture to a period of net investment into the sector.

One of the most important characteristics of agricultural reform in China is the pace of reform. Our analysis is consistent with that of Rozelle (1996) which shows that the sequencing of agricultural reform policies followed the gradualism strategy of China's more general, economy-wide reforms that McMillan and Naughton (1992) describe. In the initial stages of reform, leaders consciously restricted the promotion of market-based economic activity, allowing at most the exchange of minor products (e.g., minor fruits and vegetables) in sharply circumscribed regions. Not until 1985, after the completion of HRS, did policy makers begin to encourage market activity for more important commodities (e.g., grain), although initially market activity only occurred within the framework of China's renowned two tier price system (Sicular, 1988b). Leaders did not commit themselves to more complete market liberalization until the early 1990s, more than a decade after the initiation of HRS. From this description, it is clear that China's reforms fall into 2 distinct stages: the incentive reforms that dominate the period from 1978 to 1984; and a period of gradual market liberalization that begins in 1985 and extends through the 1990s. In the rest of this section we look in more detail at three of the main parts of China's reform strategy.

In addition, outside of agriculture many policies and other factors affected the sector. Other rural policies, for example, such as those that govern fiscal reform, township and village enterprise emergence and privatization and rural governance almost certainly have a large, albeit indirect, effect on agriculture. Urban employment policies, residency restrictions, exchange rate management and many other policy initiatives also affect agriculture by affecting relative prices in the economy, the access to jobs off the farm and the overall attractiveness of staying on the farm.

When taken together, these policies have been shown to have a dramatic effect on China's agricultural sector. They have increased output of food, driven prices down and improved supplies of non-grain food and raw materials for industry. The mix of policies—pricing; improved property rights; market liberalization; investment; trade—also have made producers more efficient, they have freed up labor and resources that are behind the structural transformation in the agricultural economy, specifically, and the rural economy, more generally. One of the most convincing indicators showing that agriculture in China is beginning to play effective roles in the nation's development is that the importance of grain is shrinking inside the cropping sector; the importance of the cropping sector is shrinking inside the overall agricultural sector; and the importance of agriculture is shrinking in the general economy. Rural incomes are up; productivity is up. Many of the rises in welfare, however, are being generated by individuals (and there have been more than 200 million of them) that have been able to escape grain and move into high-valued crops; escape cropping and move into livestock and fisheries production; and most importantly escape agriculture (the rural economy) and move into an off farm job (in the city).

The Role of Agriculture in China's Ongoing Development: Future Challenges

Are we too optimistic? Can the development of the agricultural sector really be counted as successful? Certainly, it is possible to level the criticism that we have put too much emphasis on the performance criteria of growth, structural transformation and liberalization. Because of this, it may be that our analysis seems to be at odds with observations of many social scientists that have focused on the ills of society in rural China (e.g., Bernstein and Lu, 2000).

While we certainly do not want to be accused of wearing rose colored glasses, we believe our analysis is defensible given our assumption that for China to become a modern, wealthy nation, it will have to transform itself from an agriculture-based economy to an industrial/service-based one. If China is to join the ranks of the developed world, it also will have shift the vast bulk of the population from rural areas to urban centers. We do not dispute that this process of transformation is wrenching and thoroughly disruptive of people's lives. We understand and read with interest the reports of social scientists that report of the difficulties of migration, the uncertainties of shifting agricultural enterprises, and the risks—and frequent failures—that rural families experience during the process of development. There is no doubt that large segments of the rural population suffers tremendously during periods of industrialization and urbanization. By not spending time on analyzing the human costs that are incurred during China's recent rush of economic growth, we do not by any means want to downplay its seriousness.

However, in the history of the modern world, all developed countries have had to go down more or less the same path. Some of done it faster; others slower; some have done it with less disruption to the lives of the rural population; others have inflicted enormous pain on its people. Our analysis in this paper is focused primarily on whether

or not agriculture has begun to play a constructive role in aiding the transformation of the economy. The findings of our chapter are that agriculture failed in the Socialist era. It was unable to provide large amounts of inexpensive food for consumers, raw material for industry, exports for foreign exchange reserves and income for rural residents. The set of production, marketing and trade policies inside agriculture and the nature of economic planning in the economy as a whole also kept the rural economy from supplying labor to industry and minimize the linkages that allowed structural transformation to occur.

In contrast, during the Reform era—despite the cost to some parts of the rural population—agriculture has been playing a constructive role in many dimensions. Indeed, it is arguable that agriculture’s responsibilities in three of its roles are largely fulfilled: Food is plentiful; industry is not being constrained by raw material shortages; and China has some of the high holdings of foreign exchange reserves in the world. Moreover, the cropping sector, in particular, and agricultural sector, more generally, are being transformed with remarkable speed as farmers with strong incentives are responding to market signals and shifting their productive energies more toward higher-value commodities in which China has a comparative advantage in producing. The linkages between the rural and urban economies are also beginning to strengthen as more than 200 million people—in more than 8 out of 10 rural households—have found employment off the farm. The changes have been driven by a complicated and wide-ranging set of reform policies that have been implemented over the past 20-plus years: beginning with the household responsibility system; gradual market liberalization, both domestically and internationally; continued investments in water; breakthroughs in agricultural R&D; and the creation of an environment in which farm families—who albeit are still generally poor—are reacting to the signals of the market and are, on average, becoming better off as their incomes have risen, assets have accumulated and opportunities to work off the farm improved.

