

# Chapter 3

## The Role of Agriculture in China's Development: Performance, Determinants of Successes and Future Challenges

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### 3.1 Introduction

In the post-World War II era, development economists mostly agree that the role of agriculture and rural development is an integral part of the process of nation building and development (Johnston 1970; Johnston and Mellor 1961). Agriculture plays five important roles in the development of an economy: supplying high quality labour to factories, constructions sites and the service sector; producing low-cost food which will keep wages down for workers in the industrial sector; producing fibre and other crops that can be inputs to production in other parts of the economy; supplying commodities that can be exported to earn foreign exchange that can help finance imports of key technology packages and capital equipment; and raising rural incomes.

The goal of this chapter is to document the performance of China's agricultural sector during the People's Republic era, against the Johnston and Mellor criteria to assess how well the sector has done. In the next section, we will examine the performance of China's rural economy during the reform era. In Sect. 3.3, we will analyse the policies that have helped or hindered progress since the 1980s. In Sect. 3.4, we will discuss some of the future policy challenges.

### 3.2 The Role of Agriculture in China's Transition Era

The performance of China's agriculture sector improved remarkably during the reform period. The Rural Reforms span the late 1970s (1978, to be exact) until the 2000s. The ups and downs that characterised the performance of agriculture in the

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prereform period disappeared after 1978. Whatever metric of success 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% annually, the annual growth rate nearly tripled to 7.1% during the initial Reform period, 1978–1984, compared with 1.8% of population growth in the same period (Table 3.1), although during the later reform periods (1985–1995; and 1995–2000) the annual growth rates slowed (around 4% or so in real terms, which was about four times higher than population growth).

### ***3.2.1 Revival of Agriculture and Solving China's Grain Problem***

At least 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% per year. Production rose for each of the major grains—rice, wheat and maize. While the 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 playing its role of supplying abundant, 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 fell. When using a regression approach to measure the trends, grain prices fell in real terms between 33% (maize) and 45% (wheat) between the late 1970s and early 2000s. Coupled with rising incomes, falling grain prices have reduced the share of the consumption budget accounted for by grain from nearly 40% in the late 1970s to about 14% for rural households in 2004. In urban areas, grain accounted for more than 20% of total expenditure in the late 1970s and it has been less than 3% since 2003.

### ***3.2.2 Beyond Grain: The Transformation of the Agricultural 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 compared to the 1970s. Unlike grain (with the exception of land-intensive staples, such as cotton), the growth of the non-grain sector continued throughout the reform era. The rise in some sectors has been so fast that it almost defies description. For example, between 1990 and 2005 China added the equivalent of the production capacity of California (the world's most productive

Table 3.1 Annual growth rates (%) of agricultural economy by commodity and population, 1970–2005. (Sources: NSBC 1980–2007; MAO 1980–2007)

Commodity	Reform period				
	Pre-reform 1970–1978	1978–1984	1985–1995	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
<i>Rice</i>					
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
<i>Wheat</i>					
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
<i>Maize</i>					
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
<i>Cotton</i>					
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

Table 3.1 (continued)

Commodity	Reform period				
	Pre-reform 1970–1978	1978–1984	1985–1995	1996–2000	2001–2005
Edible oil crop production	2.1	14.9	4.4	5.6	0.8
Vegetable area	2.4	5.4	6.8	9.5	3.1
<i>Fruit</i>					
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
Population	1.8	1.4	1.4	0.9	0.6

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. Because vegetable production data are not available, only annual growth rate vegetable area is reported

**Table 3.2** Changes in structure (%) of China's agricultural economy, 1970–2005. (Source: NSBC, China's Statistical Yearbook (various issues) and China Rural Statistical Yearbook (various issues from 1980 to 2007))

	1970	1980	1985	1990	1995	2000	2005
<i>Share in agricultural output</i>							
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

vegetable basket) every 2 years. It is interesting to note that the rapid growing cash crop sector is dominated by small farms with average farm sizes of less than 0.6 ha in recent years (Wang et al. 2009).<sup>1</sup> China also is moving rapidly away from crop-first agriculture. The rise of livestock and fishery sectors outpaces the cropping sector, in general, and most of the subcategories of cropping (Table 3.2). 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.<sup>2</sup>

