Impacts of non-farm income on inequality and poverty: the case of rural China

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Abstract: Based on data from the Living Standards Measurement Surveys, we examine the effects of non-farm income on inequality and poverty in rural China using two approaches. Firstly, we consider non-farm income as an "exogenous transfer", which adds to the total household income, and study the contribution of different types of income on inequality using the decomposition of the Gini index. Secondly, we consider non-farm income as a "potential substitute" for other household earnings, and compare the distribution of the simulated income in the absence of non-farm activities with that of the observed income to examine the impact of participation in non-farm activities on inequality and on poverty. We find that, the prosperity of the non-farm sector after the economic reform alleviates rural inequality and poverty. It increases the income levels of the poorest households and reduces the income gaps between poor households.
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1 INTRODUCTION

In developing countries, non-farm activities play a more and more important role in sustainable development and poverty reduction in rural areas. Non-farm activities can influence the rural economy through various channels. First, non-farm employment reduces the pressure on the demand for land in poor areas. Consequently, non-farm activities can contribute to breaking the vicious cycle of "poverty – extensive cultivation – ecological deterioration – poverty". Second, the income obtained from non-farm activities can significantly increase total household income and hence enhance the investment capacity in farm activities. It can also mitigate income fluctuations and enable the adoption of some more profitable but "risky" agricultural technologies, which favor the transformation of traditional agriculture to modern agriculture. Third, non-farm income is often a source of savings, which plays an important role in food security. The households that diversify their income by participating in non-farm activities are more capable of overcoming negative shocks.

Many researchers show that non-farm activities have an important impact on income distribution. The impact depends on the ranking of the household in the social scale as well as on the specific types of non-farm activities involved. Results

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vary across regions and differ according to the methods of analyses used. Most research shows that non-farm income distribution is more unequal than that of farm income.[1] By improving the rural income as a whole, the participation in non-farm activities can increase income disparities, in particular, in poor areas. However, some other researchers show that as the proportion of non-farm income in total income increases, the distribution of the latter will become more uniform, which reduces income inequality, as well as the social and political tension.[2]

China is an agricultural country with a typical dualist socio-economic structure, as predicted by Lewis (1954). Given the high demographic pressure on the countryside and the relatively limited quantity of cultivable land,[3] the agricultural income per capita has always been low. In such a situation, non-farm sectors play a particularly important role in absorbing the surplus agricultural labor, in enhancing the income of farmers, and in reducing rural poverty. The economic reforms, which began in the late 1970s, in particular, the implementation of the Household Responsibility System (HRS), led to a massive rural/urban migration and a rapid development of rural non-farm sectors. It strongly reinforced economic growth and enhanced household income in rural areas. The proportion of non-farm income in total rural household income has been increasing as time passes.

Some studies show that rural inequality significantly increases with economic reforms, and that the increase in this inequality is essentially explained by the enhancement of the proportion of non-farm income in total income. Knight and Song (1993) argue that the distribution of non-farm income is less egalitarian compared to that of farm income in China, based on a country-level survey. Hussain et al. (1994) draw a similar conclusion about the unequal distribution of non-farm income and point out that non-farm income contributes to the rise in rural inequality. These results suggest that rural inequality aggravates as rural labor becomes more engaged in non-farm activities. Many researchers suggest that the growing importance of non-farm activities in rural areas, which may result in an increase in inequality, will increase the cost of economic restructuring during the transition process in China.[4]

However, in our opinion, most of the studies above are based on a macroeconomic analysis, using data at the provincial or county levels. The role of non-farm activities is rarely examined from the angle of microeconomic behavior of rural households. In addition, these studies consider non-farm income only as an exogenous/extra income, which adds to the resources of household. They do not take into account the interactions between the participation in various productive activities. A further review of the literature shows that the results depend largely on the method of analysis. For example, some other studies, such as Adams and He

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[1] Barham and Boucher (1998); Elbers and Lanjouw (2001); Escobal (2001); Khan and Riskin (2001); Leones and Feldman (1998); Reardon and Taylor (1996); Shand (1987).

[2] Chinn (1979); Lachaud (1999); Richard and Adams (1994); Sadoulet and De Janvry (2001); Stark et al. (1986).

[3] In 2000, the quantity of per capita cultivable land in rural area was only 0.138 hectare (*National Statistics Bureau of China,* 2001: p. 374).

[4] Bhalla (1990) ; Yao (1999) ; Zhu (1991).

(1995) and Adams (1999), argue that non-farm income reduces the overall inequality in Pakistan and in Egypt, respectively. They argue that households poor in farm income (because of the unequal accessibility to land, etc) are more engaged in non-farm activities, and the pro-poor distribution of non-farm income across the income scale of the population mitigates the inequality.

The present study tries to examine the role of non-farm activities in overall income distribution, taking into account the specialties of rural household production in China. Based on data from the Living Stands Measurement Surveys (LSMS), we study the impacts of the participation in non-farm activities on the inequality and poverty in rural China, and analyze the determinants of farmers' income at the micro level. We use two different approaches, on the one hand considering non-farm income as an "exogenous transfer", and on the other hand, as a "potential substitute" for other household earnings. In the following section, we briefly describe the development of the non-farm activities in rural areas of China and articulate its growing important role. Section 3 discusses the methods of analysis. Section 4 focuses on the data. Section 5 comments on the results. We conclude in section 6.

