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The Role of Agriculture in China's Development: Performance, policy determinants of success, and lessons for Africa

Jikun Huang

Professor and Director, Center for Chinese Agricultural Policy,
Institute for Geographical Sciences and Natural Resource Research,
Chinese Academy of Sciences

Scott Rozelle

Helen F. Farnsworth Senior Fellow,
Co-director of the Rural Education Action Program,
Freeman Spogli Institute for International Studies,
Stanford University

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Abstract

The lost decades for China in the 1950s, 1960s and 1970s look remarkably like the lost decades of Africa in the 1980s and 1990s. Poor land rights, weak incentives, incomplete markets and inappropriate investment portfolios. However, China burst out of its stagnation in the 1980s and has enjoyed three decades of remarkable growth. In this paper we examine the record of the development of China's food economy and identify the policies that helped generate the growth and transformation of agriculture. Incentives, markets and strategic investments by the state were key. Equally important, however, is what the state did not do. Policies that worked and those that failed (or those that were ignored) are addressed. Most importantly, we try to take an objective, nuanced look at the lessons that might be learned and those that are not relevant for Africa. Many parts of Africa have experienced positive growth during the past decade. We examine if there are any lessons that might be helpful in turning ten positive years into several more decades of transformation.

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Introduction

The view of agricultural and rural development in the modern world has changed dramatically in the past several decades. Traditionally, agriculture was thought of as an inferior partner in development. Since the size of the sector falls during development, the early view was that it could be ignored. Why would leaders ever want to invest in a shrinking sector? Some academics urged policymakers to treat agriculture like a black box from which resources could be costlessly extracted. In their view, all investment should be targeted at industry and cities. As a low productivity sector, agriculture did not deserve investment.

Unfortunately, countries that took this path 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 in failure (Timmer 1998). Neglect of agriculture meant that a large part of the population was left out of the development process. Without investment, those in the low productive part of the economy found it difficult to shift to developing parts of the economy. Dual economies grew apart. In many cases, production in agriculture fell and food prices rose. Many households fell into isolated subsistence; stability required for growth disappeared and development stagnated or even reversed. There are many examples of countries that encountered these difficulties, e.g., Argentina, Mexico, Nigeria and even parts of the Former Soviet Union. In contrast, nations that grew fast and entered the ranks of developed nations, e.g., Japan and Korea, invested heavily in agriculture as an integral part of their development strategy.

In the post World War II era, most modern development economists agree that the role of agriculture and rural development is an integral part of nation building and healthy development (Johnston and Mellor 1961; Johnston 1970). Agriculture plays five important roles in the development of an economy by: a) supplying high quality labor to factories, constructions sites and the service sector; b) producing low cost food which keeps 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 exportable commodities that can help finance imports of key technology packages and capital equipment; and e) raising rural incomes. In this paper, agriculture is broadly defined to include crops, livestock, and fisheries, and a sector that sources labor for migration.

If one is interested in the recent and future development of China during the People's Republic era, it is crucial to know how well agriculture has performed and the role that it has played in the development process. How has agriculture contributed to rising rural incomes and growth in general? Has it been successful in supplying labor to the off-farm sector? *One of the overall goals of this paper is thus to document the performance of China's agricultural sector.*

This paper, however, seeks to go further than describing the achievements and shortfalls of China's agricultural economy. We also aim to identify the factors—domestic policies, economic events (e.g., marketization, technological breakthroughs), and foreign

initiatives (e.g., foreign trade negotiations)—that have been behind China’s agricultural performance. Well-managed policies and massive investments are required to: create an agricultural economy that can feed the population, efficiently supply industry with labor and raw materials, develop markets, earn foreign exchange, produce income for those that live and work in the sector, and contribute to the nation’s structural transformation. Large investments in education, training and health are also needed to increase the productivity of both the industrial and agricultural labor force. Improvements in agricultural productivity keep food prices low, allow farmers to adopt new technologies and farming practices as markets change, and raise incomes of those still in farming. Investment is further needed in technology, land, water, and other key inputs that are in short supply. *In this paper we seek to point out both policies that have facilitated the performance of the agricultural sector and those that have constrained it.*

Finally, this paper considers if there are lessons from China’s experience that are useful for policy makers from other developing countries, especially Africa. While there are many environmental and historical factors that differ between China and Africa, like China—which experienced three decades of rapid growth after several decades of stagnation—the economies of many countries in Africa have begun to grow. *In this spirit, the final goal of this paper is to consider carefully the role of policy in making agriculture thrive in the years of China’s growth, and extract lessons that might be useful for Africa and other developing countries.*

The bottom line of our work is that China’s agricultural sector performed remarkably well during the reform era (1980s, 1990s and early 2000s), and that policy played an important role. Over this period, food production increased, in excess of 3000 calories per capita per day; moreover, during most years, China was a net agricultural exporter of food. Rural incomes also rose, and the economy began transforming into an industrial, urbanized economy. Improved incentives and more secure property rights, products of the decollectivization movement, led to dramatic increases in productivity. Gradually improving domestic markets and agricultural trade liberalization induced a fundamental shift in the production orientation of many producers. Improved market conditions encouraged higher levels of commercialization and increased specialization into many labor-intensive, high-value crops for which China had a comparative advantage. During this same time, China became 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 also encouraged the creation of strong linkages between the rural and urban economies—through credit markets, commodity markets and input markets, especially for labor. In short, the agricultural sector has clearly played a successful role in supplying labor, food, raw materials, exports and jobs to support China’s extraordinary economic performance.

Agriculture in the reform era—performance

The stagnation that characterized the performance of agriculture in the pre-reform period disappeared after 1978. Whatever metric of success that was used to describe China during the 1950s, 1960s, and 1970s was surpassed during the reform era as agriculture

finally began to carry out its various roles in the development process. The annual growth rate of the gross domestic product of agriculture more than tripled to 8.2 percent during the initial reform period, 1978-1984, compared to a 2.7 percent annual increase in the early and mid-1970s (Table 1). Although annual growth rates slowed to about 4 percent in real terms during the later reform periods (1985-1995 and 1995-2000), these are still extraordinarily high rates of agricultural growth over such a sustained time period.