### 3.2.3 Moving off the Farm

The Reform era has brought even more fundamental, transformative changes when looking at a picture of the rural economy. While the average annual growth of agriculture averaged about 5% throughout the entire reform period, the growth rates of the economy as a whole and of the industrial and service sectors were faster (Table 3.3). In fact, since 1985, the growth of the industry and service sectors has been two to three times faster than that of agriculture. Because of the differences in sectoral growth rates, agriculture's share of GDP has fallen from 40% in 1970 to 12% in 2005 (Table 3.4). The shifts in the economy can also be seen in employment. Agriculture employed 81% of labour in 1970. By 2005, however, as the industrial and service sectors grew in importance, the share of employment in agriculture fell to 45%. 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).

<sup>1</sup> Wang et al. (2009) showed that small and poor farmers actively participate in the emergence of China's horticulture economy. Middle-stream markets are operated by hundreds of thousands of small wholesalers and brokers. Markets are very competitive. There is little penetration of modern retailers into rural wholesale markets and rural communities.

<sup>2</sup> 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).

**Table 3.3** Annual growth rates (%) of China's economy, 1979–2005. (Source: NSBC, Statistical Yearbook of China (various issues))

	Reform period			
	1979–1984	1985–1995	1996–2000	2001–2005
<i>Gross domestic products</i>	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
<i>Foreign trade</i>	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
<i>Rural enterprises output</i>	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

Figure for GDP in 1970–1978 is the growth rate of national income in real terms. Growth rates are computed using regression method

**Table 3.4** Changes in structure (%) of China's economy, 1970–2000. (Source: NSBC, China's Statistical Yearbook (various issues), and China Rural Statistical Yearbook (various issues))

	1970	1980	1985	1990	1995	2000	2005
<i>Share in GDP</i>							
Agriculture	40	30	28	27	20	15	12
Industry	46	49	43	41	47	46	48
Services	13	21	29	32	33	39	40
<i>Share in employment</i>							
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

### 3.2.4 Domestic Market Integration

China in the 2000s may have one of the least distorted, domestic agricultural economies in the world. In a recent survey by the CCAP, with the exception of farmers that were renting village-owned orchards that had been planted in the 1980s and early 1990s, in 100% of the responses, unlike during the Socialist period in China, the farmer said that he/she made the planting decision and was not compelled by local officials (Rozelle et al. 2006). In another survey, every farmer stated that they purchased all of their chemical fertiliser 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, since the 1990s the

majority of sales of grains and oilseeds and fibre crops and literally all purchases of horticulture and livestock products are to small, private traders (Huang et al. 2008; Wang et al. 2010). 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 *first buyers*, individual entrepreneurs who are trading on their own account (Table 3.5). Even in 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 fertiliser are equally well integrated (Qiao et al. 2003). Although few authors have attempted to quantify the gains from market liberalisation, in the few papers that do exist, it is found that farmers have been gaining from increased allocative efficiency (deBrauw et al. 2004; Huang and Rozelle 1996; Lin 1991). The authors conjecture (without empirical basis) that the gains are due in part to increasing specialisation. The results of our survey show that indeed specialisation has been occurring in China's agricultural sector. Between 1995 and 2004, the percentage of villages that are specialising in an agricultural commodity has increased sharply and has done so in every province (Table 3.6). On average, throughout our sample from across China, 30% of China's villages are specialising, up from 21% in 1995. When examining the composition of the output of villages that are specialising, it is clear that the rise in the demand for horticulture and other speciality products is what is driving the specialisation. In our sample, fully 60% of those villages that are specialising are producing either fruits (28%) or vegetables (13%) or other cash crops (28%, for example, sugar cane, tobacco and cotton). There also are villages that specialise in livestock commodities, oilseed crops, forest products and other commodities.

