The Chinese Agriculture Miracle Revisited

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A large body of work has tried to attribute the remarkable growth of Chinese agriculture between 1979 and 1984 to the dismantling of collectives. This paper critically reviews the evidence and finds that decollectivisation did not contribute to agricultural growth in the early 1980s. In particular, its response to Lin (1992) challenges the consensus and argues that decollectivisation was largely irrelevant to the exceptional growth in this period. It is held that a more intensive application of modern inputs and favourable weather conditions accounted for most of the spurt in growth.

1 Introduction

It has been nearly 30 years since rural collectives were dismantled in the Chinese countryside (1979-84). The general consensus is decollectivisation was the major reason for China’s impressive performance in agriculture in the early 1980s. Though different studies have come to varying conclusions, most of them accept decollectivisation was the single most important reason for the high growth rate of agriculture.

However, Chinese agricultural productivity slowed down significantly after the process of decollectivisation. The transition from collective to household production took five years and by 1984, the household production system, which has stayed stable since then, was firmly established. Table 1 lists the growth rate of the yields of the three most important crops (grain, cotton and oil crops) in China, which constituted more than 80% of the total sown area in both the transition era and the stable household production era. For all three crops, the average growth rates in yield decreased dramatically after 1984. It is thus fair to conclude that agricultural performance in the stabilised household production period has been inferior to that in the transition years.

Table 1: Household Agriculture Before and After 1984

<table>
<thead>
<tr>
<th>Crop</th>
<th>Percentage of Total Sown Area</th>
<th>Yield Growth (in Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1970</td>
<td>1980</td>
</tr>
<tr>
<td>Grain</td>
<td>83.12</td>
<td>80.09</td>
</tr>
<tr>
<td>Oil crops</td>
<td>3.15</td>
<td>5.42</td>
</tr>
<tr>
<td>Total</td>
<td>89.75</td>
<td>88.87</td>
</tr>
</tbody>
</table>


Since the performance of the stabilised household production period has not been impressive, it raises the question of the real source of the Chinese agricultural miracle during the transition period. It is therefore time to revisit the causes of the remarkable growth in the early 1980s.

This paper provides a critical review of the historical process and earlier studies. It finds that decollectivisation did not have a significant impact on output, while more intensive application of modern inputs and other exogenous factors such as weather accounted for most of the growth in output. The organisation of the paper is as follows. Section 2 provides the historical background of the institutional and technological changes during the transition period, while earlier studies on the impact of decollectivisation are critically reviewed in
Section 3. In Section 4, the short-term effects of decollectivisation on agriculture are analysed, and Section 5 presents the concluding remarks.

2 Historical Overview of the Transition Period

The transition period was a complex historical process with very different forces operating at the same time. While it is not possible to cover all the facets of change during this interval, this overview offers an analysis of various factors from weather conditions to institutions.

2.1 Household Responsibility System

Before the reform, Chinese rural production and distribution were managed by production teams as the basic units under people's communes. In the early stage of reform, some management adjustments in the collectives were permitted but the collective framework was maintained and work management and income allocation were still determined by collectives. One of the popular steps was contracting small jobs to work groups or individuals with specific skills. Small job contracting per se was not new as it had been practised during the collective era, but under the new policy regime more economic incentives were involved. That was why this policy was called the “responsibility system” (zeren zhi) or more accurately the “performance-based compensation and responsibility system” (lianchan zeren zhi).

The initial reforms in the collective system proved to be minor compared to the decollectivisation of 1980-81 when collective-owned land was divided among rural households and production, distribution and related business became fully controlled by individual families. This new policy basically dissolved collectives and made households the basis of the new system of production from 1984. The decollectivisation reform was named “divide-all-up” (da bao gan), but later it was renamed the “household contract and performance-based compensation and responsibility system” (jiating lianchan chengbao zeren zhi) or in short the household responsibility system (HRS). The HRS expanded very fast (see column 1 in Table 2) – in 1980, only 14% of the production teams adopted the HRS; two years later, 80% of them did so.