Table 1. Annual growth rates (%) of the agricultural economy by commodity, 1970-2005

Commodity	Pre-reform	Reform period			
	1970-78	1978-84	1985-95	1996-2000	2001-2005
Agricultural Gross Domestic Product	2.7	7.1	4.0	3.4	3.9
Grain total					
Production	2.8	4.7	1.7	0.03	1.1
Sown area	0.0	-1.1	-0.1	-0.14	-0.7
Yield	2.8	5.8	1.8	0.17	1.8
Rice					
Production	2.5	4.5	0.6	0.4	-0.8
Sown area	0.7	-0.6	-0.6	-0.5	-0.8
Yield	1.8	5.1	1.2	0.8	0.0
Wheat					
Production	7.0	8.3	1.9	-0.6	-0.4
Sown area	1.7	-0.0	0.1	-1.6	-3.1
Yield	5.2	8.3	1.8	1.0	2.7
Maize					
Production	7.4	3.7	4.7	-1.3	5.6
Sown area	3.1	-1.6	1.7	0.8	2.7
Yield	4.2	5.4	2.9	-0.9	2.9
Total cash crop area	2.4	5.1	2.1	3.5	1.5
Cotton					
Production	-0.4	19.3	-0.3	-1.9	6.5
Sown area	-0.2	6.7	-0.3	-6.1	5.3
Yield	-0.2	11.6	-0.0	4.3	1.2
Edible oil crops	2.1	14.9	4.4	5.6	0.8
Vegetable area	2.4	5.4	6.8	9.5	3.1
Fruit					
Orchards area	8.1	4.5	10.4	2.0	2.4
Outputs	6.6	7.2	12.7	10.2	21.0
Meat (pork/beef/poultry)	4.4	9.1	8.8	6.5	4.9
Fishery	5.0	7.9	13.7	10.2	3.6

Note: Growth rates are computed using a 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: NSBC (1980-2007) and MAO (1980-2007).

In the early reform period, output growth—driven by increases in yields—occurred in all subsectors of agriculture. Between 1978 and 1984, grain production, in general, increased by 4.7 percent per year. Production rose for each of the major grains—rice, wheat and maize. While sown area did not change during this time, annual growth rate of yields for grains in general more than doubled between the late part of the pre-reform era and the early reform period.

The success of agriculture in supplying abundant, inexpensive food can be illustrated by an examination of grain prices. During the reform era, with the exception of price spikes in 1988 and 1995, the real price of rice, wheat and maize fell. When using a regression approach to measure the trends, grain prices fell 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 reduced the share of the consumption budget accounted for by grain from nearly 40 percent in the late 1970s to about 14 percent for rural households in 2004. In urban areas, grain accounted for more than 20 percent of total expenditures 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, specifically cotton, edible oils, vegetables, and fruit, also grew rapidly in the early reform period when compared to the 1970s (Table 1). Unlike grain (with the exception of land-intensive crops, such as cotton), the growth of the non-grain sector continued throughout the reform era. Hence, in the case of many commodity groups high growth rates are continuing to accelerate or at least maintain this 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 the retail food sector and cotton for the textile sector.

The rise in some sectors has been so fast that it almost defies description. For example, between 1990 and 2005 the increase in vegetable production capacity was so fast that China as a nation added the equivalent production capacity of California (the world's most productive vegetable basket) every two years. When comparing 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 U.S., the EU, Japan and India).

China is also 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 crops (Table 1). Livestock production rose 9.1 percent per year 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 most years of the reform era. The rapid and continuous rise in livestock and fisheries has steadily eroded the predominance of crops (Table 2).

Table 2. Changes in structure (%) of China's agricultural economy, 1970-2005

	1970	1980	1985	1990	1995	2000	2005
Share in agricultural output							
Crop	82	76	69	65	58	56	51
Livestock	14	18	22	26	30	30	35
Fishery	2	2	3	5	8	11	10
Forestry	2	4	5	4	3	4	4

Source: NSBC Statistical Yearbook of China and China Rural Statistical Yearbook, various issues from 1980 to 2007.

Moving off the farm

The reform-era brought even more fundamental, transformative changes across the entire rural economy. While the average annual growth of agriculture averaged about 5 percent throughout the entire reform period, the growth rates of the economy as a whole and of the industrial and service sectors were faster (Table 3). In fact, since 1985, the growth of the 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 12 percent in 2005 (Table 4). These figures highlight the ironic feature of agricultural development; the more transformative role that agriculture plays in development the faster its importance will fall.

Table 3. The annual growth rates (%) of China's economy, 1979-2005

	Reform period			
	1979-84	1985-95	1996-2000	2001-2005
Gross domestic products	8.8	9.7	8.2	9.6
Agriculture	7.1	4.0	3.4	3.9
Industry	8.2	12.8	9.6	10.7
Service	11.6	9.7	8.2	10.2
Foreign trade	14.3	15.2	9.8	25.0
Import	12.7	13.4	9.5	25.5
Export	15.9	17.2	10.0	24.6
Rural enterprises output	12.3	24.1	14.0	NA
Population	1.40	1.37	0.91	0.63
Per capita GDP	7.1	8.3	7.2	9.0

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: NSBC, Statistical Yearbook of China, various issues.

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

	1970	1980	1985	1990	1995	2000	2005
Share in GDP							
Agriculture	40	30	28	27	20	15	12
Industry	46	49	43	41	47	46	48
Services	13	21	29	32	33	39	40
Share in employment							
Agriculture	81	69	62	60	52	50	45
Industry	10	18	21	21	23	22.5	24
Services	9	13	17	19	25	27.5	31

Source: NSBC Statistical Yearbook of China and China Rural Statistical Yearbook, various issues from 1980 to 2007.