But, as anyone who has visited China’s rural areas in recent years knows, China is not yet a developed nation and many of its rural areas are still backward. We do not disagree with this. And, in fact, we believe that China currently is entering a new stage of agricultural development and it is one that is filled with as many new and demanding challenges as were being faced at the onset of the reforms. It also is a stage of development in which many of the former policies that aided agriculture and its transformation in the past may become less helpful or even inhibiting. In fact, China’s trade policy, in particular, makes China’s challenge unique (at least in East Asia), since it will be forced to develop in a relatively open economy environment.

Unlike the Reform era when the main challenges were to provide incentives, allow farmers to make decisions which were more consistent with the economy’s resource scarcities and increase the productivity of producers through investments in water control and new technologies, in the future the real challenge will be twofold: first, a large number of farm families must make the complete transition from rural to urban areas (that is, engage in permanent migration to the city); and second, for those families that stay behind, they must be able to modernize their farming operations and do so on substantially larger farms. These two challenges are needed in order for China’s

agricultural sector to finish playing its transformative role. The shift by many families to the city is needed to improve productivity and provide labor for the increasing more intensive and complex industrial and service sector that is developing in China's coastal and urban areas. Larger farm sizes are needed so those that stay behind can continue to increase their incomes; higher incomes are needed for many reasons—first, so those that stay behind can gradually lift themselves out of poverty; second, so those left behind in the first wave of migration will have the resources to invest in the human and physical capital investments that are required of them to move during the second, third and future waves of migration; and third, so those left behind can begin to create a modern agricultural industry. It will only be when this happens that China will begin to be able to say that they have joined the ranks of modern nations.

In assessing the challenge, one of the most conspicuous differences between China's current challenge and the path that was taken by China's successful neighbors (Japan, Korea, etc.) and its island province (Taiwan) is that there is a strong emphasis on the need to enlarge farm size. In fact, during the period of rapid development in East Asia, farm size did not change much. Instead, in place of larger farm sizes, government officials used trade policies to seal off their markets from foreign competition and allow rising domestic demand (aided by policy-provided supports) to bid up agricultural prices. Although such a set of policies is not necessarily efficient in pure economic terms, it did serve the purpose of helping to raise rural incomes and inflate the value of rural assets. In contrast, China—due to its WTO commitments—does not have the option to carry out such a border-protection induced income transfer scheme. Because the current size of farms, as discussed above, are so small, even strong productivity gains from successful agricultural R&D investments will not be sufficient to raise incomes significantly. Higher incomes in agriculture—those that are somewhat more on par of those of wage-earning workers—will only be able to be generated by increasing farm size and mechanization.

Meeting the two challenges, however, will not be easy and they will depend on a number of policies—both inside and outside agriculture—that will be needed to overcome the constraints that currently are facing the rural population. Of course, the most important element that will allow for the continuing shift of rural residents into the cities will be more jobs, which ultimately will depend on continued growth. Assuming that China's pace of growth continues—at least at rates that are high enough to continue to produce employment opportunities in industry and services—urban policies undoubtedly will have to change. The hukou system, despite significant relaxation in recent years, still supports a two-tier system of citizenship. Other chapters discuss the detailed changes that are needed to allow more permanent moves by rural individuals and families to the city.

On the rural side in order to enhance migration opportunities three policies are needed: education; education and education. Despite policy efforts in recent years to improve access to rural education, China's rural education is generally poor in quality, under-funded (and expensive for rural families) and does not meet the needs of rural families. We do not believe it is a bad thing that the best educated are first to go. Indeed,

it is expected and it is the experience of most nations that have gone through the development process. And, it is because of this the responsibility for funding rural education should primarily rest with the central government. The social return to education has been shown to be very high (Fan et al., 2004). Education has been shown to have significant private returns not only through higher wages (deBrauw and Rozelle, forthcoming), but also through improve access to off farm opportunities in the first place. Much more is needed in this area. In addition (and in every respect as important), other investments that improve human capital—investments in health; child nutrition—are equally needed.

In a very real sense, any policies that help increase farm size and raise incomes will also be pro-migration. Migration is always a high cost activity and permanent migration, especially into an urban area in which average incomes are significantly higher, will be very expensive. Families will need to be able to afford urban housing, health care, education and other living expenses. Before they are able to make the move, then, having higher income earning activities will enhance their ability to save, which can be used to finance the move.

The challenges of being able to increase farm sizes in China should not be minimized. Although Deininger and Jin (2005) have shown the rental transactions are becoming increasingly common, most are still short term and there are many reasons that families will not attempt to amass larger land holdings. Above all, the current system of property rights work against the expansion of farm size (Brandt et al., 2002). Since cultivated land is formally owned by the collective, farm households that want to move to the city can not sell their land to help them finance their move; and farm households that want to expand their land holdings are unable to get long term rights to use and income that are needed to induce them to make the investments that will make their farm enterprises more productive. Lack of strong property rights also keeps banks from lending on the basis of land holdings—either to finance the move to the city or to finance productive investments.