### 3.2.5 *Expanding Agricultural Trade*

In the reform process, China has turned 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 most years the level of agricultural exports has exceeded that of imports (Fig. 3.1). Perhaps more remarkable 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 *labour-intensive products*, such as horticultural and animal products (includ-

**Table 3.5** Supply and marketing channels of horticultural markets in greater Beijing Area, 2004. (Source: Wang et al. 2006)

	Modern supply chains			Traditional supply chains			Other supply chains		
	Supermarkets	Specialised suppliers	Processing firms	Small traders	Farmers sell in local periodic markets	Co-operatives	Consumers direct purchase from farmers	Others	
<i>Panel A: First-time buyers (%)</i>									
Horticultural crops	0	2	2	79	8	0	7	2 <sup>a</sup>	
Vegetables	0	3	5	82	5	0	1	3 <sup>a</sup>	
Fruit	0	1	1	75	11	0	9	3 <sup>a</sup>	
Nuts	0	6	0	88	3	0	3	0 <sup>a</sup>	
<i>Panel B: Second-time buyers (%)</i>									
Horticultural crops	3	3	10	49	13	0	22 <sup>b</sup>		
Vegetables	6	0	6	57	11	0	20 <sup>b</sup>		
Fruit	1	2	9	46	16	0	26 <sup>b</sup>		
Nuts	3	10	19	50	6	0	12 <sup>b</sup>		

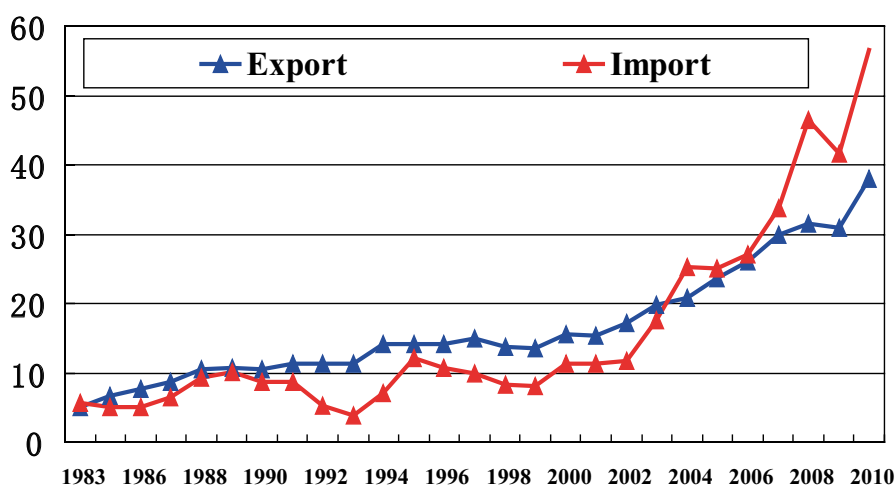
<sup>a</sup> *Others* (first-time buyers) includes purchases by agents of hotels or restaurants, gifts to other farmers or procurement by organised groups (such as enterprises for distribution to their workers)

<sup>b</sup> *Others* (second-time buyers) includes sales to other villages and sales to market sites that supply processing and other food firms



**Table 3.6** Percentage of villages and sown area with specialisation by region. (Source: Huang and Rozelle 2005, FAO paper)

	Percentage of villages <sup>a</sup>		Percentage of sown area <sup>b</sup>	
	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

**Fig. 3.1** Agricultural exports and imports (billion US\$) 1983–2010

ing 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.

### 3.2.6 Small Farms and Emerging Co-operatives

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 households has actually fallen, from 0.71 to 0.55 ha. Moreover, while the rate of growth of production and marketing co-operatives (called Farmer Professional Associations or FPAs) has risen in recent years, few villages and few farmers (percentage-wise) belong to them. According to Shen et al. (2005), only 7% of villages

have FPAs, and, of the villages that have FPAs, only about one-third of farmers belong to them. As a result, as of 2005, in all of China, only about 2% of farmers belonged to co-operatives, 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%. Between 2005 and 2008, there has been progress. According to a recent study by the CCAP, there has been a steady growth of co-operatives (Deng et al. 2009). By 2008, 22% of villages had a co-operative and about 13% of households belonged (5% as formal members and 7% as informal members).

### 3.2.7 Productivity Trends and Rural Incomes

Output per unit of land (or yields) all rose sharply (Lardy 1983). Trends in agricultural labour productivity, measured as output per farm worker, parallel those of yield. Several series of TFP estimates have been produced for China's agriculture (Fan 1991, 1997; Huang and Rozelle 1996; Jin et al. 2002; Lin 1992; McMillan et al. 1989; Wen 1993). The studies uniformly demonstrate that in the first years after reform (1978–1984), comprehensive measures of productivity (either constructed TFP indices or their regression-based equivalents) rose by 5–10% per year. Although Wen (1993) worries that TFP quit growing in the post-reform period (1985–1989), Fan (1997) and Jin et al. (2002) demonstrate that during the 1990s, TFP continued to rise at a rate of around 2% per year. A more recent study by Jin et al. (2010) shows that the record of TFP growth in China is remarkably consistent—especially after 1995.