2 ECONOMIC REFORMS AND FARMERS' NON-FARM INCOME IN CHINA

The Chinese countryside has been characterized by economic autarchy and traditional agriculture for a long time. Following the model of the former-USSR, China gave priority to the development of heavy industries at an early stage of industrialization. Farmers were heavily taxed – enormous agricultural surplus was transferred to industrial investments. Before the reforms, in order to stabilize agricultural production, farmers were fixed on land in two ways: (i) through rural collectivization, and (ii) by the famous civil status system "*hukou*".[5] Rural collectivization tightened the links between farmers' income and their daily work-participation in collective land – a farmer gained "working-points" if he or she worked on the collective land, the points he or she got depended on how much time he or she spent on the collective land (*gongfenzhi*).[6] The civil status system consisted in closely combining the civil status with the supply of consumption goods and access to jobs. Without urban civil status, rural/urban migrants could not settle down on a permanent basis outside their original place. These two ways divided the Chinese society into two completely different parts – urban area and rural area, that is to say, the dualist economy predicted by Lewis (1954). We argue that this division, which led to the inefficient allocation of resources and the low incentive in productive activities, was the essential source of rural poverty. The objective of agricultural reform was to remove/abolish the above constraints and to establish a new agricultural mechanism.

[5] Davin (1999); Zhu (2002).
[6] See McMillan et al. (1989: pp.783-785).

The economic reforms that began in the late 1970s brought big changes in rural China. First, the collapse of the system of "People's Commune", as well as the implementation and generalization of the Household Responsibility System in rural areas,[7] restored greater liberty to farmers – farmers could freely allocate their time, and freely choose their careers and their mode of production. Second, agricultural reforms strongly increased agricultural production and the supply of grains in the markets, which enabled people living in urban areas without urban civil status (*hukou*) to purchase food in free markets. It finally led to abandoning the rationing system. Since 1984, gradually, the market of alimentary goods became open, and housing in cities became marketable. These two factors enabled farmers to enter cities and stay there in a permanent way without changing their civil status (*hukou*). Third, with the development of various non-state economies, the urban labor market was gradually established, which made it possible for rural/urban migrants to seek jobs and earn their living in cities. In addition, the development of urban infrastructure required extra labor, and the diversification of consumption resulting from the improvement of living standards created the niches for the survival of small businesses. All these factors led to an increase in the demand for labor in urban areas, which accommodated the vast movement of agricultural labor from rural areas to cities in China since the 1980s. The spontaneous movement of rural population progressively broke the constraints on migration. Finally, the relaxing of the control on migration by the Government in 1984 further led to the vast rural / urban exodus. .

Given the heavy demographic pressure on land, agricultural labor productivity continues to stay at a very low level. The stagnant and low rural income strongly encourages farmers to quit working on land. However, although the shortage of food is no longer a threat, the government continues to control rural/urban migration with some direct or indirect measures for three principal reasons. First, urban residents are not willing to share their relatively higher living standards with rural residents (Zhao, 1999a). Second, urban infrastructure is not capable of supporting a great exodus to cities, due to, for example, the capacity of some public facilities. Finally, urban areas also suffer from serious unemployment problems due to the reform of State-Own-Enterprises (SOEs), and have difficulties in absorbing more labor force. The pushing forces from the countryside are strong, but the attracting forces in cities are insufficient. In this context, farmers develop non-farm activities, which do not suffer from the shortage of land, to reap the gains. Thus, the non-agricultural sector has developed rapidly in rural China, and absorbs a large quantity of the surplus agricultural labor that seeks better job opportunities and higher income.[8] The rural non-farm sector consists mainly of Township and Village Enterprises (TVEs) and the rural private economy.

The rural/urban migration and the development of the rural non-farm sector strongly modified rural household income. Non-farm activities gradually become

[7] See De Beer and Rocca (1997 : p.56) ; Zhu and Jiang (1993).

[8] Aubert (1995); Banister and Taylor (1990); Byrd and Lin (1994); Goldstein and Goldstein (1991); Zhou (1994).

an importance income source for rural households, and serve as a motor of rural growth. Table 1 shows that, the proportion of income earned from primary sector decreases with the rapid growth of rural household income; on the contrary, the proportion of income earned from secondary sector and from tertiary sector continuously increases. In 2000, the share of non-farm income reached 44.1% of the total.

Table 1: Growth and decomposition of rural household income per capita

		Income earned from productive activities (%)				
		Income earned from				
Year	Net total income (*yuan*)	Total	Primary sector	Secondary sector	Tertiary sector	Other incomes
1978	133.57	92.9	85.0	7.9	0.0	7.1
1980	191.33	88.3	78.2	10.1	0.0	11.7
1985	397.60	92.5	75.0	7.4	10.0	7.5
1990	686.31	95.8	74.4	10.3	11.0	4.2
1995	1577.74	93.8	63.2	18.2	12.4	6.2
2000	2253.42	94.5	50.4	26.6	17.5	5.5

Source: National Statistics Bureau of China, 2001: p.323.

In the following sections, we will analyze the impact of non-farm income on inequality and poverty, and examine the determinants of the participation in non-farm activities and those of the income drawn from these activities, using data from the Living Standard Measurement Survey in two Chinese provinces.

3 METHODOLOGIES

Two methods could be applied to the studies on the impact of non-farm activities on inequality and poverty. On the one hand, we can consider non-farm income as an "exogenous transfer", which adds to pre-existing total household income, and examine its impact on income distribution. Using this method, we decompose the total gain of the household and study the contribution of each source to the income level and total income distribution.[9] On the other hand, we can consider non-farm income as a "potential substitute" for farm income. Using simulations, we can compare the observed household income level and distribution with those in the absence of non-farm income.[10]

3.1 First approach: decomposition of the Gini index

The decomposition of the Gini index is often used to analyze income inequality (Pyatt et al., 1980; Stark, 1991). Suppose that $y_1, y_2, \cdots, y_K$ stand for K

[9] Leones and Feldman (1998); Pyatt et al. (1980); Stark (1991); Yao (1999).
[10] Adams (1989); Barham and Boucher (1998); Lachaud (1999).

components of household income and y_0 is the total income so that: $y_0 = \sum_{k=1}^{K} y_k$.

The Gini index of total income, G_0, can be decomposed as follows:

$$G_0 = \sum_{k=1}^{K} R_k G_k S_k \quad (1)$$

where S_k stands for the proportion of the component k in total income, G_k is the Gini index corresponding to the component k; and R_k is the correlation of the Gini of the component k with the total income.