2.2 Technology Diffusion and Conditions of Production

One of the remarkable features of the transition period was the intensive use of chemical inputs. Column 2 in Table 2 shows the volume of chemical fertilisers used in the years between 1970 and 1987. The application of fertilisers went up in the last few years of the collective system because production improved and this trend continued in the transition period when fertiliser application almost doubled in five years. Moreover, it has been noted that the Chinese agricultural system was severely nitrogen-constrained during the 1960s and 1970s and there was a significant improvement in the quality of fertilisers during the transition period because the large synthetic ammonia/urea complexes purchased in 1973-74 (during the collective era) went into production in the late 1970s (Stone 1988).

The green revolution began in China during the collective era and a nationwide agricultural research system, which was “highly developed, broadly-based, and sophisticated” (Stone 1988), was established in a short time. The spread of improved seeds (high-yield varieties) was particularly important to Chinese agricultural growth. As early as 1959, 80% of China's sown area was planted with improved varieties (Stone 1988), but seeds were continuously improved through the collective era. For example, hybrid rice, which was developed in the mid-1970s, was only gradually disseminated nationwide and this coincided with decollectivisation, as can be seen from column 3 in Table 2. Given that the collectives had been building water reservoirs and other rural infrastructure starting from the late 1950s, the dramatic increase in chemical fertiliser availability and improvements in its quality in the transition period compounded the advantages of hybrid varieties (Bramall 2000: 247).

Table 2: Conditions of Production: 1970-87

<table>
<thead>
<tr>
<th>Year</th>
<th>HRS Adoption</th>
<th>Chemical Fertiliser Application</th>
<th>Hybrid Rice Diffusion</th>
<th>Aggregate Machine Power</th>
<th>Weather Index</th>
<th>Multiple Cropping</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>0</td>
<td>3,512</td>
<td>21,653</td>
<td>-73.72</td>
<td>141.9</td>
<td></td>
</tr>
<tr>
<td>1971</td>
<td>0</td>
<td>3,647</td>
<td>NA</td>
<td>-294.1</td>
<td>144.7</td>
<td></td>
</tr>
<tr>
<td>1972</td>
<td>0</td>
<td>4,207</td>
<td>NA</td>
<td>21.67</td>
<td>147</td>
<td></td>
</tr>
<tr>
<td>1973</td>
<td>0</td>
<td>5,111</td>
<td>NA</td>
<td>21.53</td>
<td>148.2</td>
<td></td>
</tr>
<tr>
<td>1974</td>
<td>0</td>
<td>4,858</td>
<td>NA</td>
<td>23.01</td>
<td>148.7</td>
<td></td>
</tr>
<tr>
<td>1975</td>
<td>0</td>
<td>5,369</td>
<td>NA</td>
<td>-12.62</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>1976</td>
<td>0</td>
<td>5,828</td>
<td>NA</td>
<td>150.6</td>
<td>150.6</td>
<td></td>
</tr>
<tr>
<td>1977</td>
<td>0</td>
<td>6,480</td>
<td>NA</td>
<td>150.5</td>
<td>150.5</td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>0</td>
<td>8,840</td>
<td>12.6</td>
<td>17,149</td>
<td>53.61</td>
<td>151</td>
</tr>
<tr>
<td>1979</td>
<td>0.01</td>
<td>10,863</td>
<td>15.4</td>
<td>13,795</td>
<td>12.02</td>
<td>149.2</td>
</tr>
<tr>
<td>1980</td>
<td>0.14</td>
<td>12,694</td>
<td>14.2</td>
<td>14,745</td>
<td>47.4</td>
<td>147.4</td>
</tr>
<tr>
<td>1981</td>
<td>0.45</td>
<td>13,349</td>
<td>15.4</td>
<td>15,680</td>
<td>26.9</td>
<td>146.6</td>
</tr>
<tr>
<td>1982</td>
<td>0.8</td>
<td>15,134</td>
<td>16.8</td>
<td>16,614</td>
<td>7.4</td>
<td>146.7</td>
</tr>
<tr>
<td>1983</td>
<td>0.98</td>
<td>16,598</td>
<td>20.3</td>
<td>18,219</td>
<td>10.17</td>
<td>146.4</td>
</tr>
<tr>
<td>1984</td>
<td>0.99</td>
<td>17,398</td>
<td>26.7</td>
<td>19,972</td>
<td>2.69</td>
<td>146.9</td>
</tr>
<tr>
<td>1985</td>
<td>0.99</td>
<td>17,758</td>
<td>26.4</td>
<td>20,912</td>
<td>47.18</td>
<td>148.4</td>
</tr>
<tr>
<td>1986</td>
<td>0.99</td>
<td>19,360</td>
<td>28.3</td>
<td>22,950</td>
<td>53.46</td>
<td>150</td>
</tr>
<tr>
<td>1987</td>
<td>0.99</td>
<td>19,993</td>
<td>33</td>
<td>2,48,360</td>
<td>34.63</td>
<td>151.3</td>
</tr>
</tbody>
</table>

