Chapter 4
Examination of Collective Farming from Production Cost Survey

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Abstract This chapter examines the profit structures of farm management under the People's Commune by using a production cost survey and re-calculated the amount of net revenue utilizing our hypothetical wage for agricultural labor. The estimated results showed that the levels of hypothetical wages were consistently lower than those of official standard wage for major crops. Moreover, the amount of net revenue for major crops by use of the hypothetical wage recorded consistent surplus during the Mao era. These results suggested that production teams generated positive revenues from agricultural production and the surpluses were siphoned off through higher-level organizations such as brigades and communes to urban areas.

Introduction

The People's Commune was the most powerful and influential administrative and socioeconomic organization in rural China during the Mao era. Collective farming under People's Commune formulated the structure of agricultural production and marketing in China. Therefore, to evaluate the efficiency of agriculture during the Mao era, it is essential to examine the functions of the People's Commune as a principal entity of agricultural production as well as an important player in agricultural marketing.

In the context of agricultural organization, land-owned farm households, which were created as a result of land reform in the 1940s and the early 1950s, were forced to undergo a fundamental change by the radical agricultural collectivization movement that began in the mid-1950s. During this movement, all farmers and rural residents were forcibly absorbed into rural cooperatives and were obliged to join the People's Commune. It encompassed a vast range of rural activities, including industry, agriculture, commerce, schools, and the militia, as well as the administrative functions of the township government to control all aspects of rural society.

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Simultaneously, the Chinese government implemented strict controls over agricultural marketing in 1953. The system was called the "unified purchase and unified supply system" (*tonggou tongxiao*), and free market transactions of agricultural products were strictly restricted since the mid-1950s. Under this system, government departments monopolized the procurement of agricultural products, mainly grain, from agricultural producers at official prices and distributed these to urban residents.[1] The People's Commune and this marketing system worked closely together to form a mechanism by which the government directly controlled all aspects of agriculture and the rural economy.

Until the early 1980s, there were few academic studies on People's Commune. This is mainly because the Chinese government severely restricted both domestic and foreign academic field surveys to investigate real situations in rural China, and maintained tight control over information on the rural economy for political purposes. However, since the 1980s, field surveys and academic research on rural China have been officially permitted, and academic literature on the examination of the people's commune has begun to develop considerably (Tajima, 1996). The representative literature that focuses on People's Commune is Putterman (1989), Putterman (1993), Cao et al. (1995), Zhang (1998), Zhang (2007), Huang (2011), and Huang and Zhang (2016). These micro level studies have revealed the practical administration of labor allocation and its reward, social functions as a rural community, and the intermediate role of capital transfer from rural to urban areas during the prevalence of People's Commune.

However, macro-level analysis of agricultural production and its marketing during the Mao era has received less attention from academic researchers. Hence, some aggregated statistical data have not been fully utilized despite their importance. One of these is the production cost survey of agricultural products (published as *the Compilation of Production Cost Data on Agricultural Products*), which started in 1953 and continues to date. The survey was suspended during the period of the Cultural Revolution, and the survey design has also changed over time. Until the early 1990s, detailed summary data from this survey were treated as internal documents and only selected summary data were disclosed and utilized in statistical analysis and research articles. The survey includes information on production costs for major grains (rice, wheat, and corn), major crops (e.g., cotton, tobacco, and oilseed rape), and livestock products (pig and poultry farming). Thus, it is useful for understanding the actual status of agricultural activities during this period.

Han and Feng (eds.) (1992) was probably one of the earliest studies to conduct a systematic analysis of agricultural management and marketing using survey data. Some Japanese researchers, such as Nakagane (1992) and Matsumura (2011), also utilized the survey data to examine agricultural management in the 1960s and the 1970s. These macro-level studies complement micro-level analyses to examine the efficiency of collective farming under the People's Commune, contributing to an accurate re-evaluation of development policies during the Mao era.

Considering the importance of collective farming in rural society and the economy, this chapter aims to elucidate the characteristics of agricultural management and calculate the amount of economic surplus under People's Commune based on a production cost survey. More specifically, we utilize the data of commodity-specific production cost to decompose agricultural income into yield and margin and clarify the determinants of its variation. Furthermore, by calibrating the hypothetical wages of farm labor, we measure the labor remuneration that could be distributed to agricultural workers and estimate the amount of agricultural surplus. These analyses would enable us to provide new macroeconomic insights into collective farming and people's lives.

The remainder of this chapter proceeds as follows. Section 4.1 outlines the characteristics of agricultural production and its management under People's Commune and examines the living conditions of rural people on a statistical basis. Section 4.2 explains the design of the production cost survey and summarizes the characteristics of agricultural management. Section 4.3 describes the factor decomposition of agricultural net revenue into yield, margin, and cross term and examines the amount of agricultural surplus under the hypothetical wage. The final section concludes the discussion and explains the remaining issues to be addressed.

4.1 Agricultural Organization and Marketing System During the Mao Era

4.1.1 Agricultural Marketing Under the "Unified Purchase and Unified Supply System"

In examining agricultural management under People's Commune, it is necessary to summarize the structure of the agricultural marketing system at that time. After the establishment of the People's Republic of China (PRC) in 1949, the total amount of grain production steadily increased until the mid-1950s but the amount of commercial grains available for urban residents was still insufficient due to rapid urbanization and industrialization, causing frequent hikes of grain prices in urban areas (Sun, 1991).

To ensure an equitable and efficient distribution of grains among urban consumers, the Chinese government formally introduced the "unified purchase and unified supply system" in 1953, which gave state agencies a monopoly in grain procurement and distribution. Under the system, a delivery quota, known as "fixed quota for purchasing" (*dinggou*), was assigned to each individual farmer (later to each production team) specifying the amount of grain and the official fixed price. Meanwhile, grain coupons were allocated to urban residents at a low price for use only in state grain shops, food stores, and restaurants. Oil crops and cotton were also included in this monopolistic marketing system (Zhong, 2004). All shops and factories that were involved in the distribution or processing of grain, including public–private joint

capital, were under the control of the state grain department and prohibited from engaging in independent activities (Ikegami, 1989; Zhou, 2000).

In addition, the "purchase by state quota system" (*paigou*) was introduced at the end of 1955, and the more than 100 items of major agricultural produce (e.g., pork, major fruits, marine products, vegetables, tea, hemp, cocoons, and sugar cane) were administratively controlled. Under the state quota system, the government determined the items, quantities, and prices of the purchased crops and allocated a specified quota to peasants and producers to supply their products to the state. The remainders of the agricultural products after fulfillment of their quotas were allowed to be shipped to the market for sale (Zhou, 2000).

The intensification of direct control over agricultural products was closely related to the substantial increase in population and stagnation in grain supply per capita. Grain production experienced a significant decline during the Great Leap Forward (GLF) and recovered in the mid-1960s. Meanwhile, China's population growth rate also remained high. Thus, grain production per capita did not exceed the level existing in the mid-1950s, throughout the Mao era. More specifically, the amount of grain production per capita exceeded 300 kg for the first time in the mid-1950s and remained at this level thereafter, but fell to around 200 kg during the GLF. Although the amount of grain production per capita recovered to 287 kg in 1966, growth remained stagnated until 1974, when the grain production per capita exceeded 300 kg.[2] Therefore, it appears that the major purpose of implementing a monopolistic marketing system was to maintain a steady food delivery to urban residents at the cost of rural people.

