

# The Influence of Labor Force Transfer and Its Differentiation on Farmland Input Structure- Take Two Counties (Cities) in Jiangxi Province as an Example

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**Abstract:** Based on the survey data of farmers in fengcheng city and suichuan county of Jiangxi Province in 2015, this paper verifies the influence of labor transfer and its differentiation on the structure of agricultural land input. Overall, labor transfer has significant negative and positive effects on labor input and capital input respectively. Judging from the differentiation mode of labor transfer, local transfer and mixed transfer have significant negative effects on labor input. The mixed transfer has a significant positive impact on capital investment, showing the differentiated impact of labor transfer and its differentiation on the structure of agricultural land investment. Finally, according to the results of empirical analysis, the corresponding policy recommendations are put forward.

## 1. Introduction

Over the past 40 years of reform and opening up, China's economic development has achieved remarkable achievements, accompanied by a large-scale transfer of rural labor to urban and non-agricultural sectors. According to the national monitoring report on migrant workers in 2018 issued by the National Bureau of statistics, in 2018, the total number of migrant workers in China reached 288.36 million, and a large number of young and middle-aged people in rural areas chose to go out to work. It has become a common phenomenon that farmers work concurrently [1].

In reality, in addition to observing the large-scale transfer of rural labor to the non-agricultural sector, it is also found that the input of factors in agricultural production has increased. For example, the amount of chemical fertilizer applied per hectare of cultivated land in China has increased from 128 kg in 1980 to 457 kg in 2010, which is nearly four times the world average [2]. In 2014, the number of pesticide use by Chinese farmers increased from 2-3 times around 2000 to 6-8 times [3]. What we should pay attention to is whether there is an internal correlation mechanism between the large-scale transfer of rural labor force and the increase of agricultural production factor input?

Academia has paid more attention to the above problems. Some studies have found that labor transfer or non-agricultural employment helps farmers to increase productive investment [4], increase land purchase [5], and promote the application of pesticides and fertilizers [6-7]. Some studies have found the opposite relationship between the two, that is, the higher the degree of labor transfer, the lower the agricultural input [8-9]. Other studies have found that the safety of land property rights is closely related to agricultural production input or investment [10-11]. Obviously, the academic community has not reached a consensus on this issue. There are two reasons: First, the sample data and research areas used by scholars are different. These differences mean different limitations and their conclusions may be different. Second, the calculation methods of labor transfer or agricultural production input indicators are inconsistent. As far as labor transfer is concerned, the 2018 National Migrant Workers Monitoring Report shows that the eastern coastal cities are no longer the primary choice for rural laborers to go out for work. With the gradual advancement of China's new urbanization and the employment discrimination of migrant workers in the urban labor market, the differentiation of rural labor migration patterns will be accelerated [12]. However, the academic circle has not paid enough attention to the impact of labor transfer mode differentiation on farmland investment, and the conclusion of general research on the impact of labor transfer on

farmland investment is not targeted. Is there any difference in the impact of different labor transfer modes on the input structure of farmland? From the perspective of labor transfer and its differentiation, it is of great significance to explore its impact on the input structure of agricultural land in order to improve farmers' production profits and control rural non-point source pollution.

## **2. Analysis Framework and Research Hypothesis**

Farmers' investment in farmland includes two types: one is capital investment, including capital investment of renting machinery, chemical fertilizers, pesticides, seeds, films and other elements; The other is labor input. At the same time, according to the on-the-spot investigation in this article, labor transfer is divided into local transfer and off-site transfer. Local transfer means that labor is engaged in non-agricultural employment within the township where the household registration is located. Off-site transfer means that the labor force is engaged in non-agricultural employment outside the township where the household registration is located. In addition, labor force transfer may bring about two results: first, farmers directly withdraw from agricultural production; The second is to continue to engage in agricultural production, but adjust the input combination of factors so as to optimize the use of factors. Therefore, the implicit assumption of this study is that farmers continue to engage in agricultural production.