The formula (1) allows decomposing the role of the different components in three interpretable terms: (i) the relative importance of the component k in total income, S_k, (ii) the inequality in distribution of the component in question, G_k, and (iii) the correlation of the component in question with total income, R_k.

To understand the impact of non-farm income on inequality, we compare the Gini index of total income (which includes the contribution of non-farm activities), G_0, and that of farm activities only, G_a. If G_0 is inferior to G_a, then non-farm income reduces income inequality; and vice-versa.

Furthermore, using this decomposition, we can calculate the impact of a marginal variation of a particular component on the Gini index of total income as well as on the social welfare level.[11]

Although this approach provides a direct and simple measure of how non-farm income contributes to income distribution, it does not address the economic issue of what the non-farm workers would be contributing to their families if they had not participated in non-farm activities. In other words, this approach implies some hypothesis on the independence of the participation of various activities, which is not always justified, since inside a household there exists a certain substitution between the participation of non-farm activities and farm-activities. Due to some unobservable characteristics, it is possible that the participations of various productive activities correlate (Escobal, 2001; Kimhi, 1994). Hence, it is necessary to employ a mixed estimation to exploit all available information and obtain as efficient estimators as possible. Herein follows our second approach: household income simulation.

3.2 Second approach: household income simulation

We should take the interactions between the participation in non-farm activities and that in farm activities into account when studying the impact of non-farm income on inequality and poverty. To do that, we compare the observed household income distribution with an economically interesting counterfactual income distribution-one without non-farm activities. Adams (1989) estimates a household

[11] Stark (1991: pp.258-261, 269-271).

income function for non-migrant households. Then, he applies the coefficient estimates and the endowment bundles of migrant households (without migration and remittances) to impute their earnings under a no-migration scenario, and studies the impact of remittance on inequality. In a similar research, Barham and Boucher (1998) correct the selection bias and improve the model. Using a bivariate probit model of double selection, Lachaud (1999) moves a step forward to simulate the household income obtained in the absence of remittances and migration, and examines the impact of private transfer on poverty. Following these researchers, we will first estimate the household income equations from the observed values; then simulate the household income in the case that the household participates only in farm activities using the income equation; finally we will compare the statistics of the simulated income with those of the observed income (the total gain in the presence of non-farm income), and examine the impact of non-farm income on inequality and poverty.

3.2.1 Estimation of income equations

In rural China, the implementation of the *HRS* led to the change of the mode of production. The households became productive units after that. As a rational agent, farmers naturally try to maximize their utilities by optimizing their decisions on participation in productive activities and by allocating their labor between farm activities, local rural non-farm activities, migration, etc. The income of a household obtained from a given activity depends on two factors: first, whether the household participates in the activity in question and, second, the net income that the household obtained if it participates in this specific activity. The anticipated income of a particular activity is hence the product of the probability of participation in this activity and the net anticipated income received by the household subject to participation in this activity (Taylor and Yunez-Naude, 1999: pp.55-58).

Since households that participate in non-farm activities do not spread randomly and uniformly among the sample, the estimation of the income equations might be biased. The method of Heckman (1979) is often used to correct the selection bias. Using the Probit model, we first estimate participation equation in which a dummy variable equals 1 if the household participates in the activity and 0 if not, and regress over all the independent variables:

$$\begin{aligned} P_i^* &= \alpha Z_i + \varepsilon_i \\ P_i = 1 &\Leftrightarrow P_i^* > 0 \\ P_i = 0 &\Leftrightarrow P_i^* \le 0 \end{aligned} \qquad (2)$$

where P_i^* is a non-observed continuous latent variable and P_i is an observed binary variable, which equals 1 if the household participates in the non-farm activity and 0 if not; Z_i is a vector of independent variables of the participation equation. Then, we estimate two income equations respectively, one for the

households that participate in non-farm activities, and the other for the households that participate only in farm activities by introducing the inversed Mills ratio obtained from equation (2) to correct the selection bias:

$$\log y_i = \beta_1 X_i + \gamma_1 \lambda_{1,i} + \mu_{1,i} \qquad \text{for } P_i = 1 \tag{3}$$

$$\log y_i = \beta_0 X_i + \gamma_0 \lambda_{0,i} + \mu_{0,i} \qquad \text{for } P_i = 0 \tag{4}$$

where y_i is the total household income; X_i is a vector of independent variables; $\lambda_{1,i}$ and $\lambda_{0,i}$ respectively the inversed Mills ratios of the two groups of households.[12] We consider equation (4) as the income equation in the case that household participates only in farm-activities.

3.2.2 Simulation of income

Having estimated the income equations, we can simulate the living standards in the absence of non-farm income for the households that actually participate in non-farm activities.

We predict the income obtained only from farm activities for all households, $\hat{y}_{0,i}$, using equation (4) estimated above:

$$\log \hat{y}_{0,i} = \hat{\beta}_0 X_i + \hat{\gamma}_0 \lambda_{0,i} \qquad \text{for all households} \tag{5}$$

For the households that participate only in farm activities ($P_i = 0$), their total income can be expressed by:

$$\log y_i = \log \hat{y}_{0,i} + \mu_{0,i} \qquad \text{for } P_i = 0 \tag{6}$$

where y_i and $\hat{y}_{0,i}$ stand for observed income and simulated income respectively; $\mu_{0,i}$ being the residual. For the households that have participated in non-farm activities, we do not know the unobservable part, i.e. the residual. Hence, it is necessary to simulate the residual for each household that has participated in non-farm activities.

From equation (6), we can calculate the variance of $\mu_{0,i}$ for the group of households that participate only in farm activities ($P_i^* = 0$), noted as σ_0^2. Suppose that (i) the variance of $\mu_{0,i}$, σ_0^2 is constant,[13] (ii) the variance of $\mu_{0,i}$ of the households that participate only in farm activities and that of the households that also participate in other activities are identical. Under these two hypotheses, we

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[12] $\lambda_{1,i} = \dfrac{\phi(\hat{\alpha} Z_i)}{\Phi(\hat{\alpha} Z_i)}$, $\lambda_{0,i} = \dfrac{\phi(\hat{\alpha} Z_i)}{1 - \Phi(\hat{\alpha} Z_i)}$ with ϕ and Φ stand for the density and the function of the normal distribution respectively.