HRS adoption measures the year-end percentage of production teams which adopted the HRS; chemical fertiliser is in thousand tonnes; hybrid rice diffusion measures the percentage of total rice field which plant hybrid seeds; machine power is in thousand kilowatts. The weather index is a constant weighted sum of Shouzai and Chengzai areas, the version presented here is the yearly percentage deviation of each year’s index from 1952-84 mean, more details can be found in Kueh (1995).

Sources: Lin (1992) provides the data for columns 1 and 6; column 3 is from Stone (1988); column 5 from 1970 to 1984 is from Kueh (1995), the 1985-87 index is calculated based on Kueh’s method; columns 2 and 4 are from State Statistical Bureau (2005, Section 38).
It is well known that a significant determinant of agricultural output is weather. During the collective era, rural communities were able to construct numerous dams and water reservoirs to minimise the impact of bad weather. Nevertheless, weather changes did affect the performance of agriculture, particularly in the short run. A weather index measuring weather fluctuation between 1970 and 1987 is presented in column 5 in Table 2. The index was computed as the deviation from a long-term average; thus higher numbers represent dismal weather and vice versa. The indices suggest that quite favourable weather conditions prevailed from 1970 to 1975 and that was followed by a five-year period of bad weather. Between 1980 and 1984, natural disasters were relatively less frequent and less destructive, although from 1985 onwards the weather again worsened on a national level.

Finally, a commonly used relative labour intensity measure known as the multiple cropping index is listed in column 6 in Table 2. This index is calculated as the total sown area divided by the total cultivated land so that it captures the change in relative labour on a unit of farmland. It kept increasing in the collective era because increased irrigation and mechanisation allowed collectives to cultivate more intensively (for the pros and cons of increased intensity, see Huang 1990). According to many defenders of the HRS, peasants worked less hard under collectives because monitoring was difficult. However, the intensity of labour seems to suggest the opposite – the multiple cropping index decreased in the transition period, though it seems to have risen to previous levels after it.3

### 2.3 Procurement Adjustments

From the mid-1950s, China adopted a policy called “unified procurement and marketing” (tong gou tong xiao), which gave the government a monopoly of the agricultural market. All farm products were classified into three categories. The first, which was subject to compulsory purchase, included strategic goods such as grain, oil crops and cotton. For this category, a given production quota was purchased at a “procurement” price, and output above the quota was also compulsory purchased with a 20%-30% price premium introduced in 1972. The surplus product could be sold at a negotiated price that was mostly higher than the above-quota price (Zhong 2004).

Starting in 1979, there was a significant increase in the procurement price for the first category as well as for tobacco, live hogs and sugar crops. For instance, the procurement price of grain was increased by 20% and the price premium for above-quota output increased from 30% to 50% (Sicular 1988; Zhong 2004). There were further price increases for certain crops. At the same time, the compulsory quota was gradually reduced (see grain quota changes in column 1 in Table 3), which continuously increased average prices and profit margins. Two points need to be kept in mind regarding these procurement adjustments. First, if one does not consider the impact of the quota decrease on weighted price, it would seem that prices stagnated during the good harvests of 1983 and 1984 (Aubert 1990) when in fact the profit margin increased until 1984 (the average profit margins of the three main grain crops are listed in column 2 in Table 3). Second, the industrial input price also increased, so it gives a more balanced view to look at the index of ratio of above-quota price to industrial input price (column 3 in Table 3).