So why will China's leaders not consider privatizing land? The most common answer is that land is currently the rural household's most secure source of insurance. If the household loses his job; if a member of the household loses a job or if the family business suffers a loss, since each household in China has land, the household is at most one season away from having enough to eat and subsist on (or likely has been farming at the same time and so has some income with which the family can be fed and clothed and sheltered). If land was to be privatized and a family that sold its land to finance an off farm opportunity was to suffer a shock, it is thought that such households will either become a burden to society (through the need to support through welfare payments) or could possibly turn to crime as a source of income. Although recent research from Vietnam (Brandt, 2005) suggests that there has been little of this sort of consequences in Vietnam after land was quasi-privatized, one of the most effective policy moves ultimately will be to implement rural social security system. In sum, we believe that at some point (now or in the near future) China needs to move towards privatization or at the very least formal land registration which would give farm households stronger

property rights and encourage them to use their land in more productive ways (as described above). This also may encourage land consolidation.

In addition to land, the rapid development of agriculture and its success at increasing yields in the past may be constraining the future productivity of agriculture and in some cases threatening incomes (even without land consolidation). For example, water has been cited as one possible resource that has been exploited to such a level that at some point in the near future, farmers in some areas could lose access to it. Work by Huang et al. (2005) shows that if farmers lose their ability to irrigate their crop, the cropping income drops significantly.

Although all of the concerns about water are true, in fact, the scope of the problem, while serious for those that would suffer loss of access to irrigation water, only affects a relatively small area of China. According to Wang et al. (1995b), even though nearly 70 percent of farmers in northern China rely on groundwater, less than 10 percent of these farmers (or less than 4 percent of China's land area) are in areas that are suffering "serious overdraft." We do not want to minimize the problem for those that live and produce in these areas (and there is a larger percentage that is in areas in which the groundwater table is falling). A new, concerted effort to implement a coherent set of groundwater management policies are needed in these areas. However, our point here is that water resource problems while serious is not going to bring the nation to its knees. In addition, Blanke et al. (2006) and Huang et al. (2006) have shown that in areas in which water is seriously short, farmers and local officials do respond and figure out ways to save water and conserve the resource adopting water saving technologies or shifting cropping patterns.

There also may be other limits to growth—the slow down of technology-generated TFP; land conversions to built-up area; and other problems. These should not be minimized and as the urban population increases, the tensions between agriculture and non-agriculture populations will rise. While serious, it should be noted that such problems affect all countries that are in the middle of rapid development. China will encounter these problems. What is needed in the future is better systems of governance that can mediate problems; compensate losers; regulate polluters and generally implement policies that can lead to an agricultural system that is modern and wealthy and coexists with the large majority of China's population that is living and working off the farm.

Table 1. Performance during Socialist Era in China, 1950 to 1978.

Year	Grain				Cotton			Structure of Cropping (Grain Sown Area/Total Sown Area)
	Sown Area (million ha)	Output (million tons)	Yield (Ton/ha)		Sown Area (000 ha)	Output (000 tons)	Yield (Ton/ha)	
1950	114.41	132.13	1.16		3786	692	0.180	87
1951	117.77	143.72	1.22		5485	1031	0.188	87
1952	123.98	163.91	1.32		5576	1304	0.233	88
1953	126.64	166.83	1.32		5180	1175	0.225	88
1954	128.99	169.51	1.31		5462	1065	0.195	87
1955	129.84	183.93	1.42		5773	1518	0.263	86
1956	136.34	192.75	1.42		6256	1445	0.225	86
1957	133.63	195.05	1.46		5775	1640	0.278	85
1958	127.61	197.65	1.55		5556	1969	0.353	84
1959	116.02	169.65	1.46		5512	1709	0.308	81
1960	122.43	143.85	1.18		5225	1063	0.203	81
1961	121.44	136.50	1.13		3870	748	0.195	85
1962	121.62	154.40	1.27		3497	702	0.203	87
1963	120.74	165.75	1.37		4409	1137	0.255	86
1964	122.10	180.87	1.54		4935	1663	0.338	85
1965	119.63	194.53	1.63		5003	2098	0.420	83
1966	120.99	214.00	1.77		4926	2337	0.473	82
1967	119.23	217.82	1.83		5098	2354	0.465	82
1968	116.16	209.06	1.80		4986	2354	0.473	83
1969	117.60	210.97	1.79		4829	2079	0.428	83
1970	119.27	242.92	2.04		4997	2277	0.458	83
1971	120.85	250.14	2.07		4924	2105	0.428	83
1972	121.21	240.47	1.98		4896	1958	0.398	82
1973	121.16	270.16	2.19		4942	2562	0.518	82
1974	120.98	275.28	2.27		5014	2461	0.488	81
1975	121.06	284.51	2.35		4956	2381	0.480	81
1976	120.74	286.31	2.37		4929	2055	0.420	81
1977	120.40	282.73	2.35		4845	2049	0.420	81
1978	120.59	304.77	2.53		4866	2167	0.443	80

Data source: CNSB, various years.

