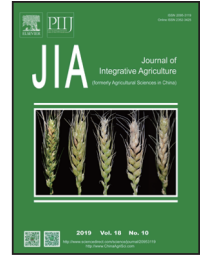




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RESEARCH ARTICLE

## More children nutrition distribution, less labor incentive: Evidence from Chinese collective agriculture



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### Abstract

Distribution system will affect the labor incentive that has been heatedly discussed by recent literatures. Using a unique micro dataset, this paper demonstrates that the equalitarian distribution system is one of the reasons for the insufficient labor incentive during the Chinese Collective Agriculture period. Specifically speaking, in the distribution of basic rations, the proportion for children (aged 1–3 and 4–7 years) was often beyond their nutrition demand, resulting the dissatisfaction of other families with more laborers and less children, thus these households will reduce their labor supply gradually. At the same time, the existence of outstanding accounts makes it a failure to use work points to buy distributions, which is the mechanism of the distribution system and insufficient labor incentive. All the results have been accepted by the robustness tests. The study will help to understand the distribution system and labor incentive, as well as the failure of the Chinese collective agriculture.

**Keywords:** ratio of children's nutrition distribution, labor incentive, outstanding accounts, Chinese collective agriculture

### 1. Introduction

Generally speaking, in the existing literature, there are two schools giving explanations for the insufficient labor incentive in Chinese Collective Agriculture: one is the difficult supervision school. They believe that, due to

the long agricultural production process and the complex agricultural work, it was very difficult to effectively supervise the agricultural laborers. Without effective supervision, it was impossible to effectively match laborers' agricultural work and the income distribution, which further results in low labor enthusiasm (Lin 1988, 1990; Dong and Dow 1998). The other is equalitarian distribution school. They hold the opinion that it is the equalitarian distribution system, which was almost an on-demand distribution system during the period of the collective agriculture, that damaged agricultural laborers' enthusiasm, especially the one that was implemented to ensure the most basic ration of farmers in the case where the central government took too much from agriculture (Conn 1982; Putterman 1987, 1990, 1993; Hsiung and Putterman 1989; Kung 1994; Huang *et al.* 2016).

Unfortunately, there is few empirical test used by both the "difficult supervision" school and the equalitarian distribution

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school, especially empirical tests based on the micro data (at the level of family or commune members). After all, the practitioners of the people's communes were members themselves. Therefore, this paper will make up for this deficiency, follow the thought of the equalitarian distribution, and use the micro data to empirically analyze the relationship between the distribution system and labor incentive from the perspective of nutrition distribution.

Field research has found that there was a certain relationship between childbearing and labor enthusiasm, such as “to work hard for a year cannot compare to bear a baby”, “no matter how diligently you work still cannot compare to have a baby”, “once you get a baby, income increases four or five hundred” (Bai 1999, personal communication; Huang's own survey 2015). These demonstrated a certain relationship between childbearing and labor enthusiasm. How the number of children affects production enthusiasm and what's the mechanism during the period of collective agriculture will be the main content of this paper.

To be specific, we will study the relationship between the ratio of ration distribution (the proportion accounting for the ration distribution for adult) for children (1–3 and 4–7 years old) and labor incentive (represented by work points of family). During the period of the collective agriculture, the distribution of grain and other things in kind consisted of two parts: ration and the grain based on work points. Ration usually was the main portion, generally accounting for around 80% of the total grain distribution (Zhang 2005; Li 2010; Xu and Huang 2014). According to age or gender, people get different ratio of ration distribution (according to the ration of adult). For example, children between 1–3 years old are allocated 60% of ration of an adult, and children between 4–7 years old were equal to 80% of an adult, etc., which varied from regions or periods. But if considering the nutrition needs of human body, the ration distribution for children was often higher than their nutrition needs. As mentioned above, the nutrition need of a 3-year-old child is around 1400 calories, which is amount to 47% of an adult's 3000 calories, while the child's ration distribution was 60% of an adult. Such a distribution system could lead to dissatisfaction among families with more labors and fewer children, as a result, these families would further reduce labor input. This is the logical relation between distribution system and labor incentive.

But another argument is that, regardless of the distribution ratio for children, by the end of the year, the family had to “pay” for the already allocated grain with work points. Thus, “distribution according to work” is still the principle that the collective agriculture actually following (Zhou 1962; Wu 1964). However, it is not the case if we study it more carefully, as the collective agriculture had a special mechanism named

“outstanding accounts (Qianzhang)”, which means farmers can owe the accounts to the production team. Families with more children and fewer laborers tend to be the ones that owe the most to production teams, and they were known as “overspending household (Chaozhihu)” (accounting for approximate one-third of the total rural households). For overspending households, it often beyond their ability to pay off all the outstanding accounts, and production teams had to find out all sorts of ways to help them, such as outstanding accounts relief, offering more chances to earn work points (by doing some inconsequential farm work), pairing with rich households, etc. And after all of these extra helps, if these overspending households still had outstanding accounts, they could only charge to their accounts. Therefore, the collective agriculture was not “distribution according to work” as some people call it. And under this mechanism, the labor enthusiasm of families with more labor force could be weakened.