### **(1) Analysis of the impact of labor transfer on the labor input of farmers**

The transfer of labor force by family members of farmers will significantly reduce the agricultural labor time of the transferred labor force itself, because the total time of a labor force is fixed, and participating in labor force transfer means that the time allocated to agricultural production decreases. Macroscopically, the survey found that with a large outflow of rural labor force, the labor hour input per rural household decreased rapidly. The average working hour input of rural households decreased from 3,500 working hours in 1991 to 2,000 working hours in 2000, while the average working hour input of rural households in 2009 was only 1,400 working hours [13]. At the same time, rice production is an agricultural activity that needs to consume a certain amount of physical strength. The physical strength of women and the elderly left behind in the countryside is relatively poor. They need more labor to complete the same agricultural work. Although some links of rice production have been mechanized to reduce certain labor time, a certain amount of labor input is still needed in transplanting, applying medicine, fertilization, irrigation and other links. At this time, the reduction of farming labor forces them to reduce the intensity of agricultural labor [9]. Therefore, this paper puts forward the research hypothesis one: the labor transfer of family members will have a negative impact on the labor input of farmland, that is, the labor loss effect exists.

### **(2) Analysis of the impact of labor transfer on the capital investment of farmers**

Capital investment includes chemical fertilizers, pesticides, machinery, films and seeds. Some of these elements are not that the more investment, the better. For example, herbicide can remove weeds in rice fields within a certain input range, but too much input will affect rice growth. However, farmers tend to increase factor inputs to replace lost labor. For example, increased input of herbicides can partially replace manual weeding. The relationship between input of other factors and labor transfer is rather complicated. For example, the application of chemical fertilizers often requires manual assistance, which is very common in small-scale farming in underdeveloped areas. As one of the important factors in agricultural production, fertilizer application needs the assistance of labor input. At this time, the two are complementary. Labor transfer has a negative impact on fertilizer application. However, the increased application of chemical fertilizers can replace the labor input of field management to a certain extent, and the two show a substitution relationship at this time. On the other hand, although the remittance income effect brought about by labor transfer provides farmers with sufficient liquidity, it does not mean that farmers will use funds to purchase capital elements. The purpose of remittances is mostly used for housing construction and children's education. And purchasing durable consumer goods, it will have a crowding out effect on agricultural capital investment. Therefore, this paper proposes the research hypothesis 2: the labor transfer of family members will induce farmers to substitute capital for labor, but the degree of impact needs to be tested in practice.

### (3) Analysis of Differential Impact of Local Transfer and Off-site Transfer on Farmland Investment

There may be differences in the impact of local transfer and relocation on labor input. Generally speaking, the labor loss effect of local transfer may be smaller than that of remote transfer, because the working place of local transfer is local, and farmers can form a part-time working state of farming during busy farming, working during idle farming and caring for rice growth. The labor loss effect of local transfer may be manifested in rice production management links, such as irrigation, which is a production management link that requires a certain amount of labor input during slack seasons (such as supervising other farmers to cut off labor input from their own irrigation water sources). Local transfer farmers may reduce labor input in irrigation due to excessive opportunity cost. However, farmers can also choose to irrigate before starting work in the morning and after finishing work in the evening, so that labor input will not be affected. However, it is difficult for farmers who have been transferred from other places to do so. Because the opportunity cost of family members returning home to work is high, they may come back when they are busy in farming, and they will work in other places at other times. Therefore, from this point of view, the labor input of migrant farmers may be less than that of local transfer.

Local transfer and non local transfer may also have different effects on the capital investment of farmers. For example, for the input of chemical fertilizer, since there are two ways of applying fertilizer, i.e. multiple application and less application and more application, the total amount of fertilization in the latter is usually more than that in the former, and the number of labor days required for the latter is relatively small. Therefore, when the opportunity cost of farming is relatively small, local transfer farmers tend to choose the former fertilization method. On the contrary, transfer farmers from different places tend to choose the latter fertilization method. But in terms of machinery investment, local transfer and off-site farmers may not be much different. Therefore, the impact of local and off-site transfers on capital investment needs to be further tested in the empirical evidence.