[13] In fact, the variance of the error term varies across individuals in the estimation of two-step Heckman procedure (Greene, 1997: p.979). Here, we simplify our study by supposing that this variance is constant.

simulate the residual of each household that participates in non-farm activities ($P_i^* = 1$) using the Monte Carlo method:

$$\hat{\mu}_{0,i} = \sigma_0 \Phi^{-1}(r) \tag{7}$$

where r stands for a random number between $[0,1)$. Φ^{-1} the inverse of the cumulative probability function of the normal distribution. So $\hat{\mu}_{0,i}$ follows a normal distribution with the parameters $(0, \sigma_0^2)$. We define the income obtained in the case that the household participates only in farm activities by:

$$\log y_{0,i}^{'} = \begin{cases} \log y_{0,i} & P_i^* = 0 \\ \log \hat{y}_{0,i} + \hat{\mu}_{0,i} & P_i^* = 1 \end{cases} \tag{8}$$

This method can be illustrated by figure 1:

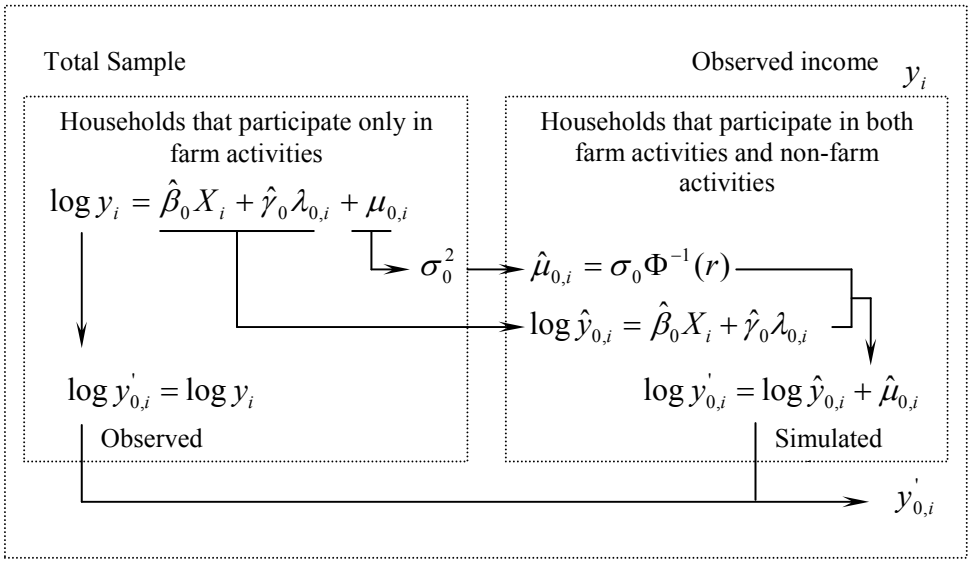

Figure 1: Illustration of the simulation of income

3.2.3 Effects of non-farm income on inequality and poverty

Having simulated the income obtained in the case that the household participates only in farm-activities, we can study the effects of non-farm income on rural inequality and poverty. In the present study, inequality is measured by the Gini index. We define the Gini index as a function of the covariance between the total income and its cumulative distribution (Pyatt et al., 1980):

$$G(y) = \frac{2\,\mathrm{cov}\left(y, F(y)\right)}{\bar{y}} \tag{9}$$

where y stands for the household income; $\bar{y}$ and $F(y)$ the average and the cumulative distribution of y respectively.

We calculate, respectively, the Gini index of the observed income, $G(y_i)$, and that of the simulated income, in case that the household participates only in farm activities, $G(y'_{0,i})$. If $G(y_i)$ is inferior to $G(y_i')$, the non-farm income reduces income inequality, and vice-versa.

Following the same idea, we study the impact of non-farm income on poverty. Poverty is captured by the class of Foster-Greer-Thorbecke (FGT) indices[14].

Considering a vector of household income in ascending order, $y = (y_1, y_2, \cdots, y_n)$ where $y_1 \le y_2 \le \cdots \le y_n$. $z > 0$ is the poverty line, which is predetermined, and $q = q(y, z)$ the number of households whose income is less than or equal to z. The general form of the measure of poverty can be expressed as follows:

$$P_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z - y_i}{z}\right)^\alpha \qquad \alpha = 0,\ 1,\ 2 \tag{10}$$

P_0, P_1 and P_2, respectively, measure the headcount ratio (the proportion of poor), the average normalized poverty gap, and the average squared normalized poverty gap. Having estimated the indices of poverty, we can calculate their corresponding standard error using the method proposed by Kakwani (1990) and test the significance of the variation of poverty.

4 DATA

In this paper, we use data from LSMS, which took place in January 1996 and February 1997 in two Chinese provinces: *Hebei* and *Liaoning*. The survey recorded the information of 787 rural households that constitute our sample of interest. These 787 households were spread over 31 villages of 15 towns or townships in 6 counties.

Household income can be divided into three categories according to the sources: (i) income earned from farm activities, including monetary income or income in kind earned from agricultural activities, livestock farming, forestry, fishing, etc.; (ii) income earned from non-farm activities, including the income earned from self-employment activities and the formal or informal wage income; and (iii) income earned from non-productive activities, for example, pensions, transfers, grants/subsidies, financial income, etc. We consider (ii) as the non-farm household

[14] Foster et al. (1984); Sen (1976).

income. Among the 787 households in the sample, 205 received only farm income, 38 only non-farm income, 537 both farm income and non-farm income, and 7 neither farm income nor non-farm income.