Using “Chinese Rural People's Commune Micro Database (CRPCMD)” (Huang's own survey 2015), we select data from production teams in Shanxi, Hebei and Jiangsu provinces for empirical tests. Empirical results show that the higher the ratio of ration distribution for children (whether the 1–3 years old, 4–7 years old, or the sum of the two), the lower the labor incentive (income of work points). We divide the sample into families with more labor and fewer labors, or families with and without children, or families with and without outstanding accounts at the end of the year, as well as select a single production team for robustness test. It comes out that all the results are robust. Finally, we analyze the influence mechanism, and find that families with more children have larger amount of outstanding accounts at the end of the year, and the higher the distribution ratio for children, the larger the amount of outstanding accounts. In other words, outstanding account is the influence mechanism of the poor labor incentives. For the first time, this article uses micro data to empirically test the relationship between the distribution system and labor incentives. Our study will contribute to the research on distribution system and labor incentives, and has great help to understand the failure of China's collective agriculture, the labor behavior of farmers and so on.

The structure of the paper is as follows: Section 2 introduces the research methods and data, including the background of collective agriculture and data used. Basic results are discussed in Section 3. The last section concludes.

## 2. Methods and data

### 2.1. Background

**Distribution system under Chinese collective agriculture** During the period of the collective agriculture, there were two distribution systems of labor income. On one hand, in order to motivate farmers to work, the work point system of “distribution according to work” was implemented. On the other hand, in order to reflect the fairness of socialism, the supply system of “distribution according to demand” was implemented. Under the premise that the state prioritized the development of heavy industry as the strategic thinking, agricultural sector became the most primary source of primitive accumulation during that period. A certain proportion of agricultural output was supplied to the industrial sector, as a result, the actual items available for distribution in rural was very limited. In other words, during the whole period of collective agriculture, the economic condition of rural areas was almost at the subsistence level, and the labor income distribution was mainly based on distribution in kind (Huang 1992; Xu and Huang 2014), which led to the proportion of distribution “on-demand” far more than “on-work”.

From the perspective of population and labor input, there were usually a certain proportion of distribution according to population and work, such as 8:2, 7:3, 6:4, etc. (Zhang 2005; Zheng 2010; Huang 2011). To be specific, what the proportion of distribution according to population and work was 8:2 means, is that 80% of the total distribution was allocated according to population, and the rest of 20% was allocated according to work. It indicates that the proportion of distribution according to population was much larger than that according to work. The specific allocation process is, firstly, dividing all the distributable items (the total income minus production cost, national tax revenue, collective retention, etc.) into a certain ratio of two parts (for example, the ratio of “on-population” to “on-work” is 8:2), and then equally distributing the part of “on-population” (80% of the total distribution) according to the number of population, the other part of “on-work” (20% of the total distribution) according to work point.

Theoretically, all the distribution allocated according to population had to be “bought” with work points at the end of the year, thus it could be regarded as distribution according to work. However, it should be noted that there is quite a difference between the time of allocation and the time of using work points to “buy” the distributions. Therefore, it is inaccurate to regard the distribution system of this period as the distribution according to work. Since the distributable things in kind, the allocation time is not fixed but adjustable

according to the harvest time of crops (this distribution system was to ensure the survival of peasants as they didn't have surplus crops). Nevertheless, work points couldn't be completely counted until the end of the year, and the time difference between crop distribution and using work points to “buy” the distributions came out. It is based on this principle that emerged the unique phenomenon — “overspending households”, which only existed during the period of the collective agriculture. That is, the income of the household converted by what distributed before the end of the year exceeded the income converted by its work points of the year, resulting the overspending, thus these overspending households could not only be allocated any cash, but also owe to the production team at the end of the year.

**Outstanding accounts** “Overspending households” were also known as “deficient households”, “upside down households” or “owed households”, that is, the households owed money to production teams at the end of the year. And it is outstanding accounts that made the work point system out of distribution according to work which could have been reached. The cancellation of land dividends in the period of senior communes was the institutional basis for the emergence of “overspending households” in rural sociality (Meng 2012).

The reason why outstanding accounts existed is that distribution happened before the settlement and work points were not enough to offset the value of what had already been allocated when settling accounts (Zeng 1979; Zhang 2005; Lu 2015). Outstanding accounts were very common during that time. For example, there were about one-fourth of households overspending at the Nanling County, Anhui Province (Lu 2015); the number of households which got overspending or had outstanding accounts accounted for over 40% of the total in 1978 at the Chao'an County, Guangdong Province, and the amount of outstanding accounts exceeded 5 million CNY. At the end of 1978, the owed households accumulated account for 36% of the total and the amount of outstanding accounts exceeded 15 million CNY (Chen 1980).

The attitude to overspending households fully reflects the welfare nature of the collective economy.

Firstly, “adding work point (Cougongfen)”, that is helping them get more work points. Taking the Nanling County for instance: “Helping the needy families increase their income by working more, that is, arranging the needy families to participate in regular and manageable work as auxiliary labor forces, such as raising pigs, grazing cattle, watching fields and making sandals, especially during the slack seasons, they would be arranged more such work.” (Lu 2015).

Secondly, “pairing help (Jieduizi)”, that is letting rich families help poor families. Because most of the overspending households were unable to pay their

outstanding accounts, production teams had no enough money to distribute. And taking the method of pairing “big households” which had receipts and overspending households, production teams can turn the cash that should have been allocated to households with receipts to the cash that overspending households owed to the “big households”. Production teams played the role of “taking from the fat to pad the lean” (Lu 2015).