Some scholars also emphasise the function of re-established rural markets during the transition period. However, the overall impact of marketisation on agriculture during this period was small, as can be seen from the percentage of grains sold on the market in column 4 in Table 3. Therefore, the impact of rural marketisation is not considered in this study. It is not hard to understand the impact of price increase on peasants’ incentives. But the exact degree of the price increase is hard to measure because there were nationwide encouragement sales programmes throughout this period to give extra grains or fertilisers for above-quota deliveries (for example, see Table A1 in Siculir 1988), not to mention various local programmes of a similar kind.

In sum, the complicated conditions during the transition period have been briefly illustrated here. Some factors were counterproductive, while most of them seemed to favour growth. Before a detailed investigation of the short-term effects of the HRS during the transition, some earlier studies are discussed in the next section.

### 3 Literature Review

Most of the literature shares an unflinching faith in decollectivisation and the HRS (the two terms are used interchangeably in this study), while some more detailed and pragmatic studies cast serious doubts on the acclaimed advantages of the HRS. Among the pro-decollectivisation studies, Lin (1992) has been the single most widely cited work and its result was frequently used in government documents, although often referred to anonymously as “some research”. It is therefore necessary to pay particular attention to this paper and provide a critical assessment of its main findings.

#### 3.1 Pro-HRS Studies

There are mainly two types of studies in this category. The first focuses on total factor productivity (TFP) in China’s agricultural sector. Most of the results suggest that TFP increased during the transition period (Wen 1993; Fan and Zhang 2002)
although some acknowledge that TFP decreased in the stable HRS period (Kalirajan et al. 1996).

There are many ways to construct TFP (or its growth rate). For instance, it can be done by a simple growth accounting exercise that extracts the weighted sum of the growth rate of certain key inputs from the output growth rate to generate the TFP growth rate. Kalirajan et al. (1996) adopts a revised growth accounting method that differentiates technical efficiency and technical changes and directly derives TFP growth rates. One may simply divide the output by a weighted sum of input to generate a TFP index (Wen 1993). In other studies, the TFP index is calculated using more sophisticated methods such as the Divisia index and the Tornqvist-Theil index (Fan and Zhang 2002; Jin et al. 2002). In essence, TFP index construction tries to eliminate the contribution of inputs from output growth to get the portion that cannot be directly explained by all traditional inputs.

Leaving aside the problematic use of the TFP in the context of underemployment in agriculture, all these studies do not provide convincing arguments on the role of the HRS. First, in their results, the transition period has generally higher TFP (or TFP growth rate) compared to the collective era. Without analysing the existence of a causal relationship between HRS adoption and production, they explicitly or implicitly but hastily arrive at the conclusion that the HRS is superior, not even asking whether the HRS was an important factor at all. As the last section showed, there were many different forces in operation during the transition and these studies fail to provide a convincing argument for the superiority of the HRS. Second, in all these studies, post-1984 TFP figures tend to decrease (in the stable HRS period). However, they are not able to develop a consistent framework to explain this decline. For example, Kalirajan et al. (1996) tries to argue that a decrease in the real procurement price after 1984 partly explains production decline while they never mention the role of price increase in the transition period.

The second type of pro-decollectivisation studies directly tackles the role of HRS adoption in the transition period. They try to differentiate the effects of the HRS from other possible factors. Nevertheless, they also suffer from a number of serious defects, as can be seen in a typical study like McMillan et al. (1989). According to this paper, 22% of the increase in productivity in Chinese agriculture between 1978 and 1984 was due to higher prices and 78% to changes in the incentive scheme (HRS). There are two major problems in this analysis. First, the authors assume that the HRS reform took place uniformly and instantly after 1978 while in reality it took a while (as column 1 in Table 2 shows) and the adoption of the HRS varied across localities (the authors acknowledge this in the paper). So the increase in productivity after 1978 cannot be simply attributed to the HRS. Second, the authors assume that no technical progress occurred during the reform period, which is simply not true. As discussed in Section 2, there were several important technology changes (hybrid seeds and better fertilisers) during this period due to the collective era’s efforts. Needless to say, the results also depend on their model set-up, which brings another level of uncertainty into them.