## 3. Model Setting, Variable Selection and Data Source

### (1) Model settings

In order to test the difference effect of local transfer and non local transfer on labor input and capital input, this paper constructs the following regression model:

$$Y = \alpha_0 + \alpha_1 migration + \alpha_2 locoffarm + \alpha_3 Z + \varepsilon \quad (1)$$

In formula (1), it refers to the labor input or capital input of farmers. Labor input refers to the input of their own labor, excluding the input of hired labor; capital input includes the input of machinery, pesticides, fertilizers, seeds, films, irrigation, information technology, etc. *migration* indicates relocation; *locoffarm* means local migration; *Z* represents a series of control variables, including householder characteristic variables, family characteristic variables, land property rights variables, village characteristic variables, etc.  $\alpha_0$  means constant term;  $\alpha_1 \sim \alpha_3$  represents regression coefficient;  $\varepsilon$  represents a random perturbation term.

### (2) Variable selection

#### ① Farmland input variable

Farmland input variables include labor input and capital input. In this paper, we use the input of our own labor force as the variable of labor input, and exclude the input of employed labor force. The reason is: using the amount of labor input from one's own family can better see the strength of the labor loss effect of local transfer and relocation.

Capital input includes the total cost of seeds, chemical fertilizers, farmyard manure, agricultural machinery, pesticides, irrigation, film greenhouses, information technology, etc. The amount of capital input is based on the material expenditure of farmers' households related to per mu rice production (including single-cropping rice and double-cropping rice) in the year, and the unit is

"Yuan/Mu".

②Labor transfer variable

In order to clarify the labor transfer and its differentiation mode, this paper classifies the farmers whose only family members are transferred locally as local transfer households, and calls the farmers whose only family members are transferred in different places as remote transfer households. Those who have no family members to participate in labor transfer are pure service farmers. The mixed transfer households are those households whose family members are both local and participating in labor force transfer in other places. At the same time, taking pure agricultural households as reference group, set local transfer households and remote transfer households as virtual variables. If it is a local transfer account, it is 1; otherwise, it is 0. If it is a mixed transfer account, it is 1; otherwise, it is 0; if it is a non local transfer account, it is 1; otherwise, it is 0.

③Characteristic variables of rural labor force

The characteristic variables of peasant household labor force include the age of the head of household, the years of schooling of the head of household and the dependency index. As the decision-maker of the household, the head of the household has some characteristics that will affect the input of agricultural land. For example, the older the head of household is, the more experienced he is, and the more advantageous he is in terms of factor matching. The dependency index refers to the proportion of the population under the age of 17 and over 65 in the total population of the family. The higher this proportion means that the main labor force of the family will be restrained, thus affecting the input of agricultural land.

④Family characteristic variable

Family characteristic variables include the value of family agricultural assets. The agricultural assets referred to in this article include threshing machines, harvesters, threshers, water pumps, oxen, etc. The unit is "Yuan". It is expected that the greater the value of agricultural assets, the less the labor input of farmers, which is due to the role of factor substitution. At the same time, it is expected that the value of agricultural assets is positively related to the capital input of farmers, that is, the greater the value of agricultural assets, the more capital input of farmers.

⑤External environment characteristic variable

The characteristics of the external environment include two variables: whether the land has been adjusted and the distance between villages and towns. Whether land adjustment has been carried out or not will have a greater impact on farmers' expectations. If there is experience of land adjustment, farmers' expectations will be unstable, and then there will be the possibility of predatory management, which will have a negative impact on farmland input. The distance from village to town reflects how close the farmers are to the market. The closer the distance is, the more sufficient the market information the farmers get, thus having a positive impact on agricultural land input.

In addition, this paper also identified the fengcheng city virtual variables, the specific variable definitions are shown in Table 1.

Table 1 Variable definition and assignment

Variable name		Definition	Mean value	Standard deviation
Farmland input	Labor input	Workers/Mu	7.87	7.93
	Capital investment	Yuan/Mu	446.33	169.04
Labor transfer	Local transfer	1= Yes, 0= No.	0.25	0.43
	Mixed transfer	1= Yes, 0= No.	0.18	0.38
	Offsite transfer	1= Yes, 0= No.	0.61	0.49
Characteristics of farmers' labor force	Age of head of household	Years	55.51	10.06
	Years of education for head of household	1= male, 0= female	0.96	0.20
	Supported index	See above	0.23	0.17
Family characteristics	Value of agricultural assets	Ten thousand yuan	0.73	5.25
Characteristics of external	Has there been any land	1= Yes, 0= No.	0.60	0.49

environment	readjustment			
	Distance from village to town	km	5.46	3.84
Dummy variable	Fengcheng city	1= Yes, 0= No.	0.58	0.49