Table 2. Grain Trade during Socialist Era in China, 1970 to 1980. (Million tons).

	Grain Import	Grain Export	Rice Import	Rice Export	Wheat Import	Wheat Export
1970	5.36	2.12	0.04	1.28	5.30	0.00
1971	3.17	2.62	0.13	1.29	3.02	0.00
1972	4.76	2.93	0.20	1.43	4.33	0.00
1973	8.13	3.89	0.07	2.63	6.30	0.00
1974	8.12	3.64	0.12	2.06	5.38	0.00
1975	3.74	2.81	0.07	1.63	3.49	0.00
1976	2.37	1.76	0.29	0.88	2.02	0.00
1977	7.34	1.66	0.13	1.03	6.88	0.00
1978	8.83	1.88	0.17	1.44	7.67	0.00
1979	12.36	1.65	0.12	1.05	8.71	0.00
1980	13.43	1.62	0.15	1.12	10.97	0.00

Data Source: CNBS, various years.

Table 3. The annual growth rates (%) of Agricultural economy by commodity, 1970-2000.

Commodity	Pre-reform	Reform period		
	1970-78	1978-84	1985-95	1996-2000
Agricultural Gross Domestic Product	4.9	8.8	3.8	4.2
Grain total				
Production	2.8	4.7	1.7	0.03
Sown area	0.0	-1.1	-0.1	-0.14
Yield	2.8	5.8	1.8	0.17
Rice				
Production	2.5	4.5	0.6	0.3
Sown area	0.7	-0.6	-0.6	-0.5
Yield	1.8	5.1	1.2	0.8
Wheat				
Production	7.0	8.3	1.9	-0.4
Sown area	1.7	-0.0	0.1	-1.4
Yield	5.2	8.3	1.8	1.0
Maize				
Production	7.4	3.7	4.7	-0.1
Sown area	3.1	-1.6	1.7	0.8
Yield	4.2	5.4	2.9	-0.9
Total cash crop area	2.4	5.1	2.1	3.5
Cotton				
Production	-0.4	19.3	-0.3	-1.9
Sown area	-0.2	6.7	-0.3	-6.1
Yield	-0.2	11.6	-0.0	4.3
Edible oil crops	2.1	14.9	4.4	5.6
Vegetable area	2.4	5.4	6.8	9.5
Fruit				
Orchards area	8.1	4.5	10.4	1.5
Outputs	6.6	7.2	12.7	8.6
Meat (pork/beef/poultry)	4.4	9.1	8.8	6.5
Fishery	5.0	7.9	13.7	10.2

Note: Growth rates are computed using regression method. Growth rates of individual and groups of commodities are based on production data; sectoral growth rates refer to value added in real terms. Sources: CNSB, 1980-2001 and MAO, 1980-2001.

Table 4. Changes in structure (%) of China's agricultural economy, 1970-2000.

	1970	1980	1985	1990	1995	2000
Share in agricultural output						
Crop	82	76	69	65	58	56
Livestock	14	18	22	26	30	30
Fishery	2	2	3	5	8	11
Forestry	2	4	5	4	3	4

Source: CNSB, Chinas' Statistical Yearbook, various issues and China Rural Statistical Yearbook, various issues.

Table 5. The annual growth rates (%) of China's economy, 1970-2000.

	Reform period		
	1979-84	1985-95	1996-00
Gross domestic products	8.8	9.7	8.2
Agriculture	7.1	4.0	3.4
Industry	8.2	12.8	9.6
Service	11.6	9.7	8.2
Foreign Trade	14.3	15.2	9.8
Import	12.7	13.4	9.5
Export	15.9	17.2	10.0
Rural enterprises output	12.3	24.1	14.0
Population	1.40	1.37	0.90
Per capita GDP	7.1	8.3	7.1

Note: Figure for GDP in 1970-78 is the growth rate of national income in real term. Growth rates are computed using regression method.

Source: CNSB, Statistical Yearbook of China, various issues.

Table 6. Changes in structure (%) of China's economy, 1970-2000.

	1970	1980	1985	1990	1995	2000
Share in GDP						
Agriculture	40	30	28	27	20	16
Industry	46	49	43	42	49	51
Services	13	21	29	31	31	33
Share in employment						
Agriculture	81	69	62	60	52	50
Industry	10	18	21	21	23	22.5
Services	9	13	17	19	25	27.5

Source: CNSB, China's Statistical Yearbook, various issues; and China Rural Statistical Yearbook, various issues.