3.2 Pragmatic Studies
There have been pragmatic-minded studies that try to debunk the myth of the HRS. Carolus (1992) concludes that the adoption of the HRS caused no more than 20% of the increase of total crop value if the most plausible set of inputs, crop mix and year-specific factors are accepted. She also points out that the effects of the HRS may vary with different pre-existing conditions. Her work provides a very wide range of effects of the HRS, so it is not able to give a clear assessment of the system. On the other hand, Riskin (1987) suggests that some of the increase in reported production represents production that already existed but was concealed before decollectivisation. Bramall (2000) doubts the fundamental validity of TFP calculations due to a lack of knowledge on exact labour time, organic fertilisers and draft animals.

Other scholars offer interesting case studies on the HRS. Han (2008) shows that Jimo county in Shandong province achieved remarkable development in the collective era but mechanisation decreased after decollectivisation (in some cases, peasants dismantled tractors and divided the metal) and irrigation also became a big problem. Several other works show that the HRS had little impact on the development of agriculture. Bramall (1995) carefully examines county-level data in Sichuan province, which was the model province for agrarian reforms for quite some time. He finds that counties that were not de-collectivised performed no worse in agricultural production than those that had already been de-collectivised. After the final implementation of the HRS, counties that adopted it did not have a surge in production. On the contrary, most of them experienced a decline in production. Putterman (1989) also finds that in Dahe county in Hebei province, grain yields rose during the 1970s while it stagnated during the transition period. A detailed study of Yangzi delta by Huang (1990: 222-51) highlights that de-collectivisation did not lead to an increase in productivity.

As many pragmatic studies show, the transition to the HRS in certain localities did not necessarily lead to a growth in productivity. This evidence strengthens suspicions about the role of de-collectivisation. But most of them do not provide a comprehensive examination of the nationwide transition, which is what this study tries to do.

3.3 Critical Assessment of Lin (1992)
In one of the most sophisticated studies on the impact of the HRS, Lin (1992) showed that almost half of the increase in output was due to the HRS reform. One of Lin’s main advantages was that he was able to get detailed provincial data for 28 provinces/districts during the 1970-87 period to form panel data, which was a much more fruitful approach than simply looking at the aggregated national production growth rate.

The core model in his paper is shown in Eq (1). It was a typical Cobb-Douglas production function with total real crop values as output and four input variables – land, labour,
power and chemical fertilisers. In addition, six ad hoc variables were included – the proportion of teams that had adopted the HRS at the end of the year (HRS); the index of market price relative to manufactured input price (MP); the index of above-quota prices relative to industrial input prices (GP, as in column 3 in Table 3); the percentage of sown area in non-grain crops (Ngca); the multiple cropping index (MCI); and a trend variable (T). Twenty-eight provincial dummies were included to account for unobserved soil, cultural, and political factors. Lin also built a two-way fixed effect model and included time dummies to capture year-specific factors such as weather and price changes. Both one-way and two-way fixed effect models are replicated in columns 1 and 2 in Table 4.

\[
\ln(Y_{i,t}) = \alpha_0 + \alpha_1 \ln\left(\text{Land}_{i,t}\right) + \alpha_2 \ln\left(\text{Labour}_{i,t}\right) + \alpha_3 \ln\left(\text{Power}_{i,t}\right) + \alpha_4 \ln\left(\text{Fert}_{i,t}\right) + \alpha_5 \ln\left(\text{MP}_{i,t}\right) + \alpha_6 \ln\left(\text{GP}_{i,t}\right) + \alpha_7 \ln\left(\text{Ngca}_{i,t}\right) + \alpha_8 \ln\left(\text{MCI}_{i,t}\right) + \alpha_9 \text{HRS}_{i,t} + \alpha_{10} T_{t} + \sum_{j=0}^{27} \alpha_{j+10} D_{j} + \varepsilon_{it} \quad (1)
\]

Note: \(Y\): crop output per team at constant 1980 price; Land: cultivated land per team; Labour: weighted labour force per team; Power: total power used (machines and draft animals); Fert: fertiliser application per team.

The most significant finding from both models was the significant positive impact of the HRS on the value of crop output. He went on to argue that from a growth accounting perspective, the HRS could account for more than 40% of the productivity increase in agriculture.