Two principal factors determine the decision of households on non-farm activity participation: first, the motivation related to some factors such as the relative return and the risk of agricultural production; second, the capacity of non-farm activity participation, which is determined by education, the welfare level of the household, and the access to credit, etc. (FAO, 1998: p.285). Suppose that these two factors are both determined by the intrinsic endowment of the household, which is essentially captured by the accumulation of physical capital and human capital, and by the external environment. We introduce the following independent variables in the estimation of the participation equation and income equation:

The number of workers in the household. We define here the members who are at least 15 years old and who are employed as workers. We suppose that this variable plays a positive role in non-farm activity participation.

The average number of years in school of the household members who are at least 15 years old, and its quadratic term. Many researchers show that the improvement of human capital has an important effect on non-farm income and that households with higher education level engage more in non-farm activities[15].

The proportion of members that have received some technical or professional training. This is another variable that captures the human capital accumulation of the household. Such training can facilitate the access to non-farm employment and increase the mobility of potential migrants.

The land surface of the household. For a rural household, land is the principle physical capital. The shortage of land encourages farmers to participate in non-farm activities. We introduce here the land surface and its quadratic term in order to detect whether the relationship between land and the dependant variables is non-linear.

The actual value of the house. The house is the most important property of rural households. We consider this variable as a proxy for the welfare level of the household.

The number of dependent persons (equal or over 6 years old). According to some researchers, for example Zhao (1999b), the dependent persons play the role of safeguarding the household's right to land by supplying a minimum amount of farm labor, and hence facilitating the exit of labor. We introduce here the number of dependent persons, including the household members who are not currently employed; while children below 5 years are excluded, for they do not offer labor services.

The distance between the center of the village and the nearest railway station and that between the center of the village and the nearest bus station. In general, the railway station situates in the hubs of transport/communication, or in urban centers. Hence, this distance can be used as the proxy for the transport easiness, the

[15] Berdegué et al. (2001); Deininger and Olinto (2001); Estudillo and Otsuka (1999); Kimhi (1994); Sadoulet and De Janvry (2001); Yunez-Naude and Taylor (2001).

cost of participation in non-farm activities, and the accessibility to information and to markets (Wang, 1995). The distance between the center of the village and the nearest bus station can also be used as proxy for the transport condition. If the first distance reflects the cost of a long-distance migration, the second captures rather that of the short-distance trip of the household members.

The per capita cultivable land of the village. As we have mentioned earlier, the shortage of land is an important factor that motivates farmers to quit agricultural production. We expect that this variable has a negative effect on the participation in non-agricultural activities.

Table 2 presents the average value of the variables used. We find that the participation in non-farm activities significantly improves the total household income. The average income of the households that participate in non-farm activities (10 353 *yuans*) is higher than that of the households that only participate in farm activities. However, the agricultural activity is still the major income source of rural households. The average household farm income (5 880 *yuans*) is higher than the non-farm income (3 204 *yuans*). As social security is not developed in rural areas and non-farm income is less stable than farm-income, farmers often keep and farm plots of land to compensate for the absence of safety net coverage.

Table 2: Description of sample statistics

	Average
Household income (*yuan*)	
Total income of all kinds of households	10035
Total income of households that do not participate in non-farm activities	9685
Total income of households that participate in non-farm activities	10353
Farm income of all kinds of households	5880
Non-farm income of all kinds of households	3204
Other income of all kinds of households	951
Characteristics of households	
Number of workers	2.44
Number of years in school	5.90
Proportion of members that have received some technical training (%)	8.35
Land surface of the household (*mu*)	10.45
Number of dependent persons	0.98
Actual value of the house (*yuan*)	15243
Distance between the center of village and the nearest railway station (kilometer)	42.84
Distance between the center of the village and the nearest bus station (kilometer)	0.66
Cultivable land per capita of the village (*mu*)	5.14

The lower part of Table 2 summarizes the characteristics of households. The average number of workers is 2.44 per household. The average number of years in school is 5.90, which is equal to the level of the primary school completion. The average land surface per household is 10.45 *mus*,[16] and the per capita quantity is only 2.92 *mus*, that is to say 0.19 hectares per capita: land is a scarce resource in the Chinese countryside.

[16] 1 *mu* = 1/15 hectares.

5 RESULTS AND COMMENTS

The results of our analysis are presented in two parts: first, the results of the decomposition of the Gini index; second, the results of the simulations of income.

5.1 Non-farm income and inequality: exogenous transfer

The decomposition of the Gini index is reported in Table 3. The first column shows the proportion of each income source. The contribution of the three income components to total inequality differ, with farm income in the lead (58.6%), followed by non-farm income (31.9%), and the other income sources being the least important. The observed income distribution in the sample, including the contribution of non-farm activities, generates a Gini index of 0.508; while the distribution of farm income generates a Gini index of 0.579. This signifies that household income in the absence of the contribution of non-farm activities is 14.0% more unequal than it is with non-farm income. In other words, the presence of non-farm income reduces inequality.

Table 3: Decomposition of Gini Index

	Proportion in total income (%)	Gini Index (%)	Correlation of Gini	Contribution to inequality	Effect of a 1% increase of a given income source on	
					inequality (%)	wealth (%)
	S_k	G_k	R_k	$\frac{S_k G_k R_k}{G_0}$	$\frac{\partial G_0 / \partial e}{G_0}$	$\frac{\partial W / \partial e}{W}$
Total income	100.0	0.508	1.00	100.0	-	-
Farm income	58.6	0.579	0.78	52.3	-0.06	0.65
Agriculture	31.5	0.635	0.62	24.6	-0.07	0.39
Living stock	16.0	0.729	0.45	10.3	-0.06	0.22
forestry and fishing	11.1	0.986	0.81	17.4	0.06	0.05
Non-farm income	31.9	0.828	0.79	40.8	0.09	0.23
Self-employment	27.1	0.927	0.82	40.7	0.14	0.13
Wage paying	4.9	0.767	0.03	0.2	-0.05	0.10
Other income	9.5	0.781	0.47	6.9	-0.03	0.12
Private transfer	3.1	0.895	0.16	0.9	-0.02	0.05
Others	6.4	0.849	0.56	6.0	…	0.07

"…" signifies that the absolute value is inferior to 0.01.