In part due to rising productivity, and perhaps also due to the increasing (allocative) efficiency associated with specialisation, shifting to the production of higher value crops and livestock commodities and the expansion of off-farm work, rural incomes during the reforms have steadily increased (Table 3.7). Between 1980 and 2000, average rural per capita incomes have risen (in real terms) from 771 to 2347 Yuan.

The inequality between rural and urban areas also has a parallel with the rural economy; in relative terms the poorest of the rural poor are falling behind.

**Table 3.7** Rural income per capita in China, 1980–2000 (in real 2000 Yuan). (Source: NBSC)

Income group	1980	1985	1990	1995	2000	2001	Annual growth rate, 1980–2001 (%)
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

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.

### **3.3 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 favour of liberalised markets (Rozelle and Swinnen 2004). Policymakers only began to shift their focus to market liberalisation in 1985, after decollectivisation was complete. Even then, liberalisation was a start-and-stop process (Sicular 1995).

#### ***3.3.1 Price Policy Changes***

Although early in the reforms China's leaders had no concrete plan to liberalise 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 the bold decision of China's leaders to administratively increase the price of farm goods that were to be received by farmers (Lardy 1983; Sicular 1988a, b). Between 1978 and 1983, in a number of separate actions, planners in China increased the above quota price, i.e., the payment farmers received for voluntary sales beyond the mandatory delivery quotas, by 41% for grain and by around 50% for cash crops (Sicular 1988b). According to data from the State Statistical Bureau, the relative price of grain to fertiliser rose by more than 60% during the first 3 years after reform.

As during the pre-reform period, during the early transition era (the late 1970s and early 1980s), input prices—especially that of fertiliser—were still mostly controlled by the state's monopoly agricultural inputs supply corporation in China (Stone 1988, 1993). Although in short supply, the government controlled the price of fertiliser 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 fertiliser from the state, but almost all of it was inframarginal. In other words, the government-supplied, subsidised fertiliser was not sufficient to meet the needs of most farmers. Producers in the early reform periods typically purchased additional fertiliser from the state at a higher price or bought fertiliser

on the fledgling markets (Ye and Rozelle 1994). Hence, unlike other transition and developing countries, at the margin, farmers in China were not able to purchase fertiliser at highly subsidised rates.

Empirical studies on China confirm the strong impact of these price changes on output during the first years of transition (Fan 1991; Fan and Pardey 1997; Huang and Rozelle 1996; Lin 1992). Lin (1992) finds that 15% of output growth during the first 6 years of reform came from the rise in relative prices.

### ***3.3.2 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 labour force. Although the control and income rights after HRS belonged to individuals, the ownership of land remained collective. China has recently passed a new land law, the Rural Land Contract Law (effective 1 March 2003), which seeks to greatly increase tenure security.

Above all, the government is searching for a mechanism that permits those that stay in farming to be able to gain access to additional cultivated land and increase their incomes and competitiveness. Even without much legal protection, over the past decade, researchers are finding that 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.

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 42–46% of the total rise in output during the early reform period (1978–1984). 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% of output growth. 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% of the rise (23%) 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% annually.

### ***3.3.3 Input Marketing Policies***

The reforms in fertiliser, 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. Decollectivisation 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, fertiliser and the seed systems virtually unchanged, and heavily planned. Since the middle 1980s, market liberalisation was gradually implemented, starting with machinery, pesticides, and farm films. The meaningful liberalisation of strategically important inputs, such as fertiliser, occurred mostly in the early 1990s. The reform of the seed industry did not begin until the late 1990s.

### ***3.3.4 Domestic Output Market Liberalisation Policies***

Leaders in China did not dismantle the planned economy in the initial stages of reform in favour of liberalised markets (Rozelle 1996). Sicular (1988a, b, 1995), Perkins (1994) and Lin (1992) 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 centred on increasing the purchase prices of crops administratively executed by the national network of grain procurement stations acting under the direction of the State Grain Bureau (Sicular 1988b; Watson 1994).