Thirdly, direct subsidies. Some families in the village still had more than 700 CNY in outstanding accounts until now. The government had also given them outstanding accounts relief before. For example, in the early 1960s, there was a poor family getting an outstanding accounts relief of over 400 CNY, which almost equals to 2 500 kg of grain (Gao 2006). According to the amount of outstanding accounts that each family owed to the production team, the member representatives of production teams would have discussions aimed at every possible needy families, and determined the list before launching the annual distribution program of the production team. At the final distribution of the year, needy families would receive different amount of work points subsidies to reduce their outstanding accounts and avoid being the “overspending households”. In the middle of the 1970s, each household could be allocated a cash subsidy of 10 to 70 CNY (later up to 95 CNY) to purchase supplies for the Spring Festival (Li 2010).

Finally, charging to the account and just leaving it unsettled. Overspending households directly charged their outstanding accounts to the account, and some of them even did it every year. Until the collective agriculture was dissolution, they were still unable to pay back, ending up with unsettled. “If you owe it, you owe it. Since you owed to the production team rather than someone else. As far as I know, their lives are pretty good, at least, they wouldn’t be starved to death.” (Meng 2012).

The existence of outstanding accounts severely influenced the labor enthusiasm of households with strong labor capacity, since, even if they obtained more work points through hard working, they could not receive all the cash they deserved, instead, part of their income would be apportioned by overspending households. Therefore, their labor enthusiasm declined greatly with time (Chen 1980; Zhang 2005; Gao 2006; Zhong 2007).

## 2.2. Nutrition distribution and hypothesis

During the period of collective agriculture, it is relatively scientific that the quota standards for adults and children were different in terms of distribution in kind, since most areas were short of grains and other things in kind during that time (Zhang 2005; Xu and Huang 2014), and because of age differences, children and adults have different

nutrition demands for physical goods like grains. For example, the general standard of basic rations of Zutang Production Brigade in Jiangsu Province in 1976 was that, the basic rations of children over 8 years old were as the same as those of adults, the 4–7 years olds were 80% of adults, and children under 3 years old were 50% of adults. However, the standards of Dongbeili Production Brigade in Shanxi Province were different, in 1971, the basic rations of children over 8 years old were as same as adults, the 4–7 year olds were 80% of adults, and children under 3 years old were 60% of adults. There was a difference of ration distribution standards between Zutang Production Brigade and Dongbeili Production Brigade.

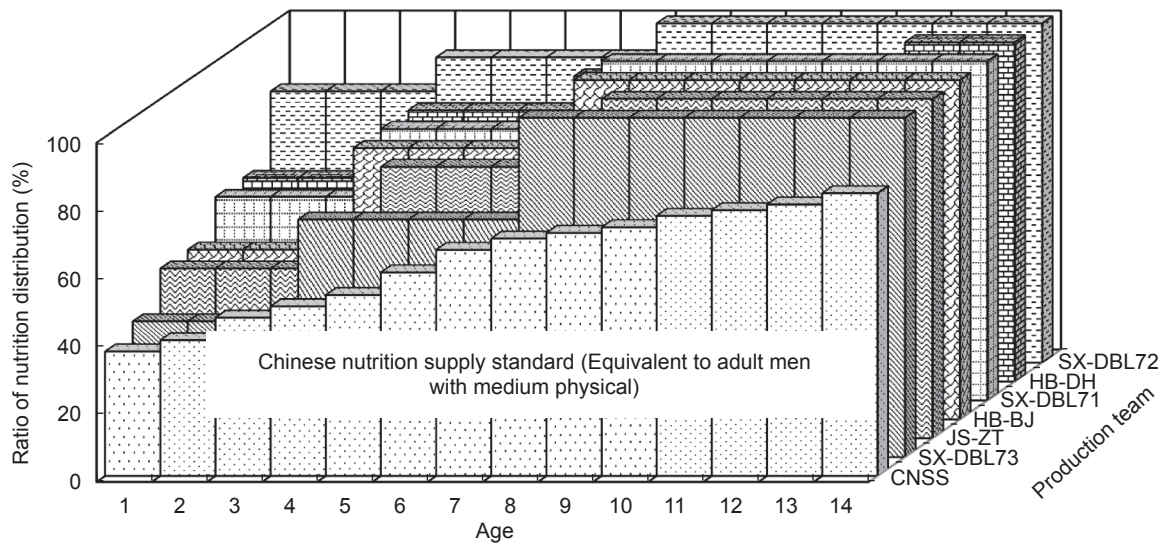
This plausible quota standards by age actually implied unreasonable composition, which also was one of the factors affecting labor enthusiasm. Since, nutrition demands of human body vary form ages, and the quotas of rations for children were often higher than they need during the period of China’s collective economy. According to Chinese nutrition supply standards formulated by the Chinese Society of Physiological Sciences Nutrition Society (He 1988), the nutrition demand of the 4-year-old is 1 500 calories, which equated to 50% of the nutrition demand of an adult male (medium manual labor); the nutrition demand of the 7 year olds is 2000 calories, which equated to 66.7% of the nutrition demand of an adult male (medium manual labor) (He 1988). However, the nutrition distribution for 4-year-old and 7-year-old children in Zutang Production Brigade in Jiangsu Province were 50 and 80% of an adult male (medium manual labor), respectively; 60 and 80% in Dongbeili Production Brigade in Shanxi Province, respectively.

Fig. 1 shows the nutrition demand standards for children of all ages and the actual amount of distribution during the China’s collective agriculture period. Obviously, the quota standards for children during China’s collective economy period were higher than the nutrition they need. It is the difference between the quota and the demand that caused the difference of labor enthusiasm among different peasant households.