Table 7. Supply and Marketing Channels of Horticultural Markets in Greater Beijing Area, 2004

Panel A: First-time buyers (percent)							
	Modern Supply Chains			Traditional Supply Chains		Other Supply Chains	
	Supermarkets	Specialized suppliers	Processing firms	Small traders	Farmers sell in local periodic markets	Cooperatives	Consumers direct purchase from farmers Others ¹
Horticultural Crops	0	2	2	79	8	0	7 2
Vegetables	0	3	5	82	5	0	1 3
Fruit	0	1	1	75	11	0	9 3
Nuts	0	6	0	88	3	0	3 0

Panel B: Second-time Buyers (percent)							
	Modern Supply Chains			Traditional Supply Chains		Other Supply Chains	
	Supermarkets	Specialized suppliers	Processing firms	Small traders	Traders sell to consumers in periodic markets	Cooperatives	Others
Horticultural Crops	3	3	10	49	13	0	22
Vegetables	6	0	6	57	11	0	20
Fruit	1	2	9	46	16	0	26
Nuts	3	10	19	50	6	0	12

Data source: Wang et al., 2006.

¹ "Others" (first time buyers) includes purchases by agents of hotels or restaurants, gifts to other farmers or procurement by organized groups (such as enterprises for distribution to their workers).

² "Others" (second time buyers) includes sales to other villages and sales to market sites that supply processing and other food firms.

Table 8. Percentage of villages and sown area with specialization by region.

	Percentage of villages ^a		Percentage of sown area ^b	
	1995	2004	1995	2004
Average	21	30	14	24
Hebei	18	19	20	24
Henan	22	23	4	9
Shanxi	51	74	11	22
Shaanxi	4	5	23	32
Inner Mongolia	9	17	38	40
Liaojing	15	32	13	29

Data source: Huang and Rozelle, 2005. [FAO paper]

Table 9. Rural Income per Capita in China, 1980 to 2000 (in real 2000 yuan).

Income group	1980	1985	1990	1995	2000	2001	Annual Growth Rate, 1980 to 2001
Average	711	1248	1305	1702	2253	2347	6%
Bottom decile (poorest)	312	448	442	493	579	578	3%
Top decile (richest)	1530	2486	3253	4763	6805	7159	8%

Data source: CNBS.

References

- Anderson, Kym, Jikun Huang and Elena Ianchovichina. 2004. "Will China's WTO Accession Worsen Farm Household Income?" *China Economic Review*, Vol 15 (2004):443-456.
- Aston, B., K. Hill, A. Piazza and R. Zeitz. 1984. "Famine in China, 1958-1961," *Population and Development Review* 10 (4 December): 613-645
- Bernstein, T., and X. Lu. "Taxation without Representation: Peasants, the Central and the Local States in Reform China." *The China Quarterly* 163 (2000): 742-763.
- Blanke, A. S. Rozelle, B. Lohmar, J. Wang and J. Huang. "Water Saving Technology and Saving Water in China," Working Paper, Center for Chinese Agricultural Policy, Institute of Geographical Sciences and Natural Resource Research, Chinese Academy of Sciences, Beijing, China.
- Brandt, L. 1989. *Commercialization and Agricultural Development: Central and Eastern China*. New York: Cambridge University Press.
- Brandt, L., J. Huang, G. Li, and S. Rozelle. 2002. "Land Rights in China: Facts, Fictions, and Issues," *The China Journal*, No. 47: 67-97.
- Chang, G. and G. Wen, 1997. "Communal Dining and the Chinese Famine of 1958-61" *Economic Development and Cultural Change* (15): 1-15.
- CNBS (National Statistical Bureau of China). *Statistical Yearbook of China*, various issues from 1981 to 2005. Beijing (China): China Statistical Press.
- CNBS (National Statistical Bureau of China). *China Rural Economy Statistical Yearbook*, various issues from 1982 to 2002. Beijing (China): State Statistical Press.
- deBrauw, A. 2006. "Modernization and the Aging of China's Agricultural Labor Force," Paper presented at the Tri-Annual Meeting of the International Association of Agricultural Economists, Gold Coast, Australia, August 13-18, 2006.
- deBrauw, A., J. Huang, S. Rozelle, L. Zhang and Y. Zhang. 2002. "The Evolution of China's Rural Labor Markets during the Reforms," *Journal of Comparative Economics* 30, 2 (June): 329-353.
- deBrauw, A., J. Huang and S. Rozelle. 2004. "The Sequencing of Reforms in China's Agricultural Transition," *Economics of Transition* 12, 3: 427-466.
- Deininger, K. and S. Jin. 2005. "The Potential of Land Rental Markets in the Process of Economic Development: Evidence from China." *Journal of Development Economics* 78(October 2005): 241-270.
- Dong, X. and G. Dow, 1993. "Monitoring Costs in Chinese Agricultural Teams," *Journal of Political Economy*, University of Chicago Press, vol. 101(3), pages 539-53.
- FAO [Food and Agricultural Organization of the United Nations]. FAO Database.