An examination of policies and the extent of marketing activity illustrate the limited extent of changes in the marketing environment of China's food economy before 1985. Reformers did allow farmers increased discretion to produce and market crops in ten 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 liberalisation, the crops that remained almost entirely under the planning authority of the government still accounted for more than 95% of sown area in 1984. The record of the expansion of rural and urban markets confirms the hypothesis that market liberalisation 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% of marketed grain and more than 99% 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).

After 1985, however, market liberalisation began in earnest. Changes to the procurement system, further reductions in restrictions to trading of commodities, moves to commercialise 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). Private traders handled more than 30% of China's grain by 1990, and more than half of the rest was bought and sold by commercialised state grain trading companies, many of which had begun to behave as private traders (Rozelle et al. 1999, 2000).

Even after the start of liberalisation in output in 1985, the process was still partial and executed in a start-and-stop manner (Sicular 1995). For example, after the initial commercialisation of the grain bureau, when grain prices rose in 1988, leaders halted the grain reforms. The policies were relaxed again in the early 1990s and retightened in the mid-1990s. Another round of liberalisation and retrenchment occurred in the late 1990s.

### 3.3.5 *Investment in Agricultural Technology*

Agricultural research and plant breeding in China during the reform era is still almost completely organised by the government. Reflecting the urban bias of food policy, most crop breeding programs have emphasised fine grains (rice and wheat). For national food security considerations, high yields have been the major target of China's research programme except for recent years when quality improvement was introduced into the nation's technology development plan. Although there have been several private domestic and joint venture investments in 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 staff that is poorly trained. One of the world's most decentralised systems, the nature of the system also promoted duplication of research effort and discouraged investments in 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 that was useful for economic development, and encouraging applied research institutes to support themselves by selling the technology they produced.

Since the mid-1990s, 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 programmes probably increased the effectiveness of China's agricultural research system, the reliance on revenue from commercialisation to subsidise research and make up for falling budgetary commitments weakened the system.<sup>3</sup> It is possible that imperfections in the seed industry partly contributed to the ineffectiveness of research reform measures in crop breeding.

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<sup>3</sup> 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.

### **3.3.6 *Investment in Water Infrastructure***

The investment by the state in water control—both irrigation and flood control—swamps the amount invested in agricultural research. As noted above, from the 1950s to the 1970s most of the state's effort was focussed on building dams and canal networks, often with the input of corvée labour 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 tube wells 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, 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). Despite concerns, many reports have shown that the water table has continued to fall.

## **3.4 Future Policy Challenges**

While we believe that four of the five roles of agriculture (the supply of labour, food, raw materials and exports) have either already succeeded or are no longer relevant, the final role—providing the 800 million rural population with income—has remained elusive.

### **3.4.1 *Small Farms and Agricultural Modernisation***

China needs to increase farm size to raise the incomes of those who were left in the agricultural sector during the industrialisation/urbanisation phase that was ongoing during the early 2000s. Since land cannot be bought or sold, this means that the expansion of farm size will have to depend on China's cultivated land rental markets. In the past (1980s and 1990s), at least, there were many restrictions on renting and the number of rental contracts was extremely small (Brandt et al. 2002). In fact, during the 1980s and mid-1990s less than 5% of cultivated land was being planted under rental tenancy. However, in recent years (since the mid-1990s) there are indications that rental markets have emerged in a vibrant way. Unfortunately, in China's national statistic surveys, there is little (almost no) systematic information on the scope of their emergence. According to this survey, the share of cultivated land that is being rented out was only 7% in 2000, but increased to 19% in 2008. More land in coastal and southern China is being rented out than in inland areas or in northern China.

One of the main issues that policymakers face is that the nature of China's land tenure (based on the contracting of land use rights of collective land to individual households for a fixed number of years) is reducing the enthusiasm for renting. Even more so, would further reform and increased security for farm households stimulate rental activity and provide greater opportunity for increasing the scale of farming? In the coming years, property rights reform will be high on the priority list of potential reforms. These reforms are complicated and will certainly create great challenges. The willingness of farmers to rent out their land for the long term (or give it up entirely) depends on their access to alternative forms of insurance, such as unemployment insurance and social security. The willingness of policymakers to initiate policies to encourage land consolidation will also depend on whether they believe that there are sufficient social insurance protections for those that have left farming in case of downturns in employment. The nation is currently experimenting and slowly expanding rural health insurance, low-income welfare payments and social security for rural households. The current programmes, however, are still either funded at a relatively low level and/or only in the pilot stages and do not cover all of rural China. Hence, success in promoting farm size doubtlessly will also depend on success in promoting these forms of social insurance.