Therefore, our hypothesis is that, during China’s collective agriculture period, given that grain and other things in kind were allocated by population, the higher the proportion of distribution for children (mainly referring to the 1–3-year-old and 4–7-year-old), the worse the labor incentive for peasant households, which is reflected by the lower work points of family.

## 2.3. Data

We use the data of “China Rural People’s Commune Micro-database (CRPCMD)” (Huang’s own survey 2015) to test the above hypothesis. The paper selected three provinces:



**Fig. 1** The actual distribution and standard of nutrition for Children. CNSS, Chinese nutrition supply standards; SX, Shanxi Province; JS, Jiangsu Province; HB, Hebei Province; DBL71–73, Dongbeili Production Team in 1971–1973; ZT, Zutang Production Team; BJ, Beijie Production Team; DH, Dahe Production Team. Data source: Chinese nutrition supply standards come from He (1988). Other data come from Huang (2015).

Shanxi, Hebei and Jiangsu. Specifically, the Dongbeili Production Team in Jinzhong District, Shanxi Province, from 1971 to 1977, with an average of 240 households per year, mainly planted wheat and corn with two harvests a year; the Beijie Production Team in Shijiazhuang City, Hebei Province, in 1975 and 1977, with an average of 87 households per year, mainly planted wheat and corn with two harvests a year; the Zutang Production Brigade in Jiangning District, Jiangsu Province, in 1974, with 11 production teams and an average of 31 households per team, mainly planted wheat and rice with two or three harvests a year. Planting industry was the main source of incomes for these production teams, and the income from sideline industry did not exceed 20%.

Table 1 shows that, the total work points of each family are around 589.9 working days, and the average work points per labor force are 294.4 working days, that is, every labor force works around 300 days a year during the period of collective agriculture, which is at a very high labor intensity. On average, each household has 4.3 people, 1.9 labor forces, 0.38 children aged 1–3 years and 0.42 children aged 4–7 years.

In terms of distribution ratio for children, among all production teams or years, for the 1–3 year olds, the lowest distribution ratio is 40% of adults (Dongbeili Production Team in 1973), and the highest distribution ratio is 80% of adults (Dongbeili Production Team in 1972); the ratio for the 4–7 year olds is higher than that for the 1–3 year olds, with the lowest of 70% (Dongbeili Production Team in 1973) and the highest of 90% (Dongbeili Production Team in 1972).

The year-end settlement is the amount of money that

converted by work points of the whole year of a household minus the sum of things in kind and cash allocated during the year. If there is any surplus, the household would be allocated cash, otherwise, it is an “overspending household” (owing money to production team). The proportion of overspending households in these production teams is 42.6%, and the most amount of over-expenditure is more than 900 CNY, which is an astronomical figure (a result of accumulation for many years) at that time. Besides, the average outstanding accounts that overspending households owed to production team is 110.4 CNY. And each surplus household, on average, could theoretically obtain 137.26 CNY in cash at the end of year.

### 3. Results and discussion

#### 3.1. Basic result

During the period of collective agriculture, the distribution system that the distribution proportion of rations for children relative to adults often exceeded their own nutrition needs led to discontent of households with more labor forces. Therefore, the distribution ratio of children should be negatively correlated with labor input (work points of households). Based on this, we set up a simple multiple regression model. Our explained variable is the household work points, and the explanatory variables are the distribution proportion of children aged 1–3, 4–7 and 1–7 years, respectively, and the control variables include the number of household labor forces, the number of household

**Table 1** Descriptive statistics

Variable	Number of observations	Mean	SD	Min.	Max.
Work point					
Total work point of household (working day)	2129	589.89	407.18	0	3152.07
Work point per labor (working day)	1855	294.38	125.23	0	1576.04
Population					
Total household population	2189	4.29	2.36	1	11
1–3 years old	2189	0.38	0.59	0	4
4–7 years old	2189	0.42	0.62	0	3
1–7 years old	2189	0.81	0.97	0	6
Total household labor force	2189	1.87	1.30	0	7
Ratio of household labor force	2189	0.45	0.29	0	1
Distribution ratio of children <sup>1)</sup>					
1–3 years old	2189	0.58	0.10	0.4	0.8
4–7 years old	2189	0.80	0.05	0.7	0.9
Year-end accounting					
Total (CNY)	2189	31.70	179.89	−923.53	1118.39
Overspending (CNY)	933	−110.40	120.98	−923.53	−0.02
Normal (CNY)	1256	137.26	139.24	0	1118.39

<sup>1)</sup> The distribution ratio of children refers to the proportion of nutrition distribution for children relative to that for adults.

populations and dummy variables of production teams. We use the OLS method to estimate at the household level.

According to the regression results showed in Table 2, there is a significant negative correlation between the distribution proportion of children and labor incentives. For example, for every 10% increase in the distribution proportion of children aged 1–3 years, the household work points will reduce 498 working days, or every household will reduce 498 working days. In other words, for every 10% increase in the distribution proportion of children, their households will reduce workload of around 1.36 labor forces working for a year ( $498/365=1.36$ ), which had a considerable influence. In the same way, for every 10% increase in the distribution proportion of children aged 4–7 years, the household work points will reduce 404 working days, which equal to the workload of 1.11 labor forces working for a year.