### Table 4: Estimation of Impacts of HRS

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Lin (1992) Replicated</th>
<th>Adjusted Models</th>
<th>Alternative Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>HRS adoption percentage (HRS)</td>
<td>0.19 (0.03)</td>
<td>0.15 (0.05)</td>
<td>0.06 (0.05)</td>
</tr>
<tr>
<td>Land (land)</td>
<td>0.65 (0.06)</td>
<td>0.58 (0.07)</td>
<td>0.69 (0.07)</td>
</tr>
<tr>
<td>Machine and animals power (power)</td>
<td>0.04 (0.04)</td>
<td>0.10 (0.04)</td>
<td>0.13 (0.05)</td>
</tr>
<tr>
<td>Labour (Labour)</td>
<td>0.14 (0.02)</td>
<td>0.15 (0.03)</td>
<td>0.13 (0.03)</td>
</tr>
<tr>
<td>Fertilise (fert)</td>
<td>0.18 (0.02)</td>
<td>0.17 (0.02)</td>
<td>0.15 (0.02)</td>
</tr>
<tr>
<td>Non-grain crops percentage (Ngca)</td>
<td>0.67 (0.23)</td>
<td>0.78 (0.22)</td>
<td>0.85 (0.23)</td>
</tr>
<tr>
<td>Multiple cropping index (MCI)</td>
<td>0.20 (0.08)</td>
<td>0.20 (0.08)</td>
<td>0.25 (0.09)</td>
</tr>
<tr>
<td>Markhit price/input price at time t-1 (MPlt-1)</td>
<td>0.02 (0.05)</td>
<td>0.03 (0.02)</td>
<td>0.001 (0.001)</td>
</tr>
<tr>
<td>Weather (W)</td>
<td>--0.3 (0.02)</td>
<td>--0.01 (0.01)</td>
<td>0.001 (0.001)</td>
</tr>
<tr>
<td>Time trend (T)</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Province dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year dummies</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>476</td>
<td>476</td>
<td>420</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.87</td>
<td>0.89</td>
<td>0.89</td>
</tr>
</tbody>
</table>

The numbers refer to the percentage of production teams that adopted HRS model.

The second problem is that the construction of the price index does not fully capture the change in peasants’ actual profitability/incentive change (as Table 3 shows). From 1981 to 1984, the index of above-quota prices relative to industrial input prices goes down, while in fact the profit margin went up. This could partly explain why prices only had negligible roles in Lin’s results, which is contrary to theory as well as common sense.

The third problem is that some important information is not included such as weather changes. As one can see from this discussion, weather conditions were better and better during...
the transition period. It could be possible that this favourable weather change contributed to production. No such experiments were explicitly carried out in Lin’s paper although the two-way fixed effect model might be able to capture the weather changes.

To briefly sum up, Lin (1992) suffers from a number of problems, which undermine his results. To examine the role of the HRS after adjusting for these problems, a more detailed short-term analysis is carried out in the next section.

4 Estimating the Real Effect of HRS

In this section, we try to estimate the real effect of the HRS by adjusting Lin’s model in the light of the critiques above. Before the empirical analysis, the above points need to be operationalised.

First, as this study argues, before any detailed data illustrating the actual HRS adoption rate before yearly production began became available, it seems to be more appropriate to use a one-period lagged value of the HRS. This way all the production progress attributed to the HRS in the model would be justified. Second, the two-way fixed effect model seems to be the more reliable specification and it will therefore continue to be used in this study. This also implies that the problematic price index used by Lin will not be a problem here because it will be dropped and the price effects will be captured by year dummies. Third, weather conditions (data is from Table 2) will be added to the model to see if the year dummies can fully capture its effects. The basic model is shown in Eq (2) as a two-way fixed effect model with almost the same variables as Lin used (see last section for variable explanation).

\[ \ln(Y_{i,t}) = \alpha_0 + \alpha_1 \ln(Land_{i,t}) + \alpha_2 \ln(Labour_{i,t}) + \alpha_3 \ln(\text{Power}_{i,t}) + \alpha_4 \ln(\text{Fert}_{i,t}) + \alpha_5 \ln(\text{Ngcai}_{i,t}) + \alpha_6 \ln(\text{MCI}_{i,t}) + \alpha_7 \text{HRS}_{i,t} + a_{i,t} + \sum_{j=0}^{2} a_j T_j + \sum_{k=0}^{2} a_k T_k + \epsilon_{i,t}, \]