### **3.4.2 *Groundwater Management***

How serious is China's groundwater problem? Where is the policy challenge? Wang et al. (2009) have shown that indeed there is a water crisis in northern China. When using other measures of scarcity, a more nuanced picture emerged. According to data on the change in the groundwater table in communities over the past 10 years, in approximately one-half of China's groundwater-using communities, there was a decline in groundwater resources. In a small share of them (about 8%), the groundwater table was falling rapidly (more than 1 m annually). But in up to half of China's communities in northern China there is no severe problem in groundwater resources. Therefore, we believe the best interpretation of northern China's water resources is that there *is* a water crisis in northern China. Hence, policies to address water scarcity problems should be implemented, but they also should be carefully targeted.

Perhaps our more important conclusion is that it is going to take a more active role of the government for China to be able to begin to solve the problems in the groundwater sector. Although the government in China has begun to make a number of responses to the groundwater shortages that are emerging in some areas, implementation has not been very effective.

### **3.4.3 *Subsidies***

China recently has moved from taxing agriculture to subsidising agriculture. In the late 1990s and early 2000s observers reported on the discontent in China's rural population, not least due to the heavy burden of fees and taxes (Esarey et al. 2000). After 2003, however, things changed a lot. The changes have occurred in both the



direction of payments, the quantity of the transfers and the nature of payment. In the first year 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 being 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 by 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% in 1 year (from a base that was already fairly high in 2007). Taxes were zero.

Beside changes in the volume of subsidies, the nature of subsidies also changed. According to the Ministry of Finance, most of the subsidy payments (more than 65%) went directly to farmers, instead of as before to agricultural enterprises and government agencies. According to government sources, farmers received several types of subsidy payments. Among them, 'grain subsidy' (*liangshi butie*) and 'input subsidy' (*nongzi zhonghe butie*) are major subsidy payments.

What triggered this turnaround in the 5-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). On one hand, with the rapid rise in demand for a number of agricultural commodities and the systematic shifts in the structure of agriculture, the government, as it has for thousands of years, professed a concern for national food security (Central People's Government, China 2008). On the other hand, policy documents stated explicitly that the government intended the subsidies to help support agricultural incomes.

We find that agricultural subsidies in China are high on per unit of cultivated area basis. Moreover, almost all producers—grain and non-grain producers and the poor and the non-poor—receive the subsidies. The level of subsidies on per cultivated area basis is almost as high as in any other country in the world. However, subsidies are mostly being given to the land contractor (Huang et al. 2010). The tiller is not the target of the subsidies. And, most importantly (in part due to the way that subsidies are given), the subsidies appear to be non-distorting. We show that there is no evidence that grain and input subsidies are distorting producer decisions. We conclude that the income goals of the subsidy programme are taking on the most importance. 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 in subsidies, there is *no* evidence that China is *not* following through with their WTO promises in the area of subsidies since these are clearly non-distorting (green box type) policies.

### ***3.4.4 Investment in Conventional Agricultural Technologies and Biotechnology***

While decollectivisation 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, the evidence suggests that technological advances have been the main engine of productivity growth (Huang and Rozelle 1996).

China's system of agricultural research faced great challenges by the late 1980s and early 1990s (Rozelle et al. 1997). After the mid-1990s, investment in R&D began to rise. Investment in government-sponsored R&D increased by 5.5% annually between 1995 and 2000 and by over 15% per year after 2000 (Shi et al. 2008). During the past decade, the increases in investment in rural research and development have been the most rapid of any large nation.

China's investment in plant biotechnology reveals that it believes future productivity gains can come from new technologies from these investments. Since the middle 1990s, the growth of China's agricultural biotechnology research investment has accelerated. The investment increased from US\$ 33 million in 1995 to US\$ 104 million in 2000 and nearly US\$ 200 million (or 953 million donors in PPP) in 2003 (Huang et al. 2005).