The changes in the official procurement price and retail price (rationing price) for major grains are summarized in Fig. 4.1. These prices are the weighted averages of six items from 1950 to 1984 and four items from 1985 to 1988.[3] From the early 1950s to the GLF, the retail price of grain was set about 40 to 60% higher than the procurement price from farmers. Therefore, the government was able to obtain a positive margin from transactions (Zhou, 2000). However, reflecting the serious reduction in agricultural production during the GLF, the government decided to increase the procurement price of grain by 24.6% and 16.1% in 1961 and 1966, respectively.

Meanwhile, the retail price of grain was slightly raised by 7–8% in 1965–1966 and was preserved at almost the same level throughout the Mao era. As a result, the margin between retail and purchase prices was considerably diminished, accounting for only 11–14% from 1960 to 1978. Considering the transaction costs involving grain procurement and its distribution, China experienced substantial losses from the transaction.[4] Under the direct control of agricultural marketing, urban residents were able to enjoy relatively cheap food, but the system was sustained with the help of tremendous policy interventions. It also imposed a financial burden on agricultural production and marketing.

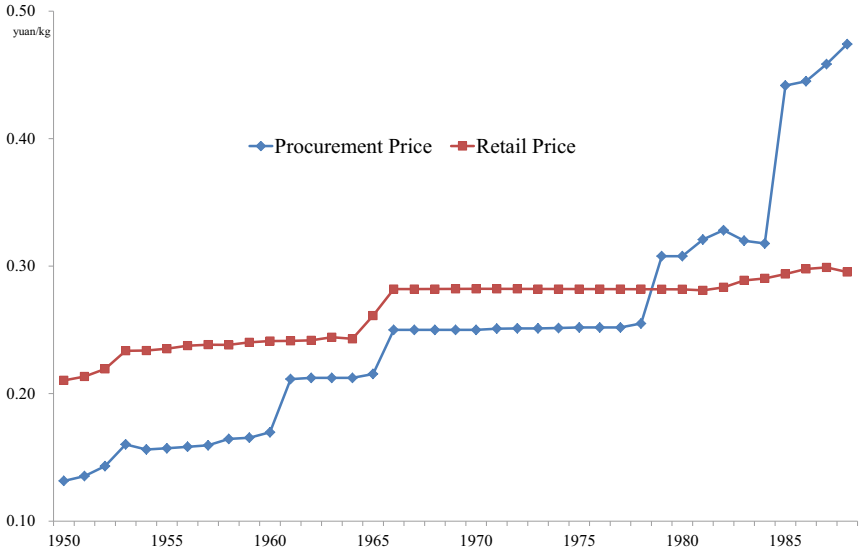

Fig. 4.1 Changes in procurement and retail prices for major grains. *Source* Author's Estimation based on Han and Feng (eds.) (1992).

Notes

1. The procurement prices are calculated based on the weighted average of the current year's volume of procurement for six items (wheat, rice (unhulled), millet (unhulled), corn, kaoliang, and soybeans) during 1950–1984 and the weighted average of the current year's volume of government purchase for four items (wheat, rice (unhulled), corn, and soybeans) during 1985–1988.
2. The retail prices are calculated based on the weighted average of the five-year retail volume for six items (flour, rice, millet, corn, kaoliang, and soybeans) during 1950–1984, and the weighted average of the current year's retail volume of four items (flour, rice, corn, and soybeans) during 1985–1988.
3. The conversion rate from "raw grain" to "trade grain" is set to 0.844

4.1.2 Production Team as an Independent Profit-Accounting Unit

Meanwhile, the modifications of agricultural institutions were substantially implemented according to changes in the political atmosphere since the mid-1950s, and the institutions experienced several twists and turns. This subsection focuses on the period after the 1960s when the normalization of People's Commune was advanced. We summarize the characteristics of the three-tier structure of People's Commune (commune, brigade, and production team).

At the Party Congress held in September 1962, the "Regulation on the Rural People's Commune (Revised Draft)" (commonly referred to as "Article 60 on Agriculture") was adopted and referred to as the basic legal rule for People's Commune. In Article 60, the production team was defined not only as an organization of the rural labor force but also as the basic profit-accounting unit of the People's Commune,

which owned the means of production. The production team was also directly responsible for preparing specific cultivation plans and determining the method of profit distribution. Article 60 also stipulated that the production team would collectively own the land and have decision-making power over production and residual distribution. The brigade above the production team would own and manage relatively large capital equipment such as irrigation systems and tractors. One production team comprised approximately 20–30 farmers, and one brigade consisted of approximately 10 production teams. Moreover, the Party branch was supposed to be established at every brigade to enforce orders from the Chinese Communist Party (CCP). One commune was made up of approximately 10 brigades, and the coverage of the commune normally corresponded to the township government.

In addition, the production team was obliged to pay agricultural taxes and submit specific volumes of grain, cotton, oilseed rape, and other products to state agencies to achieve production plans. The production team received various instructions from the brigade and commune. It also ensured employment and food distribution for their team members. All production teams had to withhold a certain amount of revenue or food under the pretext of common accumulation fund, common welfare fund, and emergency food stock at the end of the fiscal year.[5] Meanwhile, members of the production team were allocated private plots for their own use, and the total size of these plots was less than 5% of the total size of farmland in the region (Sun, 1991; Yan, 2002).

The efforts of agricultural workers in collective farming were evaluated as work points in the production team. The maximum value of the daily work point was set at 10 points, and the actual value allocated to workers was adjusted according to the quality of their labor as well as the type of work. The unit price of work points was the amount of total disposable revenue divided by the total number of work points distributed to the workers. However, it was considerably difficult for team leaders to properly monitor the practical contributions of each worker because the farming workplace was geographically dispersed and its outcome was influenced by weather conditions. Furthermore, it involved considerable difficulties in fairly and precisely evaluating the contents of each work and its labor intensities. Therefore, in practice, a simple method was widely adopted to evaluate work points. Specific and normalized points were given according to gender, age, and burden of labor, such as 5 points for men's half-day labor and women's full-day work (Huang, 2011; Shimakura, 1980).

The difficulty in strictly assessing labor contributions and the convenient allocation of work points caused a serious deterioration in work motivation for farmers. This evaluation system induced farmers to eagerly engage in sideline jobs using their own plots and housing. Sideline jobs included animal husbandry, fruit and vegetable cultivation, weaving, basket making, sewing, and embroidery services. During the GLF and the Cultural Revolution, sideline jobs were severely criticized as "tails of capitalism." The farmers were discouraged to engage in these jobs during the period. However, income from these sideline jobs was indispensable for rural residents to maintain their livelihoods throughout the Mao era, accounting for more than 30% of their income (Hamaguchi, 2019; Sun, 1991).[6]

Alternatively, the mechanization of agriculture was supposed to facilitate economies of scale and improve the efficiency of collective farming. However, the introduction of agricultural machines, especially combine harvesters and rice planters, did not advance during the Mao era. Hence, collective farming continued to adopt labor-intensive technology utilizing manual labor. This was mainly because fiscal support from central and local governments was considerably deficient and geographic conditions severely restricted the adoption of farm machinery. This labor-intensive approach was also utilized for the formation of fixed capital, such as irrigation construction and land improvement (Tajima, 1989).

At the field level, collective farming was mainly conducted under the direction of the production team leaders. Severe comments and complaints of farmers concerning collective farming were generally directed to their leaders. Hence, the leaders were always caught in a dilemma between orders from upper organizations and demands from their team members, leaving them in a difficult position. In addition, team leaders needed to exert strong leadership in motivating rural workers (Hamaguchi, 2019; Kobayashi, 1997; Tahara, 2008). However, it was difficult for the CCP to prepare a large number of capable leaders in all rural regions, resulting in weak and insufficient cohesion of production team management (Nakagane, 1992).