### (3) Data source

The data in this paper comes from the survey of farmers in fengcheng city and suichuan county in January 2015. In order to ensure the quality of the research, the research strictly follows the following principles: First, in order to ensure the reliability of the samples, the research group based on the county (city) topography and population distribution characteristics. In each county (city), 5-8 villages (towns) were selected. According to the size of villages (towns), 5-10 villages were randomly selected in each village (town), 20-30 farmers were randomly selected in each village, and 817 farmers in 42 villages were selected. Second, the investigators involved in the survey are all graduate students of our school. Before the formal survey, the investigators shall be provided with unified survey training, and the relevant content involved in the questionnaire shall be explained to clarify the connotation of the relevant issues, so as to ensure the authenticity and reliability of the survey content to the greatest extent. Excluding the samples that are not suitable for this study and incomplete data, the final sample used in this paper is 539 households, and all of them are rice production households.

## 4. Empirical analysis

### (1) Descriptive statistics

Table 2 The relationship between different labor transfer models and agricultural land input

Labor transfer mode	Labor input (Works / Mu)	Capital investment (Yuan / Mu)
Local transfer account	6.68	426.32
Mixed transfer account	6.78	487.40
Remote transfer account	8.45	449.52

Table 2 reports the relationship between different labor transfer modes and the labor input and capital input of farmers. The table shows that with the deepening of labor transfer, the labor input of the family gradually increases. This may be due to the fact that the local transfer households have been here for a long time, are familiar with the local market environment, have formed a good cooperative relationship with the employed labor force, and are easier to employ labor force to supplement the shortage of their own labor force. However, it is difficult for relocated households to achieve this. Under certain conditions, they can only increase their labor input. Capital investment increases gradually with the deepening of labor force transfer. Both mixed transfer households and remote transfer households have more capital investment than local transfer households.

### (2) Regression analysis

The regression analysis in this paper is divided into two steps. The first step is to return the overall relationship between labor transfer and farmland input. The second step is to return the relationship between the differentiation mode of labor transfer and farmland input. In order to reduce the adverse effect of heteroscedasticity on estimation results, robust estimation is adopted in regression.

①The overall relationship between labor transfer and farmland investment. The regression results between the two are reported in Table 3. In this paper, the time proportion of farmers participating in labor transfer is used to express labor transfer, that is, the ratio of labor transfer time to total time.

Table 3 Estimated results of labor transfer and agricultural land input

Explanatory variable		Labor input	Capital input
Labor transfer	Proportion of labor transfer time	-0.025*	0.054*
Characteristics of peasant household labor force	Age of head of household	0.003	-0.002
	Years of education for head of household	-0.052*	0.016*
	Supported index	0.330**	-0.049

Family characteristics	Value of agricultural assets	0.004**	0.001
Characteristics of external environment	No land adjustment	-0.011	0.020
	Distance from village to town	0.006	0.003*
Dummy variable	Fengcheng city	-0.245***	-0.142*

Note: \*, \*\*, \*\*\*, respectively represent the significance level of 10%, 5%, 1%

In terms of the impact of labor transfer on labor input, labor transfer has a significant negative impact on labor input. On average, the proportion of labor transfer time changes by one unit and the labor input per mu changes by 2.5%, which verifies our research hypothesis 1. This shows that with the deepening of the labor transfer of farmers, the labor input into agricultural production will be significantly reduced.

In terms of the impact of labor transfer on capital investment, labor transfer has a significant positive impact on capital investment per mu. On average, the proportion of labor transfer time changes by 1% units, and the capital investment per mu should increase or decrease 5.4 yuan, which verifies our research hypothesis 2. This shows that with the deepening of the labor transfer degree of farmers, labor input has decreased, but due to the existence of factor substitution, farmers tend to use other factors of production to replace the reduced labor force.