Investment in agricultural biotechnology is expected to grow. In 2008, in addition to the current research programmes on agricultural biotechnology, the State Council approved a new and major 12-year 'Special Program' to support research on and the development of genetically modified (GM) crops and animals. The total budget was 26 billion Yuan (or US\$ 3.8 billion). Half this budget will come from the central government and the other half will be co-funding from industry and local governments.

China's GM crop commercialisation has been impressive. China had approved the commercialisation of GM cotton, petunia, tomato, sweet pepper, poplar trees and papaya before 2006, and approved the commercialisation of Bt rice and phytase maize in 2009. Bt cotton area reached 3.8 million ha in 2008. Recent approval of Bt rice and phytase maize for commercialisation is a milestone in China's GM technology development, moving China's GM crops from fibre to major feed and food crops, which is expected to have significant implications for GM technology in the rest of the world. As Bt rice and phytase maize still need to go through regional varietal demonstrations and registration in the coming years, it is expected that they will be cultivated for large-scale production within 3–4 years.

### ***3.4.5 The Emergence of Biofuels***

China was one of the countries that invested in biofuels heavily in the early periods. Four large-scale state-owned bioethanol plants were constructed in 2001. The bioethanol production capacity of these plants, which mainly use maize as feedstock, reached 1.5 million t. In 2007, China set up another bioethanol plant based on cassava. China became the third largest producer of ethanol in the world in 2007.

However, the national leaders quickly saw the trade-off between producing energy and food security. As soon as prices began to inch up in late 2007 and early 2008, China immediately put a moratorium on all biofuel plants that used food or feed crops as feedstock. This, of course, brought the growth of the industry to a rapid stop. In response, the pro-bioenergy lobby did not go away, but, instead put their efforts into finding nontraditional feedstock that would not compete with food and feed. In 2008, China produced about 1.35 million t of ethanol and 0.2 million t

of biodiesel. In the coming years, China plans on raising the target. Specifically, the government has announced a target for the biofuels industry. It wants to reach an annual production level of 10 million t of ethanol and 2 million t of biodiesel in 2020. By plan, the demand for feedstock crop will be met by cassava, jatropha, sweet sorghum and other crops that can be grown on marginal lands (Qiu et al. 2010).

While Qiu et al. (2010) have shown that China will be able to meet its biofuel production target in 2020, they are also careful to point out that the actual potential to expand beyond that is still tenuous. Several obstacles must be overcome before non-cereal-based and marginal land-based ethanol production can play a significant role in China's fuel supply. First, the cost to reclaim those marginal lands could be very high. Second, difficulties associated with collecting and transporting feedstock from the field to ethanol plants can be a big challenge. Third, the land quality of these marginal lands is much lower than that of cultivated lands, and the availability of water for these marginal lands is also a critical issue.

### **3.5 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 and the organisation of production, marketing, investments, technology and trade. One of the most important characteristics of agricultural reform in China is the pace of reform. The sequencing of agricultural reform policies followed the gradualism strategy of China's more general, economy-wide reforms. In the initial stages of reform, leaders consciously restricted the promotion of market-based economic activity. Not until 1985, after the completion of HRS, did policymakers begin to encourage market activity for 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 liberalisation 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 two distinct stages: the incentive reforms that dominate the period from 1978 to 1984; and a period of gradual market liberalisation that begins in 1985 and extends through the 1990s. In addition, outside of agriculture other rural- and urban-oriented policies and other factors affected the sector.

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 down prices and improved supplies of non-grain food and raw materials for industry. The mix of policies also has made producers more efficient and they have freed up labour and resources that are behind the structural transformation in the agricultural economy, specifically, and the rural economy, more generally.

The findings of the chapter are that although agriculture failed in the Socialist era 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 the 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 towards higher-value commodities in which China has a comparative advantage. The linkages between the rural and urban economies are also beginning to strengthen as more than 200 million people—in more than eight out of ten rural households—have found employment off the farm.

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 backwards. 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. Farm sizes need to grow. Groundwater needs to be managed. The new subsidy programme needs to be shaped and solidified, and made into an institution that will foster agricultural development, not retard it. China's position on international trade liberalisation needs to be clarified. Leaders have to make decisions on the commercialisation or the regulation of biotech and biofuels. There are many other challenges, too.

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