The shifts in the economy can also be seen in employment (Table 4). Agriculture employed 81 percent of labor in 1970. By 2005, however, as the industrial and service sectors grew in importance, the share of employment in agriculture fell to 45 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 and Swinnen 2004). From both an output and employment perspective, agriculture is performing in a way that is consistent with the transformation of China's overall economy—from agriculture to industry and from rural to urban (Rozelle et al. 1999; Nyberg and Rozelle 1999).

Productivity trends and rural incomes

Trends in agricultural productivity tell a similar story of transition. Output per unit of land (or yields) all rose sharply. In addition, for the entire reform period, trends in agricultural labor productivity paralleled those of yield.

Total factor productivity (TFP) trends moved largely in the same direction as the partial measure. 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) worried 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 continued to rise at a rate of around 2 percent per year. In other words, estimates of TFP in China generally moved in a manner consistent with the partial measure. A 2 percent annual rise of TFP is

certainly not low (Alston and Pardey 1998). The U.S., many Western European countries, and Australia grew by around 2 percent per year in the post-WWII era.

In part due to rising productivity, and perhaps also due to the increasing (allocative) efficiency associated with specialization, rural incomes during the reforms steadily increased (Table 5). Between 1980 and 2000, average rural per capita incomes rose (in real terms) from 771 to 2347 yuan (US\$96 to US\$293). 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. It thus seems surprising the amount of attention given to the rural income problem by the media. The problem was clearly rooted in the relative rise between the rural and urban incomes; urban incomes started at a higher base and rose faster than rural incomes.

Table 5. 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%

Source: NSBC Statistical Yearbook of China and China Rural Statistical Yearbook, various issues from 1980 to 2007.

The inequality between rural and urban incomes also parallel the rural economy. Those that began rich did relatively better than those who began 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 were rising (at 2 to 3 percent annually) for those in the lowest decile, the rates of increase were far lower than the richest. These numbers imply, of course, that in relative terms the poorest of the rural poor were falling behind in all senses.

Nevertheless, agriculture has been shown to play an inequality mitigating role. Two factors are responsible for this effect (Rozelle 1996). First, agricultural income is distributed more evenly. Second, the poor are proportionately more involved in agriculture. Because of these two characteristics, increases in agriculture income lead to a lower Gini coefficient and other measures of inequality.

Overall observations on agriculture's performance during the reform-era

Whereas the pre-reform era witnessed little transformation, the post-1978 period saw China's agricultural sector change dramatically. Although the sector grew, it fell in importance to the overall economy in terms of output value and employment—key characteristics of modern growth. The structure of the sector itself also changed, diversifying out of coarse grains and staple grains into higher valued crops, and out of crops into livestock and aquaculture. Trade patterns also changed more in line with China's comparative advantage. Although the most dramatic changes took place most rapidly among the richer households, change also occurred among the poor.

Policies to develop agriculture and their impacts

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 et al. (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 (e.g., grain, fertilizer, and meat products) were eliminated without institutions in place to support more efficient market exchange. Throughout, leaders also were investing and changing the rules by which domestic producers and consumers interfaced with the external economy.

Property rights reforms for cultivated land

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 for 15 years. During this time, while the ownership of the land stayed with the collective, income and control 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 late 1990s, collective ownership of land has resulted in frequent reallocation of village land. Some 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 effect 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, in March 2003 China passed a revised land law, the Rural Land Contract Law, that seeks to greatly increase tenure security.

Above all, the government is now searching for a mechanism that permits those that stay in farming to be able to gain access to additional cultivated land and to increase their incomes and competitiveness. Even without much legal protection, researchers are finding increasingly more land in China is being rented (Deininger and Jin 2005). In order to accelerate this process, the 2003 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.

1) 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.

Researchers also have documented empirical 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 about exhausted. deBrauw et al. (2004) show how the absence of property rights reforms accounted for much of the deceleration of crop output in the late 1990s. It is for this reason that China's leaders may have accelerated investment in more traditional investments in the 1990s and 2000s.

However, there is also literature that emerged during the late 1990s that calls into question the fact that the non-private nature of China's cultivated land rights has affected agricultural production. In a number of papers (reviewed in Brandt et al. 2002), researchers sought to measure the impact of the nature of China's property rights on investment into land. Most of these investments have been minor. According to Brandt et al. (2002), one major reason is that the rights actually reside with the village, and since

villages are relatively small, they have been able to create ways to manage their land so it has not had large negative productivity effects.

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 as an accounting function.

Although early in the reforms China’s leaders had no concrete plan to liberalize markets, they did take steps to improve the incentives by raising the prices that producers received for their marketed surplus. One of the least appreciated moves of the early reformers was the bold decision of China’s leaders to increase the price of farm goods received by farmers (Lardy 1983; Sicular 1988a and 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 delivery quotas) by 41 percent for grain and by about 50 percent for cash crops (Sicular 1988b). According to data from the State Statistical Bureau, 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. Prior to 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. The latter was purchased at a state-set quota price, which for the case of rice, was 50 percent below the above-quota price (Sicular 1995).

The important contribution of China’s pricing policy was 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, beginning first in the poorest areas of China, the price increases immediately affected all farmers. By 1981, the time of the second major price increase, less than half of China’s farmers had been allowed to dismantle their communes (Lin 1992). Hence, as long as there was some (even weak) link between the output price and production, the plan-based price rise would lead to increases in China’s farm output.

During the early transition era (the late 1970s and early 1980s), input prices – especially that of fertilizer – continued to be controlled primarily by the state’s monopoly agricultural inputs supply corporation in China (Stone 1988, 1993). Although in short supply, the government controlled the price of fertilizer and other inputs (e.g., pesticides, diesel fuel, 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 or bought fertilizer on the fledgling markets (Ye and Rozelle 1994). Unlike other transition and developing countries, 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 leadership administratively raised the price of fertilizer (in part because of 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).

Domestic output market liberalization policies

In addition to pricing changes and decollectivization, another major task of reformers was to create more efficient institutions of exchange. Markets—whether classically competitive or some workable substitute—increase efficiency by facilitating transactions among agents. This allows specialization and trade 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 that 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 most 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.