The impact of the number of household labor forces on household work points is significant positive, and adding one labor force will increase 222.5 working days for the household work points.

The impact of the number of household populations on household work points also is significant positive, while the impact is limited. Adding one person can only increase 25.85 working days, which is much lower than the impact of one labor force.

After controlling the influence of production teams (see the columns 4–6 in Table 2, taking Dongbeili Production Team in Shanxi Province as the compared group), the impact of the distribution proportion of the 1–3 year olds sharply decreases from 498.1 to 195.0, while the impact of the distribution proportion of the 4–7 year olds does not decrease much. It means there was a big difference of the distribution proportion of the 1–3 year olds among

production teams in different provinces, while the difference among the 4–7-year-old groups was rather small, which is consistent with the reality (the distribution proportion of the 1–3 year olds varies from 0.4 to 0.8, while that varies just from 0.7 to 0.9 for the 4–7 year olds). And the difference of the 1–7-year-old groups mainly stems from the variation of the 1–3-year-old groups.

### 3.2. Robustness test

**A comparison of labor incentives for households with and without children under 7 years old** For the impact of the distribution proportion of children under 7 years old on labor incentives of households, there may exist differences between the households with children under 7 years old and the households without children under 7 years old. Thus, we divide all the households into group with children under 7 years old and group without children under 7 years old and do regressions, respectively. We will find out whether only the households with children under 7 years old can benefit from distribution, while the households without children under 7 years old cannot get this distribution benefit and then reduce their labor input. Therefore, there may have differences between the two groups of households on economic behaviors, and it is necessary to conduct tests respectively.

Shown in Table 3, all the regression results are similar with Table 2, proving the robustness of the results. Table 3 indicates that, no matter there are children under 7 years old or not, the distribution proportion of children has a significant negative correlation with households' labor input, which means the higher of distribution proportion for children, the worse of labor incentives.

In the group of the households with children under 7 years old, the impact of the distribution proportion of the 1–3 year olds does not exceed that of the children under 7 years old (253.2:165.8).

Compared the two groups of households, the impact of the number of household labor forces on household work points is larger in the households with children under 7 years old. In the group of the households with children under

7 years old, for every one labor force increase, household work points increase 231.9 working days, while the impact in the group of the households without children under 7 years old is only 149.1, which is because the former need more labor input (theoretically, the distributions allocated to households should be “bought” with work points, but in fact, not all the distributions had been “bought” back, though it indeed caused a certain amount of labor input).

**Table 2** The impact of the nutrition distribution ratio for children on household income<sup>1)</sup>

Variable	Explained variable: Household work points					
	(1)	(2)	(3)	(4)	(5)	(6)
Ratio of the 1–3 year olds	−498.1*** (48.94)			−195.0*** (51.61)		
Ratio of the 4–7 year olds		−404.0*** (110.1)			−390.0*** (103.2)	
Ratio of the 1–7 year olds			−286.0*** (34.6)			−130.0*** (34.1)
Beijie Production Team				189.7*** (18.52)	209.2*** (17.76)	196.2*** (18.11)
Zutang Production Team				167.4*** (14.28)	186.9*** (13.28)	173.9*** (13.74)
Total household labor forces	222.5*** (5.451)	226.6*** (5.549)	224.2*** (5.487)	210.0*** (5.301)	210.0*** (5.301)	210.0*** (5.301)
Total household populations	25.85*** (2.99)	24.12*** (3.049)	25.06*** (3.011)	31.98*** (2.897)	31.98*** (2.897)	31.98*** (2.897)
Constant	338.4*** (30.28)	374.0*** (89.00)	444.9*** (49.00)	118.5*** (32.98)	313.5*** (83.51)	183.5*** (49.58)
Observations	2129	2129	2129	2129	2129	2129
R-squared	0.682	0.669	0.677	0.709	0.709	0.709

<sup>1)</sup> In columns (4)–(6), the dummy variable of production team was controlled, but not controlled in columns (1)–(3). At the same time, Dongbeili Production Team was taken as the compared group. Standard errors are in parentheses. \*\*\*, \*\*, \*  $P < 0.01$ ,  $P < 0.05$  and  $P < 0.1$ , respectively.

**Table 3** Robustness test: The impact of the nutrition distribution ratio for children on household income with and without children under 7 years old

Variable	Explained variable: Household work points					
	Group with children under 7 years old			Group without children under 7 years old		
	(1)	(2)	(3)	(4)	(5)	(6)
Ratio of the 1–3 year olds	−253.2*** (68.84)			−165.8** (66.66)		
Ratio of the 4–7 year olds		−506.5*** (137.7)			−331.6** (133.3)	
Ratio of the 1–7 year olds			−168.8*** (45.89)			−110.5** (44.44)
Total household labor forces	231.9*** (7.538)	231.9** (7.538)	231.9*** (7.538)	149.1*** (7.174)	149.1*** (7.174)	149.1*** (7.174)
Total household populations	44.10*** (4.480)	44.10*** (4.480)	44.10*** (4.480)	82.29*** (4.848)	82.29*** (4.848)	82.29*** (4.848)
Beijie Production Team	218.1*** (27.95)	243.4*** (27.12)	226.5*** (27.49)	156.8*** (21.70)	173.3*** (20.56)	162.3*** (21.10)
Zutang Production Team	252.4*** (18.70)	277.8*** (17.42)	260.9*** (17.99)	118.1*** (19.02)	134.7*** (17.70)	123.6*** (18.32)
Constant	−34.89 (46.57)	218.4 (112.3)	49.52 (67.81)	109.1*** (41.99)	274.9** (107.6)	164.4** (63.64)
Observations	1057	1057	1057	1072	1072	1072
R-squared	0.725	0.725	0.725	0.767	0.767	0.767

Standard errors are in parentheses. \*\*\*, \*\*, \* significant at  $P < 0.01$ ,  $P < 0.05$  and  $P < 0.1$ , respectively.