4.1.3 Food Expenditure of Urban and Rural Residents

To depict the standard of living of Chinese people during the Mao era, the changes in Engel's coefficients for urban and rural households are summarized in Fig. 4.2. Because political turmoil interrupted official statistical activities including household survey, several discontinuities in Engel's coefficients are observed in the figure. As shown in Fig. 4.2, Engel's coefficients were considerably high during the early 1950s through the mid-1960s, accounting for 58.4% (urban) and 68.6% (rural) in 1954 and 59.2% (urban) and 67.1% (rural) in 1964. Compared with the Engel's coefficients (35–40%) of non-farm Japanese households in the 1960s (high economic growth period), it is apparent that the Engel's coefficients of China during the Mao era were remarkably high.[7]

Due to the interruption of the household survey, the trend of Engel's coefficients during the Cultural Revolution could not be identified. However, considering the levels of the Engel's coefficients in 1978, which accounted for 57.5% of urban households and 67.7% of rural households, no remarkable gap was observed before or after the Cultural Revolution. Therefore, it can be inferred that food consumption was the most important expenditure for both urban and rural households throughout the Mao era, and the provision of sufficient and cheap food to the people was one of the most important policy duties for the Chinese government.

To examine the living standards of rural households in detail, Fig. 4.3 summarizes the changes in the amount of per capita annual income and grain consumption from the mid-1950s to the mid-1980s. As shown in the figure, the income (nominal) increased from approximately 70 yuan in the mid-1950s to 100 yuan in the early

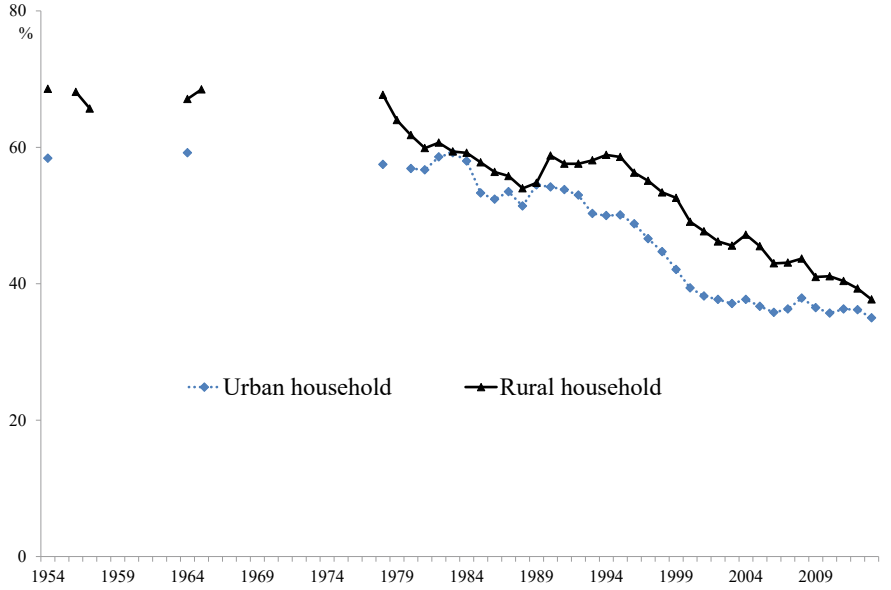

Fig. 4.2 Engel's coefficients for urban and rural households. *Source* Guojia Tongjiju Guomin Jingji Zonghe Tongjisi (ed.) (2010) and *Zhongguo Tongji Nianjian* (China Statistical Yearbook) (various issues).
Note Food consumption in the rural household survey includes self-consumption. The amount of eating-out is not included in the food consumption for both urban and rural household surveys

1960s. However, the amount remained at almost the same level in 1976 and 1977, accounting for approximately 115 yuan. Meanwhile, the amount of per capita grain consumption ranged from 230 to 250 kg in the mid-1950s and deteriorated to 210 kg in the early 1960s. In the late 1970s, the amount of grain consumed recovered to the mid-1950s level. From the rural household survey, almost the same trend can be observed for other major foods such as oilseed, meat, and eggs, suggesting a severe livelihood in rural China during the Mao era.

Comparing per capita income before and after the late 1970s in Fig. 4.3, we notice that the nominal per capita income (nominal) exhibited a substantial and rapid increase from 160 yuan in 1979 to 270 yuan in 1982 and further to 398 yuan in 1985. By contrast, the amount of grain consumption stagnated at around 260 kg from the late 1970s to 1985. However, it should be noted that the composition of grain consumption changed drastically during this period. More specifically, as shown in the line graph in Fig. 4.3, the percentage share of fine-grain consumption, including rice and wheat, steadily increased from 50% in the late 1970s to more than 80% in the mid-1980s. These results indicate that rural residents were able to enjoy more fine grains while reducing the amount of coarse grains (e.g., corn, millet and sorghum). The improvements in food consumption of rural households can be observed not

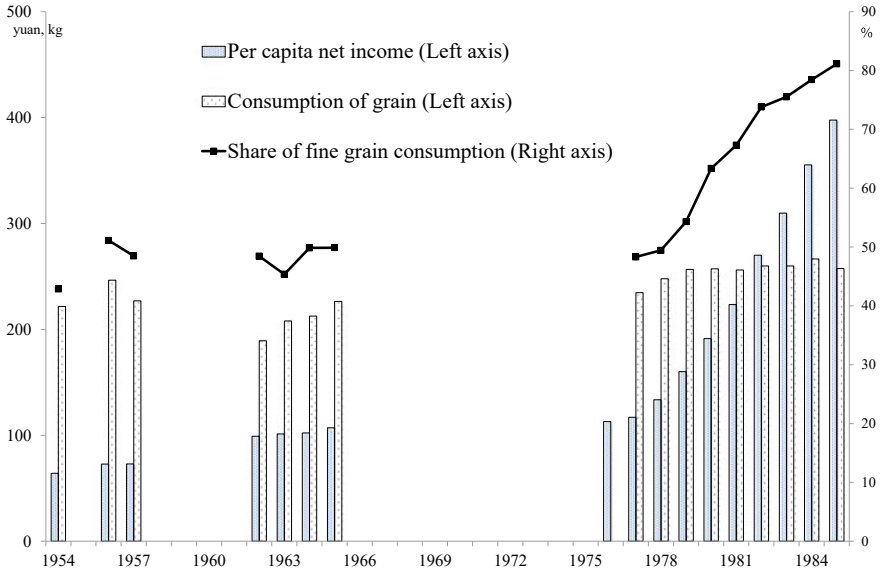

Fig. 4.3 Per capita income and grain consumption of rural residents. *Source* Guojia Tongjiju Nongcun Shehui Jingji Diaochasi (various issues) and *Zhongguo Tongji Nianjian* (China Statistical Yearbook) (various issues)

only for staple food, but also for other food such as vegetables, oilseeds, meat, eggs, and dairy products since the early 1980s as indicated by the rural household survey.

4.2 Characteristics of Collective Farming from Production Cost Survey

4.2.1 Overview of Production Cost Survey

Based on an examination of the institutional features of agriculture, this section utilizes a production cost survey to examine the actual situation of agricultural management during the Mao era from a macroeconomic viewpoint.

The varieties of crop included in the production cost survey (1953–1978) were rice (early indica rice, late indica rice, japonica rice, and the average of three varieties of rice), wheat, corn, soybeans, cotton, tobacco, peanut, oilseed rape, and sugar cane. Average data for major grains (rice, wheat, and corn) and major oilseeds (peanut and oilseed rape) were also reported in this survey. However, because of mismanagement of the original datasheets, there were several missing data points in this survey. Specifically, only the national average data were reported (no province-level data) for 1953–1965, and the breakdown data of material costs for some regions were missing

for 1975–1978, causing several inconsistencies between the national average and the sum of material costs. For these reasons, we utilize national average data for the examinations.