Leaders in China did not dismantle the planned economy in favor of liberalized markets during the initial stages of reform (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 reform period of 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 should *not* be considered as a move to liberalize markets. Planners in the Ministry of Commerce simply 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). 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. 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 initially only allowed farmers to trade vegetables and a limited number of other crops and livestock products within the boundaries of their own county. Reformers gradually reduced 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 began to sell their produce in urban settings, but free markets in the cities only began to appear in 1982 and 1983. Additionally, traders could not engage in the marketing of China's monopolized commodities that were still under strict control of the state procurement stations.

The limited expansion of rural and urban markets confirms 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 and rose to only 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 served, on average, about 200,000 Beijing residents, each transacting an average of 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 and fiber (e.g., cotton for clothing) needs of urban consumers.

After 1985, 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, leaders halted the grain reforms when grain prices rose in 1988 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 re-tightened in the mid-1990s. Another round of liberalization and retrenchment occurred in the late 1990s.

Despite its start and stop nature, 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 thus began to be undermined (Rozelle et al. 2000). After record growth in grain production in 1984 and 1985, a second stage of price and market reforms was announced in 1985 aimed at limiting the scope of government price and market interventions radically 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 an increase in procurement prices. Even for grain, the share of grain compulsory quota procurement in grain production, which reached 29 percent in 1984, was reduced to 18 percent in 1985, 13 percent in 1990 and nearly zero by 2004. The share of negotiated procurement at market price increased from only 3 percent in 1985 to 6 percent in 1985 and 12 percent in 1990.

1) Impact of price increases, market liberalization and specialization

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). Lin (1992) found 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 demonstrated that about 10 percent of the output between 1978 and 1984 came from price effects.

Although few authors have attempted to quantify the gains from market liberalization—beyond the initial increases in price—the few papers that do exist show that farmers have been gaining from increased allocative efficiency. For example, deBrauw et al. (2004) showed that there was a positive effect of increasing marketization on productivity. Lin (1991) and Huang and Rozelle (1996) found similar results. In all three of these papers, the authors conjecture that the gains were due in part to increasing specialization.

To understand whether or not specialization has occurred since the mid-1990s when markets began to emerge and integrate, we conducted a national representative survey of 400 communities in 2004. In the survey of community leaders we asked the following question: Between the period of 1995 to 2004, have farmers in your village specialized in any particular crop or livestock commodity? The results of our survey showed that indeed specialization has been occurring in China's agricultural sector. Between 1995 and 2004, the percentage of villages that were specializing in an agricultural commodity increased sharply and did so in every province (Table 6). On average, 30 percent of China's villages were specializing in 2004, up from 21 percent in 1995. It is clear from the results that the rise in the demand for horticulture and other speciality products is driving the specialization. In our sample, fully 60 percent of those villages that are specializing are producing either fruits (28 percent), vegetables (13 percent) or other cash crops (28 percent--e.g., sugar cane, tobacco, cotton). There also are villages that are specializing in livestock commodities, oil seed crops, and forest products.

Table 6. 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

Source: Huang and Rozelle (2005).

Agricultural trade liberalization

Much has been made of China's accession to the WTO as a turning point in its relationship with the world; however, China's open door policy started much earlier (Huang and Rozelle 2003). 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 percent 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 and Chen 1999; Anderson et al. 2004).

The shift in the composition of trade that China has experienced over the past 25 years is even more remarkable. 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 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 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. They 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. But beginning in the middle 1980s, market liberalization was gradually implemented, starting with machinery and pesticide. 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.

Summary: The production, marketing environment and role of government

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. This contrasts with the pre-reform era, where 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. 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 since the mid-1990s 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 had actually fallen, from 0.71 to 0.55 hectares. Although the rate of growth of production and marketing cooperatives (called Farmer Professional Associations—FPAs) has risen in recent years, few villages and a small percentage of farmers belong. According to Shen et al. (2005), only 7 percent of villages have FPAs. And, of the villages that have FPAs, only about one-third of farmers belong. In all of China, only about 2 percent of farmers in 2005 belonged to cooperatives; a level of participation that is far below almost all other East Asian nations, where participation rates were almost 100 percent, at least nominally. Between 2005 and 2008, cooperative activity steadily increased (Deng et al. 2009). By 2008, 22 percent of villages had a cooperative and about 13 percent of households belonged (5 percent were formal members and 7 percent were informal members). China still has a long way to go before farm organizations make the transition toward larger, more modern farms; likely a result of the nature of China's agricultural property rights.

What are China's cultivated land property rights like today? Land ownership resides with the collective leadership (equivalent to the village in most communities). The collective leadership then contracts land use rights to farmers. According to policy and the Cultivated Land Contracting Law of 2004, farmers are supposed to get 30-year use rights. They also have the right to all of the income on the land and to transfer the land within the control period. With the exception of being able to sell the land use rights or bequeath

it to their children, rights are fairly strong. The resulting changes in incentives triggered both strong growth of output and a dramatic increase in productivity (McMillan et al. 1989; Lin 1992; Huang and Rozelle 1996). There is concern that restrictions to selling or bequeathing land is a constraint on farmer investment (and migration) behavior, but empirical evidence suggests it is not an important constraint.

Overall, China in the 2000s may have one of the least distorted, domestic agricultural economies in the world. In a recent survey done by the Center for Chinese Agricultural Policy, in 100 percent of the responses, the farmer said that he/she made the planting decision and was not compelled by local officials (Zhang et al. 2005). The exception was for village-owned orchards that had been planted in the 1980s and 1990s. 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. All purchases were made from private vendors.

In prior years, government parastatals were responsible for purchasing the output of China's farms; however, since the 1990s, a large majority of sales of grains, oilseeds and fiber crops, and literally all horticulture and livestock products, are to small, private traders (Wang et al. 2009; Huang et al. 2008). Even with the rise of supermarkets and processing firms that are catering to the retail needs of the urban population, recent research shows that almost all purchases of fruit, vegetables, nuts and livestock products are by the *first buyers*, i.e., 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.