There are two kinds of effect in households with children: the objective material effect like allocating more rations and the effect of higher provider-receiver rate (the ratio of non-labor populations to labor forces). The former has negative incentive to labor, while the latter has positive incentive to labor, and the sum of the two is net incentive. In the group of households with children under 7 years old, the net incentive is  $-21.3$  ( $-253.2+231.9$ ), which is negative; In the group of households without children under 7 years old, the net incentive is  $-16.7$  ( $-165.8+149.1$ ), which is also negative, but the impact is smaller than the group of households with children under 7 years old.

However, the total household populations have opposite impact in the two groups of households, and the impact in the group with children under 7 years old is smaller than that in the group without children under 7 years old, which is 44.1 and 82.3, respectively. The obvious reason for this is that the group of households with children who cannot work.

**A comparison of labor incentives for households with more and fewer labor forces** We divide households into the group of households with more labor forces and the group of households with fewer labor forces according to the ratio of household labor forces to total household populations (if the ratio exceeds 45%, the household belongs to the group with more labor forces), and then regress respectively. The results show that impact of distribution proportion of children on household work points is still robust.

Table 4 shows that the distribution proportion of children is significantly negatively correlated with household work

points, that is, the higher the distribution proportion of children, the fewer household work points (the worse the labor enthusiasm). In terms of labor force groups, the distribution proportion of children aged 1–3 years has greater impact on the group of households with more labor forces than the group of households with fewer labor forces. For every 10% increase in the proportion, the work points of households with more labor forces will reduce 242.5 working days, and that of households with fewer labor forces will reduce 158.6 working days. There is a difference of 83.9 working days between the two groups. Because there had been a negative impact of the distribution proportion of children on household labor enthusiasm, it could be more obvious in the households with more labor forces.

As for the net effect of the distribution proportion of children on labor incentives, the same results are concluded. The group with more labor forces has a net effect of  $-42.8$  ( $-242.5+199.7$ ), and the net effect of the group with fewer labor forces is 8.5 ( $-158.6+167.1$ ). Apparently, households with more labor forces has negative net effect, that is, the more labor forces, the worse labor incentives.

**Labor incentives of Dongbeili Production Team** The above regressions and empirical tests are all based on data from three provinces, in order to get further robust results, we separately tested data from production teams in one province. Since the data from Dongbeili Production Team in Shanxi Province has a better continuity (7 continuous years from 1971 to 1977), and there were average 240 households per year, we choose it to conduct the robust test. Table 5

**Table 4** Robustness test: The impact of the nutrition distribution ratio for children on household income with more and fewer labor forces

Variable	Explained variable: Household work points					
	Group with more labor forces			Group with fewer labor forces		
	(1)	(2)	(3)	(4)	(5)	(6)
Ratio of the 1–3 year olds	-242.5*** (78.74)			-158.6** (66.19)		
Ratio of the 4–7 year olds		-485.1*** (157.5)			-317.3** (132.4)	
Ratio of the 1–7 year olds			-161.7*** (52.49)			-105.8** (44.13)
Total household labor forces	199.7*** (12.72)	199.7*** (12.72)	199.7*** (12.72)	167.1*** (12.36)	167.1*** (12.36)	167.1*** (12.36)
Total household populations	50.32*** (7.303)	50.32*** (7.303)	50.32*** (7.303)	37.30*** (5.388)	37.30*** (5.388)	37.30*** (5.388)
Beijie Production Team	211.7*** (24.40)	236.0*** (23.08)	219.8*** (23.68)	145.8*** (28.35)	161.6*** (27.49)	151.1*** (27.90)
Zutang Production Team	219.5*** (19.91)	243.8*** (18.28)	227.6*** (19.02)	112.6*** (20.07)	128.5*** (18.86)	117.9*** (19.43)
Constant	91.93* (49.76)	334.5*** (126.9)	172.8** (75.13)	136.9*** (43.47)	295.5*** (107.8)	189.8*** (64.51)
Observations	1024	1024	1024	1105	1105	1105
R-squared	0.751	0.751	0.751	0.597	0.597	0.597

Standard errors are in parentheses. \*\*\*, \*\* and \*, significant at  $P < 0.01$ ,  $P < 0.05$  and  $P < 0.1$ , respectively.



shows the distribution proportion of different age groups of children in Dongbeili Production Team each year. OLS method is used to estimate the impact of the distribution proportion of children on household work points, and the results are shown in Table 6.

The results prove that the impact of the distribution proportion of children is robust. As showing in Table 6, for every 10% increase in the proportion of children aged 1–3 years, household work points will decrease 250.1 working days, also seeing a same trend after controlled the labor forces (more or fewer).

**Whether there were outstanding accounts at the end of the year** During China's collective agriculture period, over one-third households became the "overspending households" at the end of the year. Therefore, in order to find out whether there is difference of the impact of children's distribution ratio on labor incentives due to outstanding accounts, we divide households into the group with outstanding accounts and the group without outstanding accounts and regress respectively. The results are shown in Table 7 (omitted groups of the 4–7 year olds and the 1–7 year olds).