The survey's production data consisted of the volume and value of the main products and their by-products, and the average price of sales data is also included in the survey. Meanwhile, production costs can be disaggregated into material input expenditures, labor costs, and taxes. The material input expenditure consists of direct costs (seeds, fertilizers (farmyard manure and chemical fertilizer), pesticides, agricultural plastic, livestock, machinery, irrigation, fuel, and power) and indirect costs (depreciation of assets, repair of small farm machinery, administrative costs, and marketing costs). Labor cost was calculated by multiplying the average number of working days for each crop by the "standard wage" per day (explained later), and tax expenditure is aggregated in total, with no breakdown data.

Two types of crop-specific revenue indicators were presented in this survey: "net output value" (*xianjin shouyi*) and "net revenue" (*jing lirun*). The net output value denotes the total value of production minus material input expenditure, and net revenue denotes the net output value minus labor costs and taxes. Although land rent fees and imputed values of self-cultivated land should be included in the standard production cost survey, these items were not surveyed or reported until 2004. Therefore, the impact of land rental fees on collective farming cannot be examined in this study.[8]

4.2.2 Factor Decomposition of Agricultural Income

To identify the determinants of net output value (or net revenue), we decomposed it into land productivity and profitability. More specifically, we denote the amount of net output value (or net revenue) as π, the size of cultivated farmland as T, the amount of production volume and its sales price as Y and p, respectively, and the production cost as c. Net output value or net revenue per cultivated farmland can be decomposed into the following:

$$\frac{\pi}{T} = \frac{(pY - c)}{T} = \frac{Y}{T}\left(p - \frac{c}{Y}\right) = \text{yield} \times \text{margin} \tag{4.1}$$

The net output value per cultivated farmland can be divided into the product of yield (Y/T) and margin (the gap between the sales price and unit production cost). Furthermore, when Eq. (4.1) is fully differentiated for time and divided by the net output value (or net revenue) per farmland, the following equation can be derived:

$$\begin{aligned}\Delta\left(\frac{\pi}{T}\right)\Big/\left(\frac{\pi}{T}\right) = \Delta\left(\frac{Y}{T}\right)\Big/\left(\frac{Y}{T}\right) + \Delta\left(p - \frac{c}{Y}\right)\Big/\left(p - \frac{c}{Y}\right) \\ + \Delta\left(\frac{Y}{T}\right) * \Delta\left(p - \frac{c}{Y}\right)\Big/\left(\frac{\pi}{T}\right)\end{aligned} \tag{4.2}$$

Equation (4.2) indicates that the rate of change in net output value per cultivated farmland can be decomposed into three parts: the percentage change in yield, the percentage change in margin, and cross term between percentage changes in yield and margin. In decomposing the amount of net revenue, it is necessary to carefully treat the composition of costs, especially labor costs. It should be noted that the wage level of the production cost survey was not evaluated based on field survey but utilized specific wage level (the "standard wage"), which was set at 0.7 yuan per day in 1953–1954 and 0.8 yuan per day in 1956–1980 for all crops.

However, as mentioned above, wages distributed by the production team to its members were calculated based on the total disposable revenue divided by the total number of work points distributed to their workers. Thus, the practical remuneration paid to team members was changed according to the unit price of work points earned by agricultural workers. Furthermore, production teams needed to pay agricultural taxes to the government and achieve a food quota assigned by the government. At the time of settlement, production teams also had to withhold a certain amount of revenue or food as a common accumulation fund, common welfare fund, or emergency food stock, and the remainder became the source of funds available for payment.

To determine the distribution of the residuals, a combination of "distribution according to labor" (*anlao fenpei*) and "distribution according to need" (*anxu fenpei*) was widely adopted for most production teams, and specific share of the combination was determined according to local situations. The term "distribution according to labor" means the way of distribution based on the number of work points, while the term "distribution according to need" indicates the distribution method considering the necessities of food and cash based on the number of household members. Hence, distribution by production teams reflected a form of social security support for poor people (Huang, 2011; Shimakura, 1980). However, because the production cost survey covered only the number of working days per farmland and the amount of wage expenditure, it was difficult to conduct detailed examinations on a complex distribution within the production team. For these reasons, this article examines potential economic rewards to rural residents by use of "hypothetical wages," based on strong assumptions of economics.

Specifically, we assume a Cobb–Douglas production (net output) function for each crop with labor (L), land (T), and capital (K). The elasticities of labor, land, and capital are α, β and γ, respectively, and A is a constant term (technological progress). Thus, the production function can be specified in Eq. (4.3). Furthermore, we assume a perfectly competitive market for agricultural production; thus, the production elasticity of labor coincides with the labor's share (α) of the production distribution. Employing the number of working days of labor and the amount of net output from the production cost survey, the "hypothetical wage" (w^*) can be specified in Eq. (4.4).

$$\pi = A \cdot f(L, T, K) = AL^{\alpha}T^{\beta}K^{\gamma} \tag{4.3}$$

$$w^* = \alpha \frac{\pi}{L} \tag{4.4}$$

In this chapter, we assume the labor's share of the distribution (α) as 40% and calculate the amount of hypothetical wage. Detailed reasons for this setting are described in Sect. 4.3, and a robustness check by changing the labor share is performed. By comparing the hypothetical wage with that of the standard wage of the production cost survey, we can evaluate the extent to which farmers could receive rewards from collective farming over time. By utilizing these procedures, it would be possible to examine the amount of economic surplus from collective farming under People's Commune.

4.2.3 Basic Features of Production Cost Survey

To confirm the characteristics of the production cost survey data, we compared it with nationwide production data published by the National Bureau of Statistics of China. The changes in rice yield as per the production cost survey and the nationwide data are summarized in Fig. 4.4. The amounts of yield for the production cost survey are prone to be approximately 20% higher than that of the nationwide data throughout the Mao era. This is mainly because the survey spots of the production cost survey were not necessarily selected randomly, and major rice-growing regions appear to be intensely chosen to save costs involving field surveys. This resulted in a considerable discrepancy between the production cost survey and the national average.

Meanwhile, the changing trends in the rice yield were almost parallel between the two statistics. A gradual increase in rice yield was observed since the mid-1950s, but the yield fell sharply during the GLF, after which rice yield recovered again in the early 1960s. Although the production cost survey was not conducted during the Cultural Revolution, it was resumed in the 1970s. However, the yields of the production cost survey still surpassed those of the national average since the mid-1970s, showing trends similar to the previous period.[9] Because of space limitations, only rice yield is discussed in this section, but almost similar yield patterns are observed for other major grains (wheat and corn). From these comparisons, it is safe to mention that the reliability of the production cost survey is partly ensured. However, we must also pay attention to the upper bias of the survey.

Next, Fig. 4.5 summarizes the changes in average sale prices (nominal) of the three major grains per kilogram based on the production cost survey. It is apparent from Fig. 4.5 that the sales price of wheat was the highest among grains, and the sale prices of rice and corn were second and third, respectively, without changing the ranking since 1955. The average sales prices of the three grains increased substantially in 1961. Due to the significant failure of the GLF, the Chinese government decided to raise the procurement prices of agricultural products, and the adjustment in sales prices was reflected in the production cost survey. More specifically, the sales price of wheat per kilogram was increased by 26%, resulting in an increase from 0.18 yuan in 1959 to 0.23 yuan in 1961. Similarly, the sales price of corn was also raised to the same extent, but the rate of price increase for rice was relatively smaller, accounting for only 15%.