- FAO [Food and Agricultural Organization of the United Nations]. 2002. *The State of Food Insecurity in the World 2001*, FAO, Rome.
- Fan S. 1991. "Effects of Technological Change and Institutional Reform on Production Growth in Chinese Agriculture." *American Journal of Agricultural Economics* 73: 266-275.
- Fan S. 1997. "Production and Productivity Growth in Chinese Agriculture: New Measurement and Evidence" *Food Policy* 22 (3 June): 213-228.
- Fan, S. and P. Pardey. 1997. "Research Productivity and Output Growth in Chinese Agriculture," *Journal of Development Economics* 53 (June): 115-137.
- Fan, S., L. Zhang and X, Zhang. 2004. "Reforms, Investment, and Poverty in Rural China." *Economic Development and Cultural Change* 52: 395-421.
- Gale, F. 2006. "Food Consumption in China: Feeding the Dragon," Paper Presented at the 2006 Outlook Conference for US Agriculture, Arlington, VA, February 19, 2006.
- Hu, Ruifa, Jikun Huang and Liqiu Li. 2004. "Agricultural Technology Extension in China" *Management World*, No.5 (2004): 50-57.
- Huang, J. and C. Chen. 1999. *Effects of Trade Liberalization on Agriculture in China: Commodity and Local Agricultural Studies*. United Nations, ESCAP CGPRT Centre, Bogor, Indonesia.
- Huang, J. and C. David. 1995. "Policy Reform and Agricultural Incentives in China," Working Paper, Center for Chinese Agricultural Policy, Institute of Geographical Sciences and Natural Resource Research, Chinese Academy of Sciences, Beijing, China.
- Huang, J. C. Pray, S. Rozelle and Q. Wang. 2002. "Plant Biotechnology in China," *Science* 295 (January 25): 674-677.
- Huang, J and S. Rozelle. 1996. "Technological Change: Rediscovering the Engine of Productivity Growth in China's Agricultural Economy. *Journal of Development Economic*. 49: 337-369.
- Huang, J. and S. Rozelle. 2002. "China's Accession to WTO and Likely Shifts in the Agriculture Policy." Working Paper, Center for Chinese Agricultural Policy, Institute of Geographical Sciences and Natural Resource Research, Chinese Academy of Sciences, Beijing, China.
- Huang, J. and S. Rozelle. 2005. "Market Development, Commercialization and Small Farmers in China," Working Paper, Center for Chinese Agricultural Policy, Institute of Geographical Sciences and Natural Resource Research, Chinese Academy of Sciences, Beijing, China.
- Huang, J, S. Rozelle S, and M. Rosegrant. 1999. China's Food Economy to the 21st Century: Supply, Demand, and Trade. *Economic Development and Cultural Change* (47): 737-766.
- Huang, J. 2001. "Agricultural Policy in China, 2000," Working Paper, Center for Chinese Agricultural Policy, Institute of Geographical Sciences and Natural Resource Research, Chinese Academy of Sciences, Beijing, China.

- Huang, J., S. Rozelle and M. Chang. 2004. "The Nature of Distortions to Agricultural Incentives in China and Implications of WTO Accession," *World Bank Economic Review* 18(1): 59-84.
- Huang, J and S. Rozelle. Forthcoming. "The Emergence of Agricultural Commodity Markets in China," *China Economic Review*.
- Huang, J. and S. Rozelle and H. Wang. 2006. "Fostering or Stripping Rural China: Modernizing Agriculture and Rural to Urban Capital Flows," *Developing Economies* 44(1): 1-26.
- Huang, J., J. Yang, Z. Xu and Rozelle. 2006. "Agricultural Trade Liberalization and Poverty in China," Working Paper, Center for Chinese Agricultural Policy, Institute of Geographical Sciences and Natural Resource Research, Chinese Academy of Sciences, Beijing, China.
- Huang, Q., S. Rozelle, D. Dawe, J. Huang and J. Wang. 2005 "Irrigation, Poverty and Inequality in Rural China," *Australian Journal of Agricultural and Resource Economics* 49 (June): 159-176.
- Huang, Q., R. Howitt, S. Rozelle and J. Wang. 2006. "Pricing China's Water," Working Paper, Department of Agricultural and Resource Economics, University of California, Davis, Davis, CA.
- Jin, S., J. Huang, R. Hu, and S. Rozelle. 2002. "The Creation and Spread of Technology and Total Factor Productivity in China's Agriculture," *American Journal of Agricultural Economics* 84,4 (November): 916-939.
- Johnson, D.G. "Is Agriculture a Threat to China's Growth?" Working Paper No. 95:04, Office of Agricultural Economics Research, University of Chicago, April, 1995.
- Johnston, B. 1970. "Agriculture and Structural Transformation in Developing Countries: A Survey of Research," *Journal of Economic Literature* 8: 101-145.
- Johnston and Mellor - "The Role of Agriculture in Economic Development", *American Economic Review*, 1961.
- Kendy, E., Zhang, Y., Liu Ch., Wang, J. and Steenhuis T. (2004). Groundwater Recharge from Irrigated Cropland in the North China Plain: Case Study of Luancheng County, Hebei Province, 1949-2000, *Hydrological Processes*, 18, 2289-2302.
- Lardy, N. R. 1983. *Agriculture in China's Modern Economic Development*. Cambridge: Cambridge University Press.
- Lardy, N. 2001. *Integrating China into the Global Economy*. Washington, D.C. (USA): Brookings Institution.
- Lewis, W. Arthur. 1954. "Economic Development with Unlimited Supplies of Labor," *The Manchester School* 22 (May): 139-91. Lin, Cai and Li. 1996.
- Lin, J. 1992. "Rural Reforms and Agricultural Growth in China." *American Economic Review* 82: 34-51.