Table 7. Supply and marketing channels of horticulture markets in the 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 ²
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

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.

Source: Wang et al. (2009).

The existence of millions of small traders 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 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). Statistical analysis also demonstrates that even farmers in remote, poor villages are integrated into national markets (Huang and Rozelle 2006).

Investment in conventional agricultural technologies and plant biotechnology

The importance of agricultural research and extension in increasing agricultural productivity in developing countries is now widely recognized. Successful development

is closely tied to productivity growth in the agricultural sector (Alston and Pardey 1998). In a country like China, where agriculture is dominated by small, poor farms, it is especially important.

During the reform era (the 1980s, 1990s and 2000s), it was not always clear whether China would be able to maintain the pace of technological advance needed to maintain farm incomes in a dynamic economy. While decollectivization played a key role in boosting productivity (Lin 1992) in the early stages of reform, this provided only a one-off boost to productivity. After 1985, evidence suggests that technological advance has been the main engine of productivity growth (Huang and Rozelle 1996). China was one of the first countries to develop and extend the Green Revolution technology in the 1960s, 1970s and 1980s. China's scientists developed hybrid rice in the late 1970s and, until the mid-1990s, it was the only country in the world to have commercialized this new technology.

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

A nationwide reform in research was launched in the mid-1980s (Rozelle et al. 1997). The reforms attempted to increase research productivity by shifting funding from institutional support to competitive grants, supporting research useful for economic development, and encouraging applied research institutes to support themselves by selling the technology they produced. In addition, in the late 1980s and early 1990s, new horticultural seeds, improved breeding livestock (Rae et al. 2006) and new technologies for dairy were all imported (Ma et al. 2007).

After declining between the early 1980s and the mid-1990s (Rozelle et al. 1997), investment in R&D also began to rise. Funding greatly increased for plant biotechnology, although only Bt cotton has been commercialized in a major way to date (Huang et al. 2002). China now ranks among the global leaders in agricultural biotechnology research. In the late 1990s, China invested more in agricultural biotechnology research than all other developing countries combined. Its public spending on agricultural biotechnology was second only to the U.S. and, according to some projections, it will soon outspend the U.S. government on plant biotechnology research. Investment in government-sponsored R&D increased by 5.5 percent annually between 1995 and 2000 and by over 15 percent per year after 2000. During the past decade, the increases in investment in rural research and development have been the most rapid of any large nation.

Investment in R&D has been paying off. During China's early reform period the yields of major food crops rose steadily (Jin et al. 2002). Although some of that yield increase came from greater efficiency in input use, technological improvements appear to have accounted for some of this growth; indices of aggregated inputs (that is, measures of land, labor and material inputs) for rice, wheat, and maize actually fell for all the crops during the early 1980s.

Although there was concern about the effect of the slowdown in R&D spending during the 1980s and early 1990s, the analysis of Jin et al. (2002) shows that the growth of output continued to outpace that for inputs. And, productivity trends continued to rise. During the 1980s and 1990s, China's TFP rose at the healthy rate of about 2 percent per year. Such rises, which occurred in all provinces and with all crops, increased incomes—of all farmers—regardless of whether the crop was protected or taxed. China continued to invest in agricultural R&D through the late 1990s and early 2000s.

In addition, our research has also shown that China's agricultural TFP has grown at a healthy rate for all 23 commodities (Jin et al. 2010). TFP growth for the staple commodities generally rose around 2 percent annually; TFP growth for most horticulture and livestock commodities was even higher (between 3 and 5 percent). Equally consistent, we have found that most of the increase is accounted for by technical change. The analysis is consistent with the conclusion that new technologies have pushed out the production functions, since technical change accounts for most of the rise in TFP.

1) The future role of biotechnology

While it might be easy to rest on past achievements, there are many people in the world worried about where new science for future productivity increases are going to come from. China's investment into plant biotechnology reveals it believes future productivity gains can come from new technologies from these investments. Since the mid-1990s, the growth of China's agricultural biotechnology research investment has accelerated. Investment increased from US\$33 million in 1995 to US\$104 million in 2000 to nearly US\$200 million (or US\$953 million in PPP) in 2003 (Huang et al. 2005). Based on our personnel interviews with the officials from the Ministry of Science and Technology and the Ministry of Agriculture, the investment doubled again between 2003 and 2007.

In 2008, the State Council approved a new and major 12-year "Special Program" to support research on and the development of genetically modified crops and animals. The total budget was 26 billion yuan (or US\$3.8 billion). Half of this budget came from the central government; the other half came from co-funding from industry and local governments. While existing agricultural biotechnology research programs have been working on more than 20 crops and various livestock, fishery and forestry, funding from the newly initiated Special Program will be directed towards five major crops (rice, wheat, maize, cotton and soybean) and three livestock commodities (hogs, cattle and sheep).

The larger question, of course, is whether commercialization permission will be given. Based on amount of spending, we believe it is almost certain that plant biotechnology products will be commercialized in the very near future. Policy pronouncements have stated clearly that China intends to use the products of its biotechnology programs. The nation is investing heavily in bio-safety management institutions that are being designed to monitor and supervise the new technologies. On September 7th, 2009, the China Daily reported that Niu Dun, Vice-minister of Agriculture, stated, "China has worked on research of transgenic rice and is strongly considering (its commercialization)." Other officials said that by 2020, the country could be a leader in GM foods, cloning, large-

scale transgenic technologies and new breed promotion. Rice and maize are the commodities in which the technologies are nearest to commercialization.

What would be the impact on trade of commercializing biotechnology? Almost certainly, if China commercialized rice, for example, exports would fall. But since China exports less than 2 percent of its rice production, the fall in profits from the reduction of trade would be far outweighed by the rise in productivity (Huang et al. 2004).