Among the characteristic variables of peasant households' labor force, the education level of the head of household has a significant positive effect on both labor force input and capital input. This shows that the probability of obtaining non-agricultural employment opportunities increases with the improvement of the education level of the householder. As the opportunity cost of farming increases, the input of labor force will naturally decrease, replacing labor with other factors and increasing the input of capital. The dependency index has a significant positive effect on the input of labor force per mu, which may be due to the fact that the higher the dependency index, the greater the pressure on the family's survival, and the more farmers tend to put labor force into agricultural production in order to obtain more output and raise more people. Among the family characteristic variables, the value of agricultural assets has a significant positive impact on labor input, indicating that with the increase of agricultural assets value, labor input will increase. This is because the input of agricultural assets also needs to be accompanied by the input of labor. The greater the value of agricultural assets, the more input, the more labor is needed. Among the variables of external environment characteristics, the distance between villages and towns has a significant negative impact on capital investment, which shows that the farther away villages are from towns, the more difficult it is to obtain effective market information and sufficient means of production, so capital investment will be reduced. The virtual variable of Fengcheng City has a significant negative impact on labor input and capital input, which shows that agricultural land input is greatly affected by the region.

②The relationship between different labor transfer modes and farmland input. Table 4 reports the regression results of different labor transfer modes and farmland input.

Table 4 Estimated results of different labor transfer models and agricultural land inputs

Explanatory variable		Labor input	Capital input
Labor transfer	Local transfer	-0.165*	-0.023
	Mixed transfer	-0.205**	0.114**
	Offsite transfer	-0.002	0.036
Characteristics of farmers' labor force	Age of head of household	0.001	-0.002
	Years of education for head of household	-0.046*	0.019*
	Supported index	0.288*	-0.011
Family characteristics	Value of agricultural assets	0.004**	0.001
Characteristics of external environment	No land adjustment	-0.012	0.011
	Distance from village to town	0.006	-0.003
Dummy variable	Fengcheng city	-0.231***	-0.141***

Note: \*, \*\*, \*\*\*, respectively represent the significance level of 10%, 5%, 1%

From the regression results, local transfer and mixed transfer have significant negative effects on labor input. This shows that after non-agricultural employment of household labor force, farmers will reduce the labor force allocated in agricultural production. In addition, rice production is a seasonal economic activity that requires a large amount of labor input during busy farming seasons. In addition to their own labor input, local transfer households and mixed transfer households are familiar with the local market environment and form a good cooperative relationship with the employed labor force. It is easier to use the employed labor force to supplement the shortage of their own labor force. However, it is difficult for relocated households to do this, so most of them are their own labor input.

From the perspective of the differentiation model of labor transfer and the regression results of capital investment, only mixed transfer has a significant positive impact on capital investment. This is because the rice growth process requires field management, such as fertilization and pesticide application, and the relocation and mixed relocation tend to be one-time operations, replacing the lost labor force with less and more factor inputs, thus having a significant positive impact on capital investment.

## 5. Summary

Under the background of the continuous expansion of the scale of rural labor force transfer, the influence of labor force transfer on agricultural business activities has been paid close attention to by the academia. Based on the survey data of farmers in hilly areas of Jiangxi Province, this paper analyzes the influence of labor force transfer and its differentiation on the input structure of agricultural land, and explores whether different transfer modes have differentiated effects on the input structure of agricultural land. The results show that local transfer and mixed transfer have a significant negative impact on labor input, while mixed transfer has a significant positive impact on capital input, which verifies the hypothesis of this study.

Based on the conclusions of this study, the policy implications are as follows: (1) it is expected that the degree of labor transfer will be further deepened in the future. Therefore, in order to make up for the loss of labor, local governments should vigorously support the development of agricultural production socialized services and the vacuum of labor transfer. (2) Labor transfer will increase the input of capital factors. It is necessary to be aware that labor transfer may increase the input of pesticides and fertilizers. This is not conducive to maintaining the sustainable productivity of the land. The government should guide farmers to use pesticides and fertilizers reasonably to reduce agricultural pollution and soil damage. (3) For hilly areas similar to Jiangxi Province, local governments should vigorously develop local non-agricultural industries to attract local farmers to transfer. Therefore, on the one hand, farmers can engage in non-agricultural industries to increase their income, on the other hand, they can take into account agricultural production to avoid too serious effect of labor loss, which has a negative impact on agricultural production.

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