It finds that, the distribution proportion of children aged 1–3 years, both in groups with outstanding accounts and without outstanding accounts, has negative impact on labor incentives, and the results are significant at the 1% level,

which means, no matter households have outstanding accounts or not, the distribution proportion of children reduces labor enthusiasm. This also proves that the above regressions are robust.

From Table 7, we can see that, there is a greater impact of children's distribution ratio on labor incentives in the group without outstanding accounts. The net effects are:  $-256.6 (-475.6+219.0)$  for the group without outstanding accounts and  $-140.5 (-304.3+163.8)$  for the group with outstanding accounts. This shows that the negative impact caused by distribution system is more significant on the group without outstanding accounts (usually with more labor forces). With more labor forces and less family burden, households without outstanding accounts could have invested more labor by their own ability, while the impact of distribution system made them reduce their labor inputs.

### 3.3. Mechanism analysis

During the period of collective agriculture, the distribution procedures are, firstly, production teams allocate basic rations and other necessary things in kind according to household populations, and then, at the end of the year, deducting the amount of cash converted by those already allocated things from that converted by household work

**Table 5** The distribution ratio of different age groups of children to adults in Dongbeili Production Team

Distribution ratio	1971	1972	1973	1974	1975	1976	1977
1–3 year olds	0.6	0.8	0.4	0.6	0.6	0.6	0.6
4–7 year olds	0.8	0.9	0.7	0.8	0.8	0.8	0.8

**Table 6** Robustness test: the impact of the nutrition distribution ratio for children on household income with the case of Dongbeili Production Team<sup>1)</sup>

Variable	Explained variable: Household work points					
	(1)	(2)	(3)	(4)	(5)	(6)
Ratio of the 1–3 year olds	-201.5*** (46.22)			-198.7*** (46.21)		
Ratio of the 4–7 year olds		-402.9*** (92.44)			-397.4*** (92.43)	
Ratio of the 1–7 year olds			-134.3*** (30.81)			-132.5*** (30.81)
Total household labor forces	182.7*** (5.474)	182.7*** (5.474)	182.7*** (5.474)	170.1*** (8.914)	170.1*** (8.914)	170.1*** (8.914)
Total household populations	29.53*** (2.871)	29.53*** (2.871)	29.53*** (2.871)	35.35*** (4.339)	35.35*** (4.339)	35.35*** (4.339)
Labor forces (more=1)				29.22' (16.36)	29.22' (16.36)	29.22' (16.36)
Constant	183.6*** (29.89)	385.1*** (74.96)	250.8*** (44.66)	166.4*** (31.39)	365.1*** (75.75)	232.6*** (45.77)
Observations	1 618	1 618	1 618	1 618	1 618	1 618
R-squared	0.673	0.673	0.673	0.674	0.674	0.674

<sup>1)</sup>In columns (4)–(6), the dummy variable labor forces was controlled and columns (1)–(3) not. Standard errors are in parentheses. \*\*\* and ', significant at  $P < 0.01$  and  $P < 0.1$ , respectively.

**Table 7** Robustness test: the impact of the nutrition distribution ratio for children on household income with and without outstanding accounts at the end of the year

Variable	Explained variable: Household work points					
	Group with outstanding accounts			Group without outstanding accounts		
	(1)	(2)	(3)	(4)	(5)	(6)
Ratio of the 1–3 year olds	–304.3*** (90.32)			–475.6*** (55.09)		
Ratio of the 4–7 year olds		–241.4 (206.6)			–377.2*** (122.6)	
Ratio of the 1–7 year olds			–177.5*** (64.37)			–269.8*** (38.78)
Total household labor forces	163.8*** (8.785)	163.9*** (8.834)	163.9*** (8.803)	219.0*** (6.971)	223.1*** (7.14)	220.9*** (7.034)
Total household populations	38.14*** (4.309)	37.49*** (4.328)	37.89*** (4.316)	33.57*** (3.977)	32.38*** (4.083)	32.91*** (4.017)
Constant	192.8*** (54.66)	209.9 (166.3)	261.6*** (90.26)	351.7*** (34.51)	379.4*** (99.39)	449.2*** (55.21)
Observations	890	890	890	1239	1239	1239
R-squared	0.581	0.576	0.579	0.732	0.718	0.727

Standard errors are in parentheses. \*\*\*, significant at  $P < 0.01$ .

points. If the final amount of a household is positive, the household is a “surplus household”, and if it is negative, the household is an “overspending household”. Overspending was allowed, or passively recognized, at the time. And labor incentives would be more efficient, if overspending households could pay off their outstanding accounts in time and surplus households could receive the cash they deserved at the end of the year, that is, people who work harder also get more (approximately distribute according to work). However, the problem is that overspending households were unable to pay off all their outstanding accounts in time, and surplus households could not get the cash they deserved in time either, which make sense that the labor incentives of household with more labor forces lowered.

To this end, we test the relations among the number of children (1–7 years old), the distribution proportion of children and the balance of households at the end of the year. The explained variable is the amount of total household income at the end of the year, represented by the amount of cash, and if the household is a surplus household, it is positive, and if the household is an overspending household, it is negative. Main explanatory variables are the number of children of households and the distribution proportion of children. The OLS estimate results are as Table 8.