The distribution of farm income is more equal than that of farm income, which can partly be explained by the participation rate of farm activity (94.3%), which is higher than that of non-farm activities (68.2%). Among the non-farm activities, wage paying activities has a higher participation rate (49.0%) than the self-employment activities (39.0%). The Gini index of the former (0.767) is smaller than that of the latter (0.927). This implies that the inequality of household income

earned from self-employment activities is higher than that earned from wage remuneration.

Given the high value of the Gini index for non-farm income and the low value of the Gini index for total income, we can imagine qualitatively that farm income and non-farm income are substitutes to some extent.

The effects of a 1% increase in an income source on the Gini index of total income distribution depend on three factors: (i) the positions of the recipients of this income source in the income scale of the sample, (ii) the importance of this source in total income and (iii) the distribution of this source (Stark, 1991: p.268). Hence, though farm income represents a large proportion in total income (58.6%) and the correlation between these two is high, the contribution of farm income to total inequality is only 52.3%, because the value of its Gini index is relatively low. A 1% increase in farm income would reduce the Gini index by 0.06%. On the contrary, non-farm income plays a more important role in determining total inequality (40.8%) than total income (31.9%), which implies a positive elasticity. The contribution of the non-productive income in total income is only 9.5%, and its Gini correlation is rather weak (0.47), so its contribution to Gini index is quite small (6.9%).

We turn to examine the welfare changes resulting from a 1% increase in a given source. The variation of farm income results in the greatest welfare change – a 1% increase in the farm income will lead to a 0.65% welfare increase. However, the impact of non-farm income is also important, since a 1% increase in non-farm income will lead to a 0.23% increase of wealth. On the contrary, the role of the other incomes is less important. In short, our results show that the increase of non-farm income has the second largest impact on welfare improvement, following that of farm income.

5.2 Non-farm income, inequality and poverty: potential substitute

We estimate first the participation equation and income equation. These two equations allow us, on the one hand, to specify the determinants of the participation in different activities and those of the total income; and on the other hand, to simulate the income in the case that the household does not participate in non-farm activities. Then we will compare the Gini indices and FGT indices.

5.2.1 Estimation of participation equation and income equation

Table 4 shows the estimation results of the participation equation in non-farm activities, using the Probit model. We process different estimations for each type of non-farm activities. In general, the participation in wage paying activities is rather an individual decision, while the participation in self-employment activities is a choice of the household as a whole. In addition, wage paying activities are often related to the spatial mobility, for the members concerned could quit the household and go to work outside. However, self-employment activities are usually local family work.

Table 4: Estimation of participation equations

	Regression 1: Non-farm activities	Regression 2: Self-employment activities	Regression 3: Wage paying activities
Number of workers	0.436***	0.061	0.463***
	(6.54)	(1.16)	(8.10)
Average number of years in school	0.143*	0.296***	-0.060
	(1.68)	(3.72)	(-0.75)
Average number of years in school in square	-0.002	-0.021***	0.013*
	(-0.32)	(-3.15)	(1.93)
Proportion of household members that have received some technical and professional trainings	0.859**	0.481*	0.181
	(2.32)	(1.76)	(0.63)
Land surface of the household	-0.031***	-0.004	-0.017**
	(-4.01)	(-0.30)	(-2.19)
Land surface of the household in square (/100)	0.012*	-0.024	0.008
	(1.82)	(-0.81)	(1.22)
Number of dependent persons	0.046	0.126**	-0.107**
	(0.77)	(2.49)	(-2.06)
Actual value of the house (/100000)	0.793*	0.689**	0.003
	(1.92)	(2.28)	(0.01)
Distance between the village center and the nearest railway station	-0.002*	0.001	-0.004***
	(-1.93)	(1.25)	(-3.98)
Distance between the village center and the nearest bus station	-0.087	-0.140***	0.015
	(-1.55)	(-2.60)	(0.28)
Cultivable land per capita of the village	-0.056***	-0.002	-0.054***
	(-2.62)	(-0.10)	(-2.64)
Constant	-0.562*	-1.470***	-0.662**
	(-1.82)	(-4.88)	(-2.23)
Maximum likelihood in log	-381.900	-498.386	-469.798
Pseudo R^2	0.167	0.053	0.139
Number of observation	787	787	787

The *t-student* are in brackets. *** significant in 1%; ** significant in 5%; * significant in 10% .

First, we find that households rich in labor are more likely to participate in non-farm activities, generally speaking. The problem of surplus farm labor (or disguised unemployment) became explicit in rural area after the implementation of HRS. As the quantity of the cultivable land is very limited, the large number of surplus farm labor keeps the per capita rural income at a low level, which pushes labor leaving the farms. However, the number of workers does not influence the participation in self-employment activities, that is to say, the non-farm work of the household. It can be explained by the fact that self-employment activities require entrepreneurship. In addition, the dependent persons themselves can also partially

participate in some non-farm work of the household, such as working in boutiques, restaurants, hotels, food processing, etc. So, the number of workers loses its impact on the participation in self-employment activities. On the contrary, the participation in wage paying activities and agricultural activities are rather substitutes in terms of the allocation of total household endowment of time. Other things being equal, a larger household will have a lower opportunity cost of having some members working outside.

Another variable related to household human capital accumulation is the proportion of the members that have some technical and professional training. This variable only influences the participation in self-employment activities. The special trainings can improve the competence of the household members in question and facilitate their participation in non-farm work, which often requires some knowledge of technology and management.

Our results suggest that there exists a quadratic relation in U form between the land surface of the household and the participation of non-farm production. However, the probability of non-farm production participation begins to increase when the land surface reaches 136 *mus*, which is far higher than the average value. We hence argue that the probability of non-farm production participation monotonically decreases with land surface, and not in U form in this case, i.e., the participation in non-farm activities is essentially motivated by the land shortage. However, the possession of land does not play a role in self-employment activity participation. The reason may lie in, as we mentioned above, farm and non-farm activities do not completely ruling out each other.