- Lin, J. 1991. "Prohibitions of Factor Market Exchanges and Technological Choice in Chinese Agriculture," *Journal of Development Studies* 27(4):1-15.
- Lin, J. and D. Yang. 2000. Food Availability, Entitlement and the Chinese Famine of 1959-61 *Economic Journal* 110: 136-158.
- Lin, J., F. Cai, and Z. Li. 1996. *The China Miracle: Development Strategy and Economic Reform*. Hong Kong: Chinese University Press.
- Lyons, T. 1987. *Economic Integration and Planning in Maoist China* Columbia University Press: NY, NY.
- Martin, W. 2001. "Implications of reform and WTO accession for China's agricultural policies," *Economics of Transition* 9(3):717-42
- McKinnon, R.. 1993. *The Order of Economic Liberalization: Financial Control in the Transition to a Market Economy*. Baltimore: Johns Hopkins University Press.
- McMillan, J. 1997. "Markets in Transition", in Kreps, David and Kenneth F. Wallis, eds. *Advances in Economics and Econometrics: Theory and Applications, vol. 2*, Cambridge, Cambridge University Press, pp. 210-239
- McMillan, J. and B. Naughton. 1992. "How to Reform a Planned Economy: Lessons from China", *Oxford Review of Economic Policy* 8: 130-143.
- McMillan J, Walley J, Zhu L. 1989. The Impact of China's Economic Reforms on Agricultural Productivity Growth," *Journal of Political Economy* 97: 781-807.
- Meade, R. 2000. "An Examination of China's Agricultural Reforms: The Importance of Private Plots," *China Economic Review*, 11, pp. 54-78.
- MOA [Ministry of Agriculture]. China Agricultural Development Report, 2000 and 2001. China's Agricultural Press, Beijing.
- MOA (Ministry of Agriculture). 1980-2002. China Agricultural Yearbook. Beijing (China): China Agricultural Press.
- MOFTEC [Ministry of Foreign Trade and Economic Cooperation]. 2002. Foreign trade and economic yearbook of China, China Statistical Press.
- Nickum, J. (1998). Is China Living on the Water Margin? *The China Quarterly* (156), 880-898.
- Nyberg, A. and S. Rozelle. 1999. *Accelerating China's Rural Transformation*. The World Bank, Washington DC.
- Park, A., H. Jin, S. Rozelle, and J. Huang. 2002. "Market Emergence and Transition: Arbitrage, Transition Costs, and Autarky in China's Grain Market," *American Journal of Agricultural Economics* 84,1 (February):67-82.
- Perkins, D. 1969. *Agricultural Development in China, 1368-1968*. Chicago: Aldine Publishing Company.

- Perkins, D. 1994, "Completing China's Move to the Market," *Journal of Economic Perspectives* 8.2 (Spring):23-46.
- Putterman, L. 1993. *Continuity and Change in China's Rural Development*, Oxford University Press, New York, NY.
- Qian, Y. and C. Xu. 1998. "Innovation and Bureaucracy under Soft and Hard Budget Constraints," *Review of Economic Studies* 65(1): 151-164.
- Qiao, F., B. Lohmar, J. Huang, S. Rozelle and L. Zhang. 2003. Producer Benefits from Input Market and Trade Liberalization: The Case of Fertilizer in China," *American Journal of Agricultural Economics* 85, 5 (December): 1223-1227.
- Rawski, T. 1989. *Economic Growth in Prewar China*. Berkeley: University of California Press.
- Riskin, C. and A. Khan. 2001. *Inequality and Poverty in China in the Age of Globalization* New York, NY: Oxford University Press.
- Rosen, D., J. Huang and S. Rozelle. 2004. *Roots of Competitiveness: China's Evolving Agriculture Interests*. Policy Analysis in International Economics, Volume 72. Institute for International Economics: Washington DC. June 2004.
- Rozelle, S. 1996. "Stagnation Without Equity: Changing Patterns of Income and Inequality in China's Post-Reform Rural Economy," *The China Journal* 35 (January): 63-96.
- Rozelle, S., A. Park, J. Huang, and H. Jin., 2000. "Bureaucrat to Entrepreneur: The Changing Role of the State in China's Transitional Commodity Economy," *Economic Development and Cultural Change* 48, 2: 227-252.
- Rozelle, S. and J. Huang. 2004. "China's Maize Economy: Supply, Demand and Trade," Report for the US Grains Council, Beijing, China.
- Rozelle, S. and J. Huang. 2005. "China's Soybean Economy: Supply, Demand and Trade," Report for the American Soybean Association, Beijing, China.
- Rozelle, S. and J. Huang. 2002. "Trade and Investment Liberalization and China's Rural Economy: Impacts and Policy Responses after China's Accession to the WTO," Report for the World Bank—China Office, Beijing, China.
- Rozelle S. and J. Swinnen. 2004 "Success and Failure of Reform: Insights from the Transition of Agriculture," *Journal of Economic Literature* XLII (June): 404-456.
- Rozelle, S. G. Li, M. Shen, A. Hughart and J. Giles. 1999. "Leaving China's Farms: Survey Results of new Paths and Remaining Hurdles to Rural Migration," *China Quarterly* 158 (June): 367-393.
- Rozelle, S., J. Huang and D. Sumner. 2006. "China's Horticulture Economy: Supply, Demand and Trade," Report for the Western Growers American Soybean Association, Beijing, China.