The results are illustrated in columns 5 and 6 in Table 4; the first model does not take weather into consideration whereas the second does. As both models suggest, the strong impact of the first model does not take weather into consideration whereas the second model seems to be more appropriate to use. The models also generate the same variables as Lin used (see last section for variable explanation).

\[ \ln(Power_{i,t}) + \]

As a robustness check, other specifications were also considered and their results are shown in columns 7 and 8 in Table 4. The first one uses the level of Y, Land, Labour, Power and Fert instead of their log values; and the second one transforms the level values of the five basic variables into year-to-year growth rate. Although the coefficients on other variables change considerably, the role of the HRS remains negligible and it even emerges with a negative sign in the last specification. If the more plausible results from columns 5 and 6 in Table 4 are accepted, then the output changes seems to be determined mainly by input usage changes along with changes in cropping patterns, cropping intensity and other year-specific factors such as price adjustment and weather changes. Most importantly, the HRS reform does not have any statistically significant effect on the output.

Are our results robust? In particular, we are interested in the effect of the HRS if part of the end-of-year HRS did have some impact on that year’s productivity. In other words, if Lin (1992) showed the most favourable case of the HRS, the above exercises illustrate a not-so-favourable scenario. But in case the true scenario was between the two extremes, some sensitivity test is needed to better understand the role of the HRS. Eleven alternative HRS measures are constructed as weighted averages of consecutive years’ HRS values. The first HRS (hrs 0) measure is the same as Lin (1992), which assigns zero weight for the previous year’s HRS. The weight for the previous year’s HRS increases 10% each time and the last measure (hrs 10) is just the same with one year lagged HRS.

The results are presented in Table 6, which singles out the coefficients and T values of the HRS measure. As the weight for the previous year’s HRS increases, which implies more decollectivisation took place in the latter half of the year, the effect of the HRS decreases steadily. From hrs 5, which means the process of decollectivisation distributed equally between the first and second half of the year, the HRS ceases to be significant statistically. Given our previous discussions on the pace of decollectivisation in China, it is more plausible to assume that more than half the production teams adapted the HRS in the second half of a given year, which in turn suggests that it is more likely that the HRS did not contribute significantly to productivity changes. The sensitivity test adds more confidence to our conclusion.

4.1 Further Discussions on Empirical Results

It is shown that the HRS did not directly have any significant impact on productivity. But one may raise the concern that the HRS could have had some unobservable influence on the use of major inputs and indirectly contributed to the output. Some discussions are presented below to address the concern.

Besides input changes, other factors in the model were also likely to have contributed to the output. But either they had negligible changes during the transition period (for example, mci decreased 0.3% during 1980-84 based on Table 2) or it is hard to single out their effects (for example, the effects of favourable weather are captured by the year dummies together with other possible year-specific factors like price changes). However, there are good reasons to not to worry about these. First, weather and price changes were simply not casually related to the HRS; and second, factors such as the declining mci are not likely to suggest any positive impact of the HRS. Therefore, the remaining issue is to discuss whether changes in the major four inputs – land, labour,
power and chemical fertilisers – were partly affected by the HRS reform.

First, the area of cultivated land began to decrease after the 1970s. It decreased by only 0.2% between 1975 and 1979, then shrank by 1.5% between 1980 and 1984 at a time the multiple cropping index was also declining (Table 2). This means the total sown area decreased even more during the early 1980s. Therefore, changing land usage did not contribute to the dramatic growth in output in the transition period. It is hard to find any positive role of the HRS reform in land input changes though it might be argued that the HRS reform, which began nationwide in 1980, actually contributed to an accelerated decline in cultivated land. In other words, it dampened agricultural production.

Second, the total labour input in agriculture, as we discussed, is hard to measure given that no specific data on the labour force in the crop sector is available and the prevailing underemployment in the countryside. The coefficient of labour variable in the regression only gives us some crude evidence on the impact of labour usage changes. If we adopt Lin’s methodology of calculating the crop labour force as the total labour force in the agricultural sector times the value share of the crop sector in the total agricultural output, the change in the crop sector labour force would be negligible. The annual growth rate was 0.5% between 1978 and 1980 and 0.9% between 1980 and 1984. If we look at the total labour force in agriculture as a proxy for the crop sector labour force, the annual growth rate was 2.3% between 1978 and 1980 and 1.5% between 1980 and 1984. Given that the cropping intensity (MCI) was declining during the period, we might guess the actual labour input more or less stayed the same. Again, there is no clear link between the HRS reform in the early 1980s and the labour input changes.