Investment in water infrastructure

Investment by the state in water control—both irrigation and flood control—swamps the amount invested into agricultural research. From 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. Local governments put up the initial investment with aid from county and provincial water bureaus. By the 1990s, however, the government encouraged a huge shift in ownership of pump sets and wells and other irrigation equipment 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 to make water use more efficient. Falling water tables present a looming problem for China.

Subsidies: Towards income support or production distortions

In the late 1990s and early 2000s observers reported widely about the discontent of China's rural populations, not the least due to the heavy burden of fees and taxes (Esarey et al. 2000). During this time the government transferred little by way of support to agriculture and almost nothing to farmers directly. Indeed, as late as 2002 the total amount of subsidies reported targeted to the agricultural sector by the Ministry of Finance was only 100 million yuan (or US\$15 million) (Ministry of Finance, China 2008). This amount is extremely small, regardless of the metric. Subsidies to agriculture from the central government were less than 0.007 percent of the value of agricultural output. The transfers equaled only around 0.1 yuan per capita. In addition, most of those subsidies went to enterprises, and it is unclear if farmers benefited at all.

After 2003, however, policies changed in major ways. The changes have occurred in both the direction of payments, the quantity of the transfers, and the nature of payment. In the first years of the Hu-Wen government (2003-2005) leaders abolished taxes and fees (Luo et al. 2007). In 2004, subsidies to farmers rose to 14.5 billion yuan (Ministry of Finance, China 2005). By 2005, instead of the net flow going from rural households to the government's fiscal coffers the flow reversed. Between 2004 and 2008 subsidies from the Ministry of Finance to the agricultural sector rose more than 2.5 times. In 2007,

government subsidies reached 51.4 billion yuan. Between 2007 and 2008 subsidies registered the fastest absolute growth, rising to 95 billion yuan; a rise of 85 percent in one year (from a base that was already fairly high in 2007). Taxes were zero.

The nature of subsidies also changed. According to the Ministry of Finance, most of the subsidy payments (more than 65 percent) went directly to farmers, instead of as before, to agricultural enterprises and government agencies. Farmers received two types of subsidy payments—one called a “grain subsidy” (in Chinese—liangshi butie) and one called an “input subsidy” (nongzi zhonghe butie). In fact, there also is a program called Grain-for-Green which is a conservation set aside program. Since Grain for Green only affects a relatively small subset of the rural population, discussion of this policy effort is beyond the scope of this paper.

What triggered this turnaround in the five-year period between 2003 and 2008? Policy documents suggest that leaders began to increase subsidies for two fundamental reasons (Central People’s Government, China 2008). With the rapid rise in demand for a number of agricultural commodities and the systematic shifts in the pricing structure for agriculture, the government, as it has for thousands of years, professed a concern for national food security (Central People’s Government, China 2008). At the same time, policy documents stated explicitly that the government intended for the subsidies to help support agricultural incomes.

While there has been a number of papers that have begun to write about China’s great shift—from a taxer of agriculture to a subsidizer (Gale et al. 2005; OECD 2008)—there are few papers that are based on household level data which seek to understand how the policy works on the ground. There are many outstanding questions. Are farmers actually receiving the subsidies? Who is receiving the subsidies? Who is not? Are the subsidies being given in such a way that they are distorting decision making in China’s agriculture? In the early 2000s China’s agriculture was one of the least distorted in the world. Has the new subsidy policy reversed this trend? Which objective is being realized: national grain security or income support (or both or neither)? If China’s subsidies are distorting should they be counted against the WTO-established limits for aggregate measures of support?

Finding answers to these questions and devising policies to deal with the right amount and right way to subsidize are major research and policy challenges that the government will face in the coming years. In recent work, we have generated preliminary empirical evidence that can supply some of the answers. In particular, we show from household data that what is reported on China’s national websites is true; agricultural subsidies in China are high—on a per unit of cultivated area basis. Moreover, almost all producers—those producing grain, those who are not, the poor and the non-poor—are receiving the subsidies. China’s level of subsidies is rising quickly. The level of subsidies on a per cultivated area basis is almost as high as any other country in the world.

However, there are some special characteristics of China’s subsidy programs. Subsidies are mostly being given to the land contractor. The tiller is not the target of the subsidies. And, most importantly, the subsidies appear to be nondistorting. In Huang et al. (2009), we present a series of descriptive tables, scatter plots and regression analyses. In all of these different empirical exercises, there is no evidence that grain subsidies are distorting

producer decisions. Grain area is not associated with grain subsidies. In fact, even if the producer does not plant grain, the farmer can receive the subsidy. The level of the use of fertilizer is not associated with input subsidies. Based on these findings, we conclude that the income goals of the subsidy program are most important. China's grain and input subsidies should not be expected to have much of an impact on its national food security goals. As a consequence, despite the rise of subsidies, there is *no* evidence that China is *not* following through with their WTO promises in the area of subsidies since these are clearly nondistorting policies.

The subsidy program is a popular and major policy, and likely to be a fixture of China's agriculture for some time. One of the key policy challenges will be to keep the subsidy program working as it is now.

Concluding thoughts on China's agricultural development and lessons for Africa

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 investment rose 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. Unlike its neighbors in East Asia, China did not reach the point during the transition era in which it began to heavily subsidize the agricultural economy. But it appears to be heading in that direction as noted by Timmer (1998) i.e., developing nations after 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 earlier work (Rozelle 1996) that showed that the sequencing of agricultural reform policies followed the gradualism strategy of China's more general, economy-wide reforms (McMillan and Naughton 1992). Initially, 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; market activity only occurred within the framework of China's renowned two-tier price system (Sicular 1988b). Not until 1985, after the completion of HRS, did policymakers begin to encourage market activity for more important commodities (e.g., grain). Leaders did not commit themselves to more complete market liberalization until the early 1990s, more than a decade after the initiation of HRS. China's reforms fell into two distinct stages: the incentive reforms that dominated the period from 1978 to 1984; and a period of gradual market liberalization that began in 1985 and extended through the 1990s.