Columns (1)–(4) are the year-ending earnings without standardized treatments, columns (5)–(8) are the year-ending earnings with standardized treatments, and the results of two situations show the same trend. Columns (1) and (5) show the impact of the number of children on total household income at the end of the year. From the results, the more children a household has, the lower its income is, and the more likely it becomes an overspending household

owing to production team. And for each additional child, the household income at the end of the year will reduce by 27.22 CNY. Besides, the distribution proportion of children is negatively correlated with the year-ending income, that is, the higher distribution proportion of children (for every age group), the more likely the household becomes an overspending household at the end of the year and owes to the production team. For example, if the distribution proportion of children aged 1–3 years increases 10%, the year-ending income of the household will reduce 137.8 CNY.

The existence of outstanding accounts makes the distribution system that theoretically should “buy” the allocated materials with work points has a far cry from “distribution according to work”. If there were no outstanding accounts, the collective agriculture could be “distribution according to work” at a certain extend. Nevertheless, it is the existence of outstanding accounts that lowers the labor enthusiasm of farmers and further causes the poor efficiency of collective agriculture.

#### 4. Conclusion

The production efficiency of China’s collective agriculture was not very high. The success of China’s rural reform that began in 1978 further highlighted the failure of collective agriculture, which then became a hot issue in the academic circle.

Until now, there are two main reasons for the failure of collective agriculture that classified by existing studies: the difficult supervision and the equalitarian distribution, both of which are not conducive to the exertion of labor enthusiasm. But all the existing studies lack a relative rigorous empirical study. Based on the precious data from “Chinese Rural

**Table 8** The impact of the nutrition distribution ratio for children on outstanding accounts at the year end<sup>1)</sup>

Variable	Explained variable: Total household cash income at the end of the year							
	Annual income unstandardized				Annual income standardized			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
The number of children	-27.22*** (3.767)				-0.0243*** (0.003)			
Ratio of the 1–3 year olds		-137.8* (38.26)				-0.123*** (0.034)		
Ratio of the 4–7 year olds			-275.6*** (76.52)				-0.246*** (0.068)	
Ratio of the 1–7 year olds				-91.88*** (25.51)				-0.0822*** (0.022)
Total household labor forces	43.79*** (2.83)	69.41*** (3.948)	69.41*** (3.948)	69.41*** (3.948)	0.0392*** (0.002)	0.0621*** (0.003)	0.0621*** (0.003)	0.0621*** (0.003)
Total household populations		-22.37*** (2.157)	-22.37*** (2.157)	-22.37*** (2.157)		-0.0200*** (0.001)	-0.0200*** (0.001)	-0.0200*** (0.001)
Beijie Production Team	64.55*** (13.46)	43.35*** (13.84)	57.13*** (13.3)	47.94*** (13.54)	0.0577*** (0.012)	0.0388*** (0.012)	0.0511*** (0.011)	0.0429*** (0.012)
Zutang Production Team	59.43*** (10.02)	33.56*** (10.64)	47.34*** (9.926)	38.15*** (10.25)	0.0531*** (0.008)	0.0300*** (0.009)	0.0423*** (0.008)	0.0341*** (0.009)
Constant	-42.46*** (6.77)	68.77*** (24.24)	206.6*** (61.74)	114.7*** (36.56)	0.788*** (0.006)	0.887*** (0.021)	1.010*** (0.055)	0.928*** (0.032)
Observations	2189	2189	2189	2189	2189	2189	2189	2189
R-squared	0.137	0.163	0.163	0.163	0.137	0.163	0.163	0.163

Standard errors are in parentheses. \*\*\* and \*\*, significant at  $P < 0.01$  and  $P < 0.05$ , respectively.

People's Commune Micro Database (CRPCMD)" and followed the equalitarian distribution path, we empirically analyzed the labor enthusiasm of households during the collective agriculture period.

The empirical results found that, the distribution proportion of rations for children to adults exceeded children's nutrition demands, and the allocated rations (as well other allocated things in kind) theoretically need be deducted with work points, which, in fact, hardly was achieved. Finally, the part of allocated materials that cannot be deducted was treated as outstanding accounts and chalked in production teams' accounts, or complemented it with unqualified work points. As a result, it makes the households with more labor forces and fewer children feel unfair and reduce their labor inputs. In other words, it is the egalitarian distribution system that leads to a decline of labor incentives. To be specific, such as for every 10% increase in the distribution proportion of children aged 1–3 years, the household work points will decrease 498 working days, which equated to the income of 1.36 adult labor force working for a year.

Meanwhile, we divide all households into groups with and without 1–7-year-old children, groups with more and fewer labor forces, and groups with and without outstanding accounts at the end of the year, as well as singly choose the data from Dongbeili Production Team in Shanxi Province, to conduct robust tests respectively. And all the results show a robustness of the impact of children's distribution proportion.

At the end, we discussed the influence mechanism, that is, the existence of outstanding accounts leads to using work

points to "buy" allocated materials becomes an idle talk, which further directly impacts the exertion of labor incentives. The more children a household has and the higher children's distribution proportion is, the more outstanding accounts the household has.

Of course, the existence of outstanding accounts is a compelling choice, and for another hand, it is also an advantage of the collective agriculture, since the collective agriculture is a welfare organization to a certain extend. Under the condition that giving priority to develop heavy industry, over extraction from the agricultural surplus and lacking of peasants' mobility, this egalitarian development mode of collective agriculture also objectively makes sense.

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