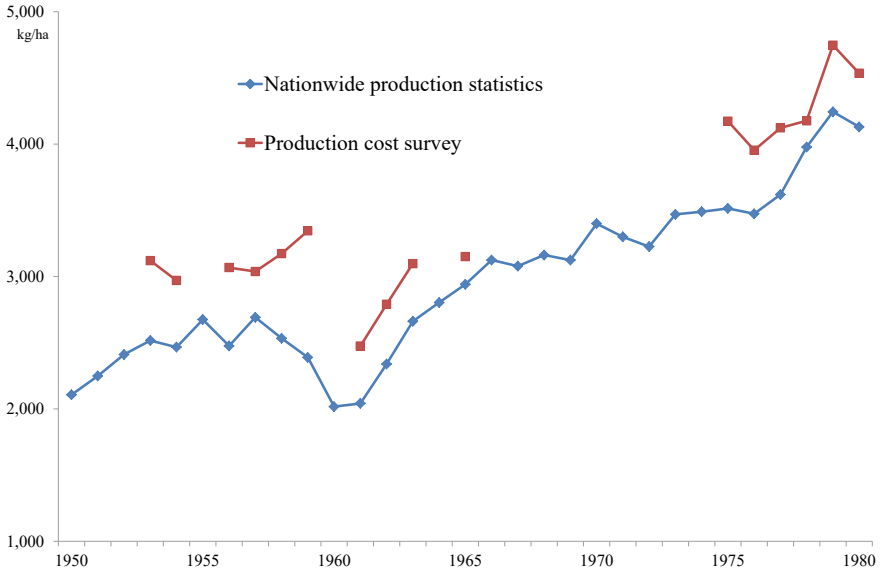

Fig. 4.4 Changes in rice yield. *Source* Guojia Fazhan he Gaige Weiyuanhui Jiagesi (ed.) (2003), Guojia Tongjiju Nongcun Shehui Jingji Diaocha Zongdui (ed.) (2000), and *Zhongguo Tongji Nianjian* (China Statistical Yearbook) (various issues)

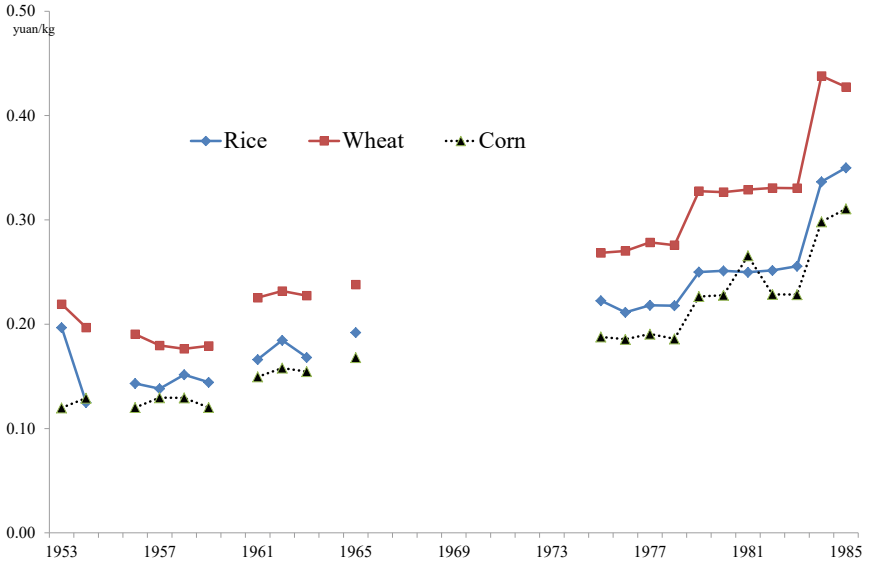

Fig. 4.5 Changes in sales prices for major grains. *Source* Guojia Fazhan he Gaige Weiyuanhui Jiagesi (ed.) (2003)

Due to the interruption of the production cost survey during the period from 1966 to 1974, the sales prices of major agricultural products were missing. However, according to official procurement prices (Fig. 4.1), the Chinese government maintained the procurement price for major grains at almost the same level during the missing period and then began to raise the prices by about 12 to 16% for the first time in the late 1970s. Therefore, the trends in sales prices of the three major grains in Fig. 4.5 were generally consistent with those of government procurement prices in Fig. 4.1.

Furthermore, the changes in labor days per farmland (days/ha) for the three major grain types are shown in Fig. 4.6. The intensity of labor per area for rice was the highest, and those for wheat and corn were relatively low and remained at almost the same level. It is also apparent from Fig. 4.6 that labor intensity exhibited a sharp increase from the mid-1950s to the mid-1960s. Specifically, the number of labor days for rice in 1953–1954 was approximately 200. Since then, labor intensity rose considerably, reaching around 300 days in the late 1950s and more than 400 days in the 1960s. Comparing the intensities before and after the Cultural Revolution, the labor intensity for rice in 1965 and 1975 was 519 and 572 days, respectively, suggesting a gradual increase during the period.

After the introduction of the household responsibility system (HRS) in the late 1970s, the intensity of labor days began to decrease markedly for all major grains. The intensity for rice fell from 501 days in 1979 to 381 days in 1982 and 328 days in 1985. The pattern in which labor intensity continuously increased during the Mao

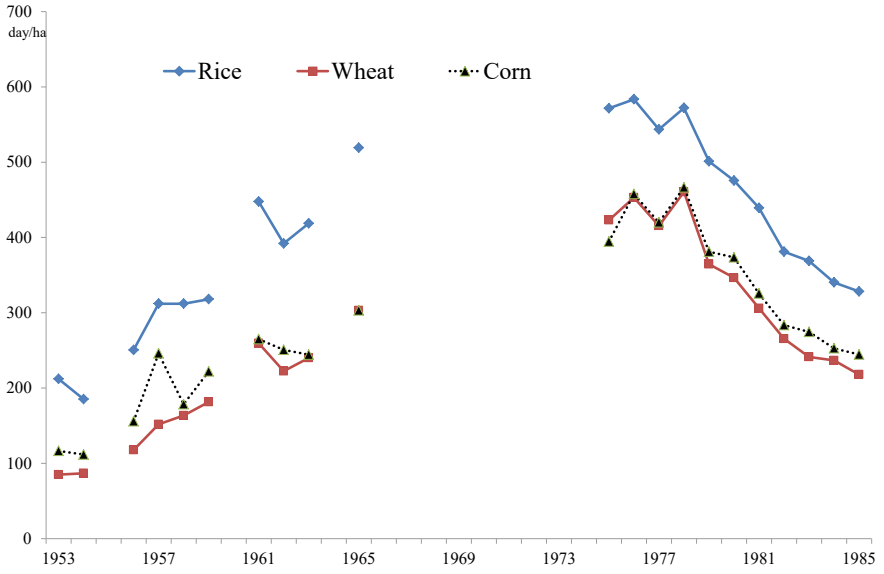

Fig. 4.6 Changes in labor days for major grains. *Source* Guojia Fazhan he Gaige Weiyuanhui Jiagesi (ed.) (2003)

era and then began to decrease rapidly after the introduction of the HRS was also applicable to other major crops such as cotton, sugar cane, and oilseeds. This suggests that labor-intensive agricultural technology was widely adopted and promoted to improve land productivity during the period per the growing rural population and labor force. However, the mechanization of farming was considerably suppressed and underdeveloped due to the deficiency in fiscal support.