In addition, outside of agriculture many policies and other factors affected the sector. Other rural policies—fiscal reform, township and village enterprise emergence, privatization, and rural governance—almost certainly had a large, albeit indirect, effect on agriculture. Urban employment policies, residency restrictions, exchange rate management and many other policy initiatives also affected agriculture by affecting

relative prices in the economy, access to jobs off the farm and the overall attractiveness of staying on the farm.

When taken together, these policies 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, and trade—also have made producers more efficient. These policies have freed up labor and resources that are behind the structural transformation in the agricultural economy, specifically, and the rural economy, more generally. Among 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 and productivity is up. Many of the rises in welfare, however, are being generated by individuals (more than 200 million) 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 and move into an off-farm job.

Policy lessons for Africa

China's agriculture is far from perfect and faces many challenges. However, China took an agricultural sector that had been stagnant for many decades and turned it into a high performing sector that contributed to the overall growth of the country. Policy—production incentives, market liberalization and investment policies—played important roles. It is in this spirit that we try to extract lessons for Africa.

1) Lesson one: Incentives are important

China's experience shows that providing incentives to farmers is more important than providing formal property rights. Until today, China's farmers did not have full and inalienable rights to the land. Yet farmers invested and exerted considerable effort, and the agricultural sector has grown for 30 years in a row. The simple lesson here is that as long as farmers can be assured of the return to their effort, they will invest in farming activities and work hard to produce profitable crops and livestock activities.

Of course, more secure land rights are better than less secure land rights. Because poor land rights make individuals less willing to make long-term investments, the state has had to take a more active role in making longer-term investments (e.g., surface water irrigation, soil improvements). As such, the state may have underinvested in longer-term activities. This result was especially true in the early years of the reform era when the fiscal capabilities of China's government were weaker. Since the mid-1990s fiscal revenues have risen and so have on-farm investments funded by the state. However, even though the quantity of investments may be quite high, there is concern that the government may not always be making the most efficient investment decisions. More secure land rights almost certainly would help. Relying on local government investments

into land can also lead to equity problems since the state's ability to invest may differ from locality to locality depending on the nature of the tax (and redistribution) system.

2) Lesson two: Markets can be effective tools for pro-poor development

Aggressive price decontrol, the dismantling of parastatal trading firms, and heavy investment into communications and transportation infrastructure can have a great impact on agriculture. When markets integrate and barriers to the flow of goods and services are removed, markets can rise, increase efficiency, stimulate specialization, and have a positive impact on the poor.

After implementing such policies, what is the role of the government in managing markets? One of the lessons from China is “mostly nothing.” If markets work well, governments can get out of the way. They do not need to procure crops. They do not need to set prices. When markets work, the private sector can emerge and play a powerful role in integrating markets, transmitting information and supplying farmers with inputs and buying their output. Subsidies are not needed. Markets provide incentives for private traders to find and service new niches (often those with poor farmers). Competition, of course, is necessary to avoid market imperfections that could lead to dependency and exploitation.

When the government is freed from a direct role in making markets, they can focus on their important, but, indirect role. The main task of the government is to invest in roads, irrigation, and communications. The national government also needs to make sure that regional and local governments do not impede the free flow of goods and services. All of these government responsibilities will enhance integration, improve competition and allow markets to have stronger and more pro-poor impacts.

3) Lesson three: The greatest role of the state is to invest in public goods, especially agricultural R&D

The state needs to be very clear about what goods are to become public and what goods are to be left for the private sector. In China, the government decided it was going to invest heavily in:

- Roads
- Water control—especially surface irrigation systems
- Afforestation projects
- Agricultural research and development (R&D)
- Agricultural extension

But, while the government took the lead in investing in public goods, they tried to keep out of investing in private activities. For example, households were left with the responsibility of investing in:

- Groundwater (wells and delivery systems)

- Orchards and vegetable production facilities (like greenhouses)
- Machinery
- Input supply

This clear division between state and private helps clarify who should be doing what. It also lets each party focus its resources on the items that are its responsibility. In the case of poor areas, there can be efforts by the government to help households fund their investments. However, in almost all cases, the households are still asked to initiate the investments and to make a sizeable share.

4) Lesson 4: Getting the incentives right for the government

While development economists in the past have recognized the importance of getting incentives right for households, it is also important to get the incentives right for government officials. If government officials can be given the correct signals and incentives, they can be led to take actions to promote growth and structural transformation. Corruption that undermines growth can be minimized. If leaders are co-beneficiaries of economic development, they will take on a more active and positive role. In China, all officials had explicit incentives that were designed to have them implement programs and encourage growth effectively.

Creating a system that appoints and promotes capable leaders is also important. In the case of China, promotion was explicitly tied to past performance. Education was also explicitly delineated to be a criterion for promotion. Officials were encouraged to seek opportunities to go back to school and get advanced degrees or undertake shorter-term certificate/training programs.

It is also important to seek ways to eliminate the propensity for bureaucracies to become entrenched. Strict seniority rules can often lead to stagnation and a situation in which local bureaucrats protect their territories and hoard resources. If there is a system of promoting younger people and rotating leaders between regions and between different bureaucracies/ministries, the system can become more flexible and innovative.

5) Lesson five: Learn what governments should not do

The experience of China also has some lessons about what not to do. China is suffering the consequences from dividing the country/economy into two artificially separate pieces: rural and urban. Setting up two systems of public services and two systems of investments will necessarily lead to severe inequality. While inequality may not be a big problem in the early stages of development, later on, as a country seeks to move from middle to high income, high levels of inequality can have many adverse, even crippling, effects. At higher levels of income, growth naturally slows and if there is excessive inequality, instability can occur that may undermine many of the positive forces of growth.

While investment into traditional agriculture is important, investments into rural health, nutrition and education are also needed. Basic education is important in making a country

move from poor to middle income. Early on in the development process, countries have to recognize that if they are going to have sustained growth after achieving middle income status, large segments of the population need higher levels of training in math, science, language (English), and computers. This means that expansion of compulsory education (to 12 years or so) needs to start earlier rather than later.