- Shen, M., L. Zhang, J. Huang and S. Rozelle. 2005. "Farmer's Professional Associations in Rural China: State Dominated or New State-Society Partnerships?" Working Paper, Center for Chinese Agricultural Policy, Institute of Geographical Sciences and Natural Resource Research, Chinese Academy of Sciences, Beijing, China.
- Skinner, W. 1985. "Rural Marketing in China: Repression and Revival" *China Quarterly*, (103): 393-413.
- Sicular, T. 1988a. "Plan and Market in China's Agricultural Commerce" *Journal of Political Economy* 96 (2): 283-307.
- Sicular, T. 1988b. "Agricultural Planning and Pricing in the Post-Mao Period" *China Quarterly* 116, pp. 671-703
- Sicular, T. 1995. "Redefining State, Plan, and Market: China's Reforms in Agricultural Commerce," *China Quarterly*, 144, pp. 1020-1046.
- Solinger, D. 1984. *Chinese Business Under Socialism*, Berkeley: University of California Press.
- Stone, B. 1988. Developments in agricultural technology. *China Quarterly* 116(December): 767-822.
- Stone, B. 1993. "Basic Agricultural Technology under Reform," in *Studies on Contemporary China*, eds, Kueh, -Y.-Y.; Ash, -Robert-F. Oxford; New York; Toronto and Melbourne: Oxford University Press, Clarendon Press, 1993, pages 311-59.
- Stone, B., and S. Rozelle. 1995. "Foodcrop Production Variability in China, 1931-1985," in *The School for Oriental and African Studies, Research and Notes Monograph Series*, Volume 9, London, August 1995.
- Timmer, P. 1998. "The Agricultural Transformation," Chapter 7 (pp. 113-135) in Carl Eicher and John Staatz (eds.) *International Agricultural Development, Third Edition* The John Hopkins University Press: Baltimore, MD.
- Wang, H. et al. 2005. "Producing and Procuring Horticultural Crops with Chinese Characteristics: A Case Study in the Greater Beijing Area," Working Paper, Center for Chinese Agricultural Policy, Institute of Geographical Sciences and Natural Resource Research, Chinese Academy of Sciences, Beijing, China.
- Wang, J., 2000. Property Right Innovation, Technical Efficiency and Groundwater Management: Case Study of Groundwater Irrigation System in Hebei, China, 2000, Ph.D. Thesis, Chinese Academy of Agricultural Sciences.
- Wang, J., J. Huang and S. Rozelle. 2005a "Evolution of Tubewell Ownership and Production in the North China Plain," *Australian Journal of Agricultural and Resource Economics* 49 (June): 177-195.
- Wang, J. Z. Xu, J. Huang and S. Rozelle. 2005b "Incentives to Water Management Reform: Assessing the Effect on Water Use, Productivity and Poverty in the Yellow River Basin," *Environment and Development Economics* 10: 769-799.

- Wang, J. J. Huang, Q. Huang and S. Rozelle. Forthcoming. Privatization of Tubewells in North China: Determinants and Impacts on Irrigated Area, Production and the Falling Water Table,” *Hydrogeology*.
- Watson, A. 1994, “China’s Agricultural Reforms: Experiences and Achievements of the Agricultural Sector in the Market Reform Process,” Working Paper 94/4, Chinese Economic Research Unit, University of Adelaide, Adelaide, Australia.
- Wen, G. 1993. “Total Factor Productivity Change in China’s Farming Sector: 1952-1989”. *Economic Development and Cultural Change* 42: 1-41.
- World Bank. 1985. *World Development Report*. Washington, DC: The World Bank.
- World Bank. 1997. *Sharing Rising Incomes* Washington, DC: The World Bank.
- Xu, Z., J. Xu, X. Deng, J. Huang, E. Uchida and S. Rozelle. Forthcoming. “Grain for Green and Grain: A Case Study of the Conflict between Food Security and the Environment in China,” *World Development*.
- Ye, Q. and S. Rozelle. 1994. Fertilizer Demand in China’s Reforming Economy, *Canadian Journal of Agricultural Economics*. 42,2 (May): 191-208.
- Zhang, L., Q. Li and S. Rozelle. 2005. “Fertilizer demand in China: What is Causing Farmers to Use So Much Fertilizer?” Working Paper, Center for Chinese Agricultural Policy, Institute of Geographical Sciences and Natural Resource Research, Chinese Academy of Sciences, Beijing , China.