4.3 Decomposition of Agricultural Income and Estimation of Agricultural Surplus

Based on the analytical framework described above, this section examines the composition of net production values and net revenue by crop and estimates the more practical economic surplus of collective farming. To clarify the differences between the major grains and other commercial crops, we used the average data of three major grains (rice, wheat, and corn) and compared the estimated results with those of other major crops.

4.3.1 Factor Decomposition of Agricultural Income by Crop

First, we calculated the extent of the crop-specific margin specified in Eq. (4.1). In this procedure, two types of income are examined: Case (1) (net production value = output–physical costs) and Case (2) (net revenue = net production value–labor costs (assessed at the standard wage)–taxes). Figure 4.7 summarizes the trends in the margins of the major grains. As shown in this figure, the margin of Case (1) was positive throughout the period, while the margin of Case (2) had negative values during 1961–1965 and 1977–1978. As explained in Sect. 4.1, the procurement price of grains (the sales price for farmers) was considerably raised in the early 1960s after the GLF. However, this adjustment was still not enough to cover the increases in production costs (mainly labor and material costs). Thus, the margin of Case (2) fell into deficit since the early 1960s. Almost the same trend can be observed when disaggregating the three major grains, and the extent of the margin tends to be larger for rice and smaller for wheat. Since 1979, a significant improvement in the margin for major grains was observed (Fig. 4.7). This tendency was more apparent in Case (2), showing a significant increase in the positive margin. It is mainly due to the introduction of the HRS and the increase in the procurement price of major agricultural products.

To confirm the trends in margins among crops, Fig. 4.8 illustrates the changes in margins (Case 2) for five crops (cotton, tobacco, peanut, oilseed rape, and sugar cane). The overall trends of these crops were similar to those of major grains, showing negative or fewer margins during the early 1960s and the mid-1970s. However,

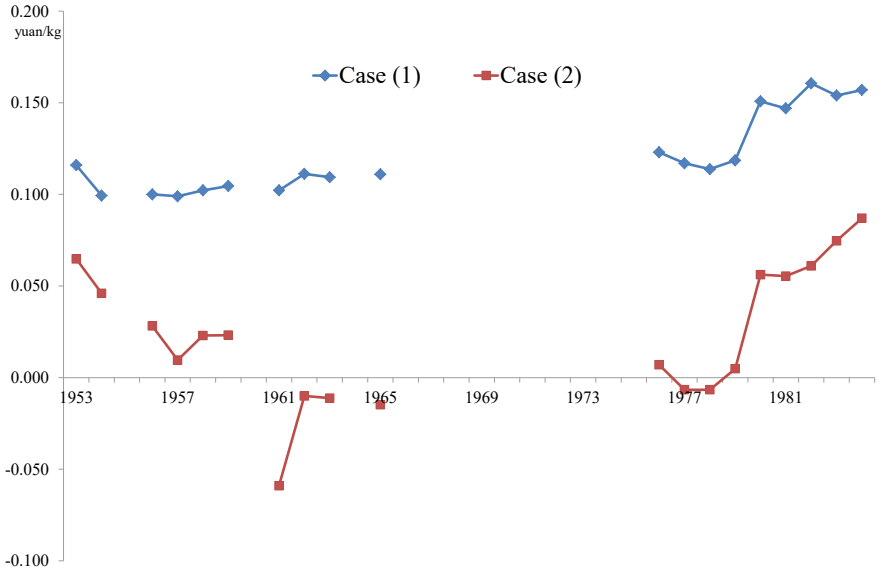

Fig. 4.7 Changes in margins for major grains. *Source* Author's calculations based on Guojia Fazhan he Gaige Weiyuanhui Jiagesi (ed.) (2003)

substantial margin gaps were observed for specific crops. Cotton and sugar cane achieved positive margins throughout the period, while tobacco was in the red from the mid-1950s to the early 1960s, and thereafter began to produce a surplus in the mid-1970s. Meanwhile, the results for the two major oil crops were contrasting, illustrating a consistent positive margin for peanut throughout the period (except for 1961), while showing a steady negative margin for oilseed rape until 1978. After the introduction of the HRS, the margins for all commodities improved rapidly, with cotton showing the fastest improvement in the price margin.

As shown in Eq. (4.2), the net production value and net revenue can be decomposed into yield and margin, and we can evaluate the contributions by employing the method. However, as explained above, the production cost survey was interrupted for several years because of political movements, such as the general line of transition, the GLF, the Four Clean Campaign, and the Cultural Revolution.[10] Therefore, we divide the time series data into six periods following the political movements and calculate the contributions of each factor to the changes in net production value and net revenue.

The estimated results of the decomposition of the major grains are listed in Table 4.1. In Case (1), the contributions of yield changes are generally higher than those of the margin, even though there were some differences during the late 1950s and the early 1960s. Meanwhile, the contributions of the margin were also relatively large except in 1963–1965. By contrast, the estimated results of Case (2) show that the contributions of the margin to the changes in net revenue are consistently larger than

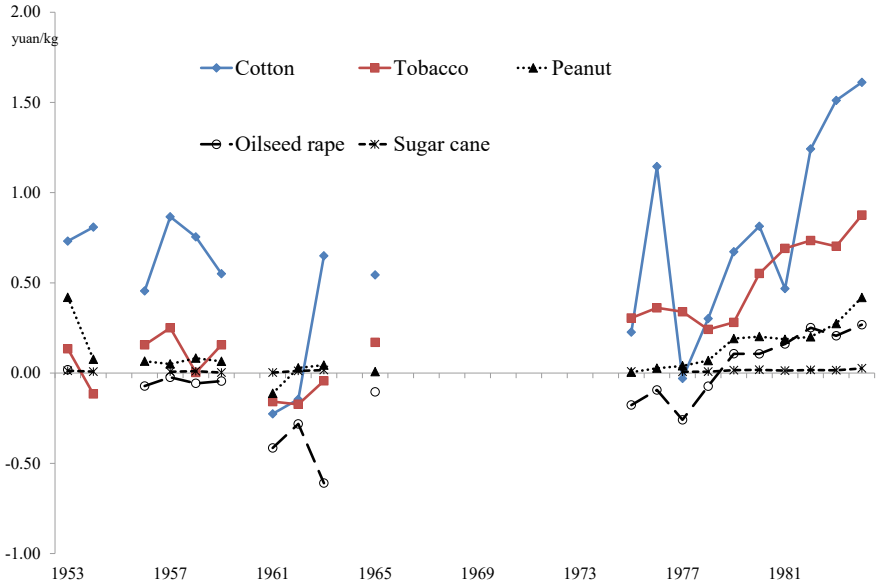

Fig. 4.8 Changes in margins for other crops. *Source* Author's calculations based on Guojia Fazhan he Gaige Weiyuanhui Jiagesi (ed.) (2003)

those of the yield and cross term throughout the period. This is mainly because labor costs and taxes are not deducted from the net production value, and the absolute values of both net revenue and margin become smaller than those for Case (1). This resulted in a more intimate correlation and larger contribution of the changes in margin for Case (2). This tendency was more apparent during 1961–1962. As explained above, the increase in the unified purchase price of agricultural products in the early 1960s improved the margin amounts. Thus, the contribution of margin to the changes in net value would become higher than in other periods.[11]

Table 4.1 Decomposition of net production value and net revenue per farmland

	Unit: %					
	Case (1)			Case (2)		
	Yield	Margin	Cross term	Yield	Margin	Cross term
1953–1954	36	69	−5	21	85	−6
1956–1959	80	20	0	27	71	2
1961–1962	60	34	5	−19	103	16
1963–1965	93	6	1	37	51	12
1975–1978	43	56	1	31	65	4
1979–1984	62	38	0	25	71	3

Source Author's estimation based on Guojia Fazhan he Gaige Weiyuanhui Jiagesi (ed.) (2003)

4.3.2 Calculation of Hypothetical Wages and Net Revenue

It is apparent from our examinations that wage settings for agricultural labor are crucial for determining the margin of net revenue. As we described in Sect. 4.2, the production cost survey utilized the "standard wage," which would not adequately reflect the situation of the rural economy. To calculate more reliable values of agricultural revenue, we utilize the hypothetical wage under the strong assumption of a perfectly competitive market and examined trends in net revenue.