Conclusion

In this paper we have described the achievements and shortfalls of China's agricultural economy. The paper found that China's agricultural sector performed remarkably well during the reform era (1980s, 1990s and early 2000s). Over this period, food production increased, in excess of 3000 calories per capita per day. During most years, China was a net agricultural exporter of food. Rural incomes also rose. Perhaps most fundamentally, between 1980 and 2010 the economy began transforming into an industrial, urbanized economy.

In addition, the paper also identified the factors—domestic policies, economic events (e.g., marketization, technological breakthroughs), and foreign initiatives (e.g., foreign trade negotiations)—that were behind China's agricultural performance. Well-managed policies and massive investments were shown to create an agricultural economy that was able to feed China's population and produce income for those that live and work in the sector. China's agriculture clearly contributed to the nation's structural transformation. Large investments in education, training and health were needed to increase the productivity of both the industrial and agricultural labor force. Improvements in agricultural productivity kept food prices low, allowed farmers to adopt new technologies and farming practices as markets changed and increased incomes of those still in farming.

Based on the findings of the paper, it was suggested that there were several lessons that might be useful for policy makers from other developing countries, especially Africa. The paper argued that getting incentives, markets and the mix of investments right were all important and necessary parts of a pro-agriculture growth policy. Implicit in the overall findings of the paper is that, while there are many environmental and historical factors that differ between China and Africa, like China—which experienced three decades of rapid growth after several decades of stagnation—it is possible that the economies of many countries in Africa could grow—if and when the right policy package is put into place.

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Core literature on “The Role of Agriculture in China’s Development: Performance, policy determinants of success, and lessons for Africa”

Lardy, N. R. 1983. *Agriculture in China's modern economic development*. Cambridge: Cambridge University Press.

In this book, Lardy recounts the experience of agriculture in the 1950s, 1960s and 1970s. The book documents the rise in yields and increase in food production. The book also shows how the real transformation of agriculture during this period was stagnant. In short, the period of collective agriculture is concluded to be mostly a failure. Lardy also is the first one to describe the initial reforms that were implemented in the late 1970s.

Sicular, T. 1988a. Plan and market in China’s agricultural commerce. *Journal of Political Economy* 96(2): 283-307.

In this paper, the reforms are described in one of the first comprehensive accounts of China’s reforms. The decollectivization policies were reviewed. In addition, the pricing policies were reconstructed. One of the most poignant insights of Sicular is that the early gains in agriculture were due to pricing changes, not decollectivization. The paper also describes that gradual nature of the reforms.

Lin, J. 1992. Rural reforms and agricultural growth in China. *American Economic Review* 82: 34-51.

This is the most cited paper on the agricultural reforms in the literature. In the paper, Lin first documents the rise in output during the late 1970s and early 1980s. The paper then decomposes the rise in output into the part due to decollectivization, the part due to pricing changes and the part due to market liberalization. It is found that by far decollectivization is the most important source of change during the 1980s.

Fan, S. 1991. Effects of technological change and institutional reform on production growth in Chinese agriculture. *American Journal of Agricultural Economics* 73: 266-275.

In this paper, Fan shows that there was one more important factor that contributed to the rise of agricultural output during the 1980s. Using a richer data set than the Lin (1991) paper, Fan shows that technology contributed as much as decollectivization to agriculture’s performance. The paper shows that productivity rose during the reform period (above and beyond the rise of output).

Jin, S., H. Ma, J. Huang, R. Hu, and S. Rozelle. 2010. Productivity, efficiency and technical change: Measuring the performance of China’s transforming agriculture. *Journal of Productivity Analysis* 33:191-207.

In this paper, Jin and coauthors document the continuous rise in China’s agricultural total factor productivity (TFP). The paper shows that during the 1980s, 1990s and 2000s TFP

rose for all grain and for many non-grain crops. The main source of rise in TFP is shown to be investment by the state in agricultural research and development.

Huang, J., R. Hu, S. Rozelle, and C. Pray. 2005. Insect-resistant GM rice in farmer fields: Assessing productivity and health effects in China. *Science* 308: 688-690.

This paper is the seminal paper showing China's commitment to agricultural biotechnology. The paper documents the rising investment by the state in plant biotechnology. The different investment targets are documented. The paper then shows that China's farmers have benefited from the widespread adoption of Bt cotton.

Anderson, Kym, Jikun Huang and Elena Ianchovichina. 2004. Will China's WTO accession worsen farm household income? *China Economic Review* 15:443-456.

In this paper, Anderson and coauthors document the fundamental changes that China has implemented in its agricultural external economy. The changes in tariffs before and after WTO are documented. One of the main findings is that the time preparing for accession to the WTO was actually more effective in opening China's agricultural sector than WTO itself. The paper concludes with the assessment that China has one of the most open agricultural economies in Asia.

Huang, J. and S. Rozelle. 2006. The emergence of agricultural commodity markets in China. *China Economic Review* 42(2): 1023-1055.

In addition to the opening of China's borders (see Anderson et al. 2004), China's leaders also opened up its internal agricultural markets. In this paper, it is shown that China's domestic markets were quite integrated. Agricultural products were also shown to move efficiently across China. The paper documents the rise in specialization and efficiency that have occurred due to market liberalization.

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: 241-270.

In this paper, Deininger and Jin document the changes in land policy between the early reforms and the first two decades of the reforms. The paper shows that land rights gradually became more secure. One of the ways that land rights have evolved is that land rentals have increased. The rises in land market transactions are shown to have increased agricultural productivity.

deBrauwer, 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): 329-353.

In this paper, we show that the rural transformation extends far beyond farming. According to the data, there is a fundamental shift between farm and off-farm. Rural off

farm employment is shown to effect men and women. The largest flow of labor is among the young. The largest part of the flow of labor is due to the rise of wage labor. Self employment also accounts for a large part of the outflow of labor.