The number of dependent persons plays a positive role in the participation in self-employment activities and a negative role in wage paying activities. We argue that the existence of dependent persons impedes other household members from leaving the household and working outside, but makes participation in self-employment easier for the household.

We find that the actual value of the house plays a positive role in self-employment activity participation. The house, being the most important property holding, can represent the initial welfare level of the household to some extent. If the family non-farm activity requires a large sum of upfront investment or if it is risky by nature, the richer households are better off in participating for they face lesser budget constraints and they are more capable of overcoming the initial barriers.

The distance between the village center and the nearest railway station does not influence the participation in self-employment activities, but it has negative effects on the participation of wage paying activities. On the one hand, this distance reflects the migration cost to some extent, on the other hand, the railway station is generally situated in cities, which offers more job-opportunities to out-migrants. Hence, being close to cities encourages people to seek wage paying activities. In contrast, the participation in non-farm activities is negatively associated with the distance between the village center and the bus station in a significant way. Bus stations are often situated in the markets of the villages, where restaurants and hotels concentrate. Evidently, households living close to bus stations are more

likely to participate in family non-farm activities. In addition, being close to the bus station would encourage the commute between village and fairs or cities, which makes household non-farm exploitation easier.

Finally, as we expect, the shortage of land in the village acts as a repulsion force that drives rural labor to quit the land and participate in non-farm activities.

Table 5 shows the results of the estimations of the income equations, with regression 1 as the selection equation.

Table 5: Estimation of income equations

	Regression 4: Households participating in non-farm activities	Regression 5: Households not participating in non-farm activities
Number of workers	-0.121*	-0.187
	(-1.93)	(-1.28)
Number of average years in school	0.164**	-0.124
	(2.48)	(-1.21)
Number of average years in school in square	-0.015***	0.011
	(-3.05)	(1.06)
Proportion of household members that have received some technical or professional trainings	0.174	-0.021
	(0.82)	(-0.04)
Land surface of the household	0.049***	0.079***
	(5.20)	(6.52)
Land surface of the household in square (/100)	-0.023**	-0.032***
	(-2.04)	(-5.00)
Ratio of inversed Mills	-0.834***	0.976**
	(-2.65)	(2.41)
Constant	8.644***	7.379***
	(22.15)	(28.54)
R^2	0.125	0.353
Number of observations	575	207

The *t-student* are in brackets. *** significant in 1%; ** significant in 5%; * significant in 10% .

We find that the number of workers does not significantly increase household income, which confirms the fact in rural China, richness in labor does not implies economy of scale – constrained by the shortage of the other productive resources,[17] The results shed light on the relation in U form between years in school and income of the households that participate in non-farm activities. However, education does not influence income level for households that only participate in farm activities, which suggests that the return to education in traditional agriculture is weak. The effects of the proportion of members with some technical and professional training are not significant. The land surface held by households has a significant impact on household income, in particular, for the households that earn income only from farm activities. The estimation shows that household income increases with the land surface held by the household. We use the results of

[17] The marginal impact of the number of workers is even slightly negative for households that participate in non-farm activities.

regression 5 to simulate the income of the households that participate in non-farm activities in the case that they participate only in farm activities.

5.2.2 Effects of non-farm income on inequality and poverty

Having simulated the income of the households that participate in non-farm activities, in the case that they participate only in farm activities, we can compare the Gini index of this simulated income with the observed income. Table 6 shows the results. We find that the Gini index of the observed income is lower than that of the simulated income in the absence of non-farm activities. It suggests that the participation in non-farm activities reduces income inequality. In the absence of non-farm income, the value of the Gini index of the total household income and that of per capita income would increase by 3.8% and 4.0% respectively.

Table 6: Comparison of the Gini indices

	Total household income	Household income per capita
Observed income	0.505	0.502
Simulated income in the case that the household had participated only in farm activities	0.524	0.522

In order to examine the effects of non-farm income on poverty, we should first determine the poverty line. According to the China statistics yearbooks, households in the first (poorest) two deciles of annual per capita income scale are considered as poor. The poverty line is hence fixed at 900 *yuans*, so that 20% of households in our sample, in terms of annual household income per capita, are below this threshold.

Table 7 presents the indicators for all households. Column A shows the parameters of the actual situation for the households that participate in non-farm activities: the average total income, the average income per capita, and the corresponding indicators of poverty incidence (P_0), poverty depth (P_1) and poverty severity (P_2). Column B presents our simulation results, which captures poverty in the absence of non-farm income. The rates of variation are calculated in comparison with the initial situation, which indicate the effects of participation in non-farm activities. A negative sign implies a reduction of poverty. In addition, the t-test proposed by Kakwani (1990) allows us to test if the effect of non-farm activity participation on poverty reduction is significant.

We find that the participation in non-farm activities does not influence the average living standard to a large extent, measured by total household income as well as by per capita income. On the contrary, all the rates of variation are significantly negative, which implies that the participation in non-farm activities largely reduces rural inequality. The inclusion of non-farm income leads to a decrease in the household poverty incidence (P_0) by 6.1%, i.e. a 29.5% decrease in relative sense; a decrease of the poverty depth (P_1) from 11.4% to 8.2% , i.e. a

39.0% decrease in relative sense; and a decrease of the poverty severity (P_2), from 6.4% to 4.9%, i.e. a 30.6% decrease in relative sense. The strong impact on poverty depth suggests that the participation in non-farm activities reduces the income gap among the poor. And, the impact on poverty severity, which assigns higher weights to the poorest of the poor, suggests that the participation in non-farm activities improves the welfare of the poorest disproportionately. In other words, the poorest households will benefit from a higher poverty reduction resulting from participation in non-farm activities.