We suppose the labor's share of the distribution is 40% and calculate the amount of hypothetical wage. The reason is that the amount of the hypothetical wage of three major grains (0.69 yuan/day) in 1954 was almost equivalent to that of the standard wage at that time (0.7 yuan/day), and the hypothetical wages calculated from other items were also approximately 0.7 yuan/day except for tobacco. Therefore, the settings of the labor share (40%) reflect market conditions before the transformation into the People's Commune, and this setting would be appropriate to examine the net revenues of agriculture during the Mao era. In addition, the amount of hypothetical wage for three major grains (assuming 40%) was also equivalent to almost the same level of standard wage after the introduction of HRS, accounting for 1.0 yuan/day in 1983 and 1.5 yuan/day in 1984. These results support the validity of our assumptions regarding agricultural wages.

Next, Fig. 4.9 summarizes the changes in the hypothetical wages by crop based on the assumption of a 40% labor share. This figure shows that hypothetical wages were generally lower than standard wages throughout the Mao era. Considering the changes in the hypothetical wages of major grains, the amounts of the hypothetical wage fell below 0.5 yuan/day since the late 1950s and further declined to 0.2–0.3 yuan/day in the early 1960s. Although the hypothetical wage for major grains stagnated around 0.4 yuan/day during the mid-1970s, the amounts of the wage exhibited a remarkable upward trend since then, reaching 0.57 yuan/day in 1979 and 1.0 yuan/day in 1983, which were almost the same level with those of the standard wages. The hypothetical wages for cotton, peanut, and sugar cane were generally higher than those for major grains during the Mao era, except for sugar cane in 1963. Even though we can observe some differences in the hypothetical wage among crops, it is common that the hypothetical wages were consistently lower than the standard wages until the late 1970s.

It should be noted that the shapes of hypothetical wages in Figure 4.9 remain unchanged but there is a shift in a parallel manner when we adjust the percentage share of the labor distribution. Namely, the levels of hypothetical wage approach those of standard wage if the labor share is set higher than 40%, while they move away from the standard wage if the labor share is adjusted lower than 40%. The frequency of the hypothetical wages exceeding the level of standard wages increased in the late 1950s assuming the labor's share of distribution at 60%. However, we confirmed that the hypothetical wages of major grains and several other crops at 60% labor's share were still generally below the standard wage during the Mao era.

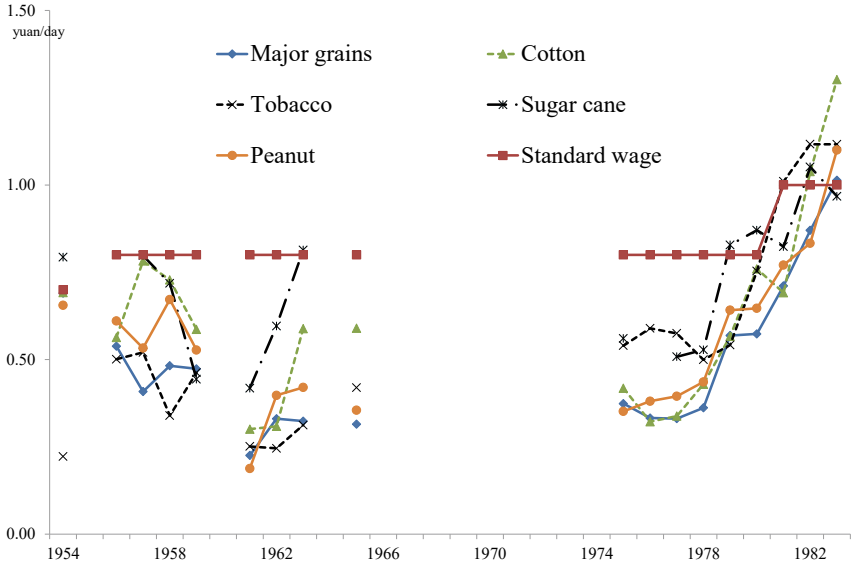

Fig. 4.9 Comparison between hypothetical and standard wages. *Source* Author's calculations based on Guojia Fazhan he Gaige Weiyuanhui Jiagesi (ed.) (2003)

Considering the results of these calculations, it appears that the standard wage adopted in the production cost survey did not properly reflect the economic situation surrounding agriculture in the Mao era. The tendency was more apparent during the period of the People's Commune, and the standard wage overestimated the remuneration to agricultural laborers compared to the real situation. Thus, it is reasonable to employ our calculation procedures to evaluate more realistic revenues for agricultural production.

As depicted in Fig. 4.6, labor-intensive technologies were introduced during the Mao era to absorb the growing rural population in the agricultural sector. The increase in the number of working days for agriculture could compensate for the decline in wages to maintain their standard of living. However, because of the lack of detailed information, we could not deduce clear results regarding this issue. Meanwhile, our calculations enable us to examine the changes in the amount of net revenue for each crop using hypothetical wages more realistically. To conduct a robustness check, we will present the results when the labor's share of the distribution is 60%.

Figure 4.10 summarizes the changes in net revenues for major grains based on three types of wages (standard wage, 40 and 60% labor's share). As shown in Fig. 4.10, the net revenues for Case (2) recorded negative values during the early 1960s and the late 1970s. By contrast, net revenues based on the hypothetical wages, both by 40 and 60% labor's shares, maintained positive numbers throughout the Mao era. The results were unchanged even if we disaggregated the major grains into individual grains (rice, wheat, and corn). We have also confirmed that almost

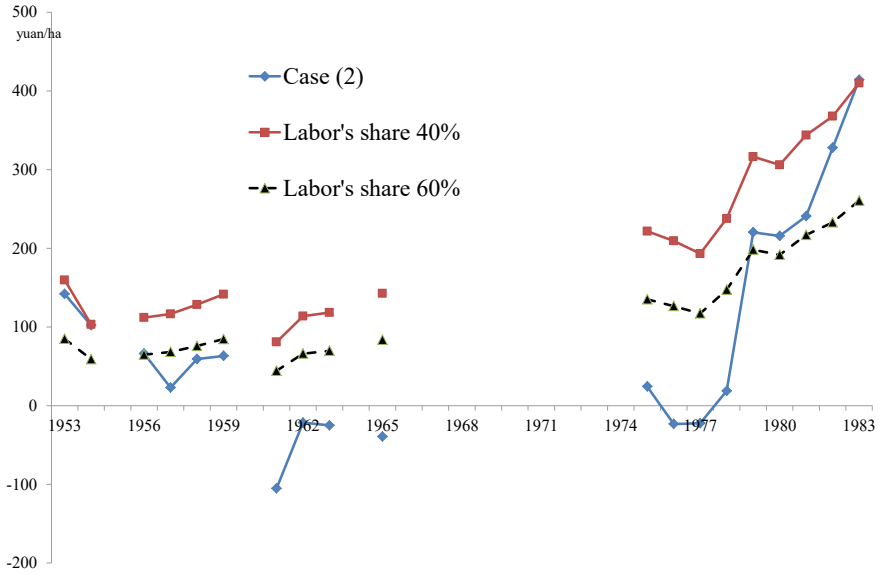

Fig. 4.10 Changes in net revenue for major grains. *Source* Author's calculations based on Guojia Fazhan he Gaige Weiyuanhui Jiagesi (ed.) (2003)

similar trends are observed for other crops, such as cotton, tobacco, and sugar cane, suggesting positive net revenues for the hypothetical wage, even for 60% labor's share.