Third, both machine power input and chemical fertiliser input changed a lot during the transition period and contributed greatly to the output. But a closer look would reveal that both of them started to take off long before the HRS reform. As Table 2 shows, during the five years before the HRS reform (1976-80), the use of machine power increased by 71% and the use of chemical fertilisers increased by 118%. This dramatic increase continued in the 1980s. During the initial five-year period in the HRS reform (1980-84), the use of machine power increased by 32% and the use of chemical fertilisers by 37%. It is more than clear that China was experiencing rapid industrialisation and green revolution all through the 1970s and early 1980s and that the increased use of machine power and fertilisers showed nothing more than the achievements of the socialist period.

Finally, some special attention must be paid to the fertiliser factor as it was also considered in Lin (1992) as the single most important input factor in output growth. There have been studies pointing out that there were two main unobservable benefits with chemical fertilisers in China. First, the quality and quantity of fertilisers improved dramatically in the late 1970s because of large investments in the collective era (Stone 1988). Second, high-yield hybrid crops began to be introduced in the late 1970s (which were also developed under the collective regime), which compounded the effects of fertilisers and water conservation (Bramall 2000: 247). Therefore, the huge impact of fertilisers from the regression exercise actually reflects these two important factors.

There are more historical factors, both supply and demand side, that need to be explained with regard to the increasing use of fertilisers. From the supply side, as previous studies argue, China’s agriculture had always been severely fertiliser-constrained until the late 1970s when earlier chemical investments began to run properly (Stone 1988). It would be hard to argue that people’s incentives to use fertilisers increased during decollectivisation; it simply became more available. From the demand side, the state made adjustments to quota procurements in 1979, which increased the profit margins of the peasants (Table 3), contributing to their ability to purchase fertilisers.

As this discussion shows, it is hard to connect the HRS reform to any of the important input changes. Moreover, it is more than clear that the dramatic input changes in the transition period were an endogenous result from pre-existing institutions. It was the remarkable development of the socialist economy in the former period that built the conditions for the dramatic growth in output. To sum up, the legacy of socialist agriculture, rather than the HRS reform, accounted for the most important part of the success of the transition period.

5 Concluding Remarks

This study attempted to investigate the sources of the Chinese agricultural miracle in the early 1980s. The historical process of the HRS reform is described in detail and the previous literature related to the HRS is critically examined. In particular, Lin’s 1992 results are critically evaluated and it is shown that the HRS reform was likely to have had a statistically negligible impact on agriculture production. Increasing inputs and favourable year-specific factors such as weather changes were much more responsible for the Chinese agricultural miracle. This study’s main limitation is that it does not show the impact of decollectivisation in the long run. It might be argued that the HRS as an institution might be beneficial for long-term agricultural performance. Nevertheless, the consensus over the superiority of the HRS in the short-term has been seriously challenged and it suggests that more efforts should be spent in understanding both the short-term and long-term effects of institutional changes in modern China.
Notes
1. Officially the land was contracted to househods for 15 years, but the contract was extended again and again, and in de facto terms the land was privatized with a temporary but highly regulated land market.
2. Take rural water-electricity stations for example, the total capacity increased from 20,000 kilowatts in 1957 to 2.28 million kilowatts in 1978 (Ministry of Agriculture 2009: 7).
3. Based on later years’ data from Ministry of Agriculture (2009: 6, 17), the cropping index was 1.55 in 1990 and 1.58 in 1994. After 1994, the size of cultivated land was adjusted to increase, therefore, the index structurally went down. In 2008, it was 1.28.
4. Chapter 7 in Putterman (1993) provides a detailed explanation and comparisons among this type of work.
5. Interestingly, the reason they provided for not considering technical progress was because “Chinese agriculture had already attained a technically advanced state before the period examined here”.
6. As a matter of fact, there are numerous non-academic articles in China these days that critique the HRS myth.
8. The appendix to Lin (1992) gives a detailed explanation on the sources of these data.
9. The national price ratio index variables are kept increasing before 1980 and began declining after that year (Bi and Zheng 2000).

References