Table 7: Comparison of the FGT indices

	Observed income (A)	Simulated income in the case that households had participated only in farm activities (B)	
Average total income (*yuan*)	10035	9928	
Average income per capita (*yuan*)	2809	2808	
FGT indices (%)			
P_0 - poverty incidence	20.7	26.8	
P_1 - poverty depth	8.2	11.4	
P_2 - poverty severity	4.9	6.4	
Rate of variation: A/B-%			
Average total income		0.48	(0.15)
Average income per capita		0.07	(0.01)
FGT indices			
P_0 - poverty incidence		-6.1***	(-2.73)
P_1 - poverty depth		-3.2***	(-2.87)
P_2 - poverty severity		-1,5*	(-1.79)

The numbers in brackets are the values of the statistics defined by Kakwani (1990: p.9-10), which test the null hypothesis of insignificance of difference in poverty indices , *** the gap is significant in 1%; ** significant in 5%; * significant in 10% .

Using the estimators of Kernel density, we illustrate the distribution on income per capita of the poor households in Figure 2. The two curbs, respectively, stands for (i) the estimators of Kernel density for the observed income per capita, i.e. the income observed in the presence of non-farm income; and (ii) the estimators of Kernel density for the simulated income per capita, i.e. the income simulated in the absence of non-farm income. We find that the distribution of the former leans towards the upper limit – the poverty line (900 *yuans*); while, the distribution of the latter is closer to a normal distribution, i.e. a more uniform distribution. Consequently, the difference in distributions between the observed and simulated income suggests that the non-farm income improves the living standards of the poorest households and hence reduces their weights in the poor as a whole.

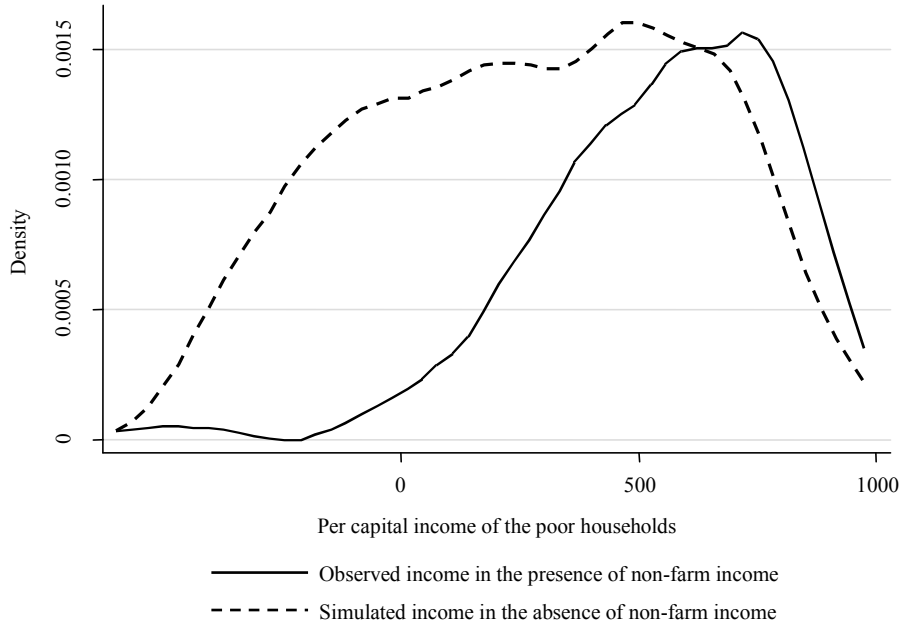

Figure 2: Distribution of per capita income of the poor households

6 CONCLUSIONS

Since the implementation of the economic reforms, rural non-farm activities have witnessed a rapid growth, which has changed the Chinese countryside. Although farm-income is still the principal source of rural households, non-farm income plays a more and more significant role in total income. Our studies show that 68% of the rural households have non-farm incomes, and non-farm incomes represent almost 32% of the total household resources on average. The average income of the households that have participated in non-farm activities is higher than that of the households that only participate in farm activities. Non-farm activities not only absorb a large quantity of surplus agricultural labor, but also improve the rural standard of living.

A preliminary analysis, based on the decomposition of the income sources, shows that non-farm income, as a whole – considered as exogenous – tends to have an egalitarian effect on earnings in rural China. These results are different from those of many other studies. Insofar as the participation in different activities interacts with each other, it seems more appropriate to examine the impact of non-farm income relative to inequality and poverty, considering this income as a potential substitute for farm income. In this respect, the econometric analyses, which simulate the living standard that the households that actually participate in non-farm activities should have in the absence of non-farm income, confirm the results of the income decomposition and support the idea that the participation in

non-farm activities mitigates, noticeably, rural poverty. Our results indicate that the participation in non-farm activities reduces rural poverty by 6.1%. It also reduces, considerably, poverty depth and poverty severity, which suggests that participation in non-farm activities, not only reduces income gap between rural poor households, but also disproportionately improves the household income of the poorest.

In fact, in rural China, following the implementation of HRS, the basic budget unit became the household. Land was allocated as a function of the household size. As rural households do not have the property right but only utilization right over the land they cultivate, the land market does not exist. Hence, farm income is relatively stable because it is impossible to increase the size of farm work. Because of this, non-farm activities may serve as a solution for rural surplus labor. The participation in non-farm activities provides an addition income source to rural households, which improves their living standards and reduces their income gaps. As Gillis et al. (1983: p.560) suggest: "To the extent that small enterprises can generate more employment per unit and can locate in smaller cities and towns, they will promote greater income equality among families, among regions, and between rural and urban areas."

The HRS significantly increases farm productivities. However, the weakness of this system began to appear recently in the 1990s. For example, the division of land into small plots strongly impedes the development of agricultural modernization. Given China's geography and existing technology, in the short run, agriculture development cannot mainly rely on land surface increase or on technical improvement, but on regrouping the plots and allocating them to experimental farmers to seek greater economies of scale. Therefore, a great part of the surplus agricultural labor must leave the agricultural sector, and non-farm activities will thus continue to play a critically important role in rural development and poverty reduction.

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