Hence, it is reasonable to conclude that the production cost survey overestimated wages for agricultural labor under the People's Commune system and that collective farming could achieve consistent positive net revenues based on our more practical setting. The surplus of production teams were likely transferred to brigades and upper-level organizations for public projects such as infrastructure construction and public health management.

Conclusion

This chapter examined the profit structures of farm management under the People's Commune by using a production cost survey and re-evaluating the image of agriculture during the Mao era. More specifically, we decomposed the variations in agricultural incomes for major grains and then re-calculated the amount of net revenue utilizing our hypothetical wage for agricultural labor. The major results of our analysis can be summarized as follows.

First, the contributions of the margin to the changes in net revenue are consistently larger than those of yield and the cross term throughout the period, while the

contributions of yield to the changes in net production value are generally higher than those of the margin. These results suggest that the treatment and setting of agricultural wages would closely affect the determinants of income decomposition. In addition, the amounts of official margins based on the standard wage of the production cost survey were small or negative for major crops because of strict state control over agricultural marketing, and such a tendency was more obvious for major grains in the early 1960s and the late 1970s.

Second, assuming that agricultural workers could obtain 40% of net production value, the levels of hypothetical wages were consistently lower than those of the standard wage for not only major grains but also for other crops such as cotton and peanut. This trend was particularly apparent in the early 1960s and the mid-1970s. These results indicate that the standard wage adopted in the production cost survey would overestimate the remuneration for agricultural workers, resulting in lower net revenue for agricultural production.

Third, the amount of net revenue for major grains by use of the hypothetical wage recorded consistent surplus during the Mao era, and the outcomes were unchanged even if the labor's share of distribution was raised to 60%. These results imply that production teams generated positive revenues from agricultural production and the surpluses were siphoned off through higher-level organizations such as brigades and communes to urban areas.

Considering the trends of Engel's coefficients and the changes in labor days per cultivated farmland, we can infer that the increase in the rural population and number of rural workers caused a decline in the rewards for agricultural labor in the 1960s and the 1970s. Under these conditions, the preservation of labor-intensive farming technologies resulted in a "shared poverty" of the rural economy in which everyone was equally poor. Certainly, it is evident from the comparison of labor days for farming before and after the late 1970s that "shared poverty" was not a rational choice from a macroeconomic viewpoint. The number of agricultural labor days per cultivated farmland decreased considerably, while the amount of off-farm employment continuously increased after the introduction of the HRS. Under strict control over agricultural production, severe restrictions on market transactions of agriculture, and strong limitations on the rural industry, the Chinese government was obliged to adopt labor-intensive farming technology and enforced "agricultural involution" among production team members.

However, there is a caveat to generalizing our results to situations throughout the Mao era. The hypothetical wage for agricultural labor is based on the assumptions of a completely competitive market, which might be inconsistent with the "unified purchase and unified supply system" during the Mao era. Although we paid attention to the robustness of the results, our hypothetical wage settings appear to be preliminary and expedient for the calculations. It should be also noted that the production team changed and adjusted its cropping patterns according to climate conditions and regional-specific risks, which were not reflected in our calculation. Furthermore, the

activities of production team management were not only restricted to farming but also covered rural industry and public administration.

Therefore, it is necessary to examine the characteristics of cropping patterns, differences in regional features, and effects of non-agricultural revenues from the rural industry to evaluate the management of collective farming. These aspects are partially discussed in Chap. 5, which focuses on specific production teams in Jingjiang County, Jiangsu Province. We hope that the examinations of collective farming management from our macro perspective along with the next chapter will contribute to a more practical re-evaluation of the rural economy and agricultural management during the Mao era.

Notes

1. The Chinese term "grain" (*liangshi*) does not only include major grains (rice, wheat, and corn), but also cover minor grains (millet, other cereal), beans (converted to dried beans), and potatoes (including sweet potatoes). The amount of potatoes was converted to one-fourth of their weight before 1963 and to one-fifth of their weight after 1964.
2. The amount of grain production and the number of total population are based on Guojia Tongjiju Guomin Jingji Zonghe Tongjisi (ed.) (2010) and *Zhongguo Tongji Nianjian* (China Statistical Yearbook) (various issues).
3. China has two series of statistics on grain. The first is production statistics as defined at footnote #1 (also called "raw grain", *yuanliang*). The other is distribution statistics (called "trade grain" (*maoyiliang*)), that includes all items of production statistics, but the amount of rice and millets are converted to their polished state.
4. Concerning the trade surplus of grain marketing, Minami (1990) insisted that the marketing agencies could obtain regular spread and the Chinese government was able to transfer agricultural surplus to the development for other industries. By contrast, Nakagane (1992) proposed negative spread of the grain marketing. Because we do not have detailed information on the management of state marketing agencies at that time, it is difficult to examine the extent of the spread and draw a clear conclusion. However, we focused on eggs and pork, whose marketing was relatively less-controlled than that of major grains, and calculated the spread between procurement price and sales price during from the 1950s through the mid-1980s. The results show that the shares of regular margins for eggs and pork accounted for approximately 25% and 60%, respectively (Han and Feng (eds.) (1992), much larger than that of major grains. Therefore, it can be inferred that the margins of grain marketing in the 1950s would be positive, while those in the 1960s and 1970s would be negative.
5. Public reserve fund denotes a fund for the improvement of fixed assets owned by production team. Public welfare fund means a fund of the activities for social security and welfare, targeting at poor families who maintained their livelihood below the minimum living standard (Shimakura 1980).
6. According to rural household survey (*the China Yearbook of Rural Household Survey 2000*), the percentage shares of "income from collective management" and "net income from household management" to the net household income accounted for 50–60% and 30–40% in 1962–1965, respectively. During the period in 1975–1978, the percentage shares of "income from collective management" increased slightly, while the shares of "net income from household management" maintained almost the same level. These results suggest that incomes from sideline business contributed to support the livelihood of rural residents.
7. The Engel's coefficients for Japan are referred from the website of the Statistics Bureau of the Ministry of Internal Affairs and Communications, Japan ("Long-Term Statistical Series for

Japan," https://www.stat.go.jp/data/kakei/longtime/index3.html) (accessed on November 24, 2021).

8. The production cost survey does not include data on public reserves, public welfare, and grain storage. However, it can be considered that these reservations by production teams would be returned to team members in the medium and long viewpoints.
9. Yuan Longping, a former teacher at an agricultural college in Hunan Province, succeeded in breeding a large number of hybrid Indica rice varieties in the 1970s. It contributed to the development of selection and crossbreeding for three varieties of hybrid rice through large-scale mobilization of human labor. As a result of these efforts, the cultivation of hybrid rice spread rapidly since the mid-1970s (Tajima 1989).
10. The Four Clean Campaign was a socialist educational movement launched by the CCP in rural areas from 1963 to the spring of 1966. The movement promoted the purification of politics, economy, organization, and ideology. More specifically, dispatched project teams conducted the inspection of accounting, warehouses, finances, and labor scores of production teams and brigades to check the errors and cheating (Amako et al. (eds.) (1999)); Hamaguchi 2019).
11. We calculated factor decomposition for each grain (rice, wheat, and corn). The results are generally consistent with those of major grains, suggesting that the contributions of yields were larger for Case (1), while the contributions of margins were more apparent for Case (2).

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