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Market Interlinked, System Non-specialized: Farmland Transfer Impacts on Rural Labor Mobility

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Abstract A survey was conducted on Canton of China land owners transferring farmland property rights and migrating from rural area to urban. The research objective was to determine how the farmland property rights transfer impacted rural labor migration behavior. Theoretical models proved that transfer of farmland would drive rural labor migration. Empirical results showed farmland transfer market interlinks with rural labor market in a non-specialized production system.

Keywords: *farmland transfer, labor mobility, specialization, spatial spillover*

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1. Introduction

The objective of the paper is to examine the impacts of farmland transfer on rural labor mobility. It is being increasingly appreciated in the literature on agrarian development that many of the key issues cannot be, analyzed without an understanding of the nature of interlinkage of factor markets (particularly those of land and labor) in the specific institutional context of a poor agrarian economy [1]. The economists work out hypotheses about the relation of the equilibrium percentage of area under tenancy with land quality factors, labor-intensity of crops, extent of unemployment, interest rates, weather uncertainty, etc [2]. Not only do rural markets abound with examples of such deals, but it is increasingly being appreciated by economists, aided by the findings of social anthropologists, that interlinkage could be the key to understanding many puzzling characteristics of rural markets [3].

Basically, the main literature on factor market linkage could be divided into two branches. The one surrounds credit market and refers to other market, such as labor market and land market [4]. For instance, [5] examines interlocked transactions between traders and landowners in the cotton and wheat markets in Sindh that facilitate the provision of credit by traders. It is concluded that the case examined provides an example where traders lend to landowners in a segment of the credit market that approximates competitive behavior, without surplus extraction by traders. [6] analyze a landlord and a moneylender as two players and demonstrate that there exist circumstances in which interlinkage is superior, even with nonlinear loan contracts, a result that carries over when there is moral hazard.

Although much attention recently has been devoted to agrarian credit markets, the potential for interlinked credit marketing arrangements for particular cash crops to promote food crop intensification remains undiminished [7]. Results indicate that households engaging in interlinked marketing programs for selected cash crops applied considerably greater fertiliser on other crops (primarily cereals) not directly purchased by the cash crop trading firm [8].

The literature on market interlinking toward the perspective of factor contract is the other branch [9,10,11], especially for the interlinked contracts [12]. Originally, [13] explores the nature of interlinked contract under adverse selection and finds interlinkage of contracts reduces investment and is second-best but the non interlinked contracts is first-best. [14] suggest a new rationale for the existence of inter-linked contracts in the agrarian economies of developing countries and show how interlinked contracts can help the dominant parties to collude in cases where collusion is not possible with non-interlinked contracts between the markets for credit and share tenancy.

In addition to work by [15], interlinked factor markets can be considered as one of the "efficiency improving institutional change" in rural agrarian economy. There is an emerging body of literature analyzing how smallholder farmers in developing countries can be linked to modern supply chains. However, most of the available studies concentrate on farm and farmer characteristics, failing to capture details of institutional arrangements between farmers and traders of agricultural production factors. [16] address these gaps by analyzing different market channels for sweet pepper in Thailand and found additional provision of inputs and credit can increase the attractiveness of contracts in the interlinking factor markets.

Finally, [17] argues, using Coasian-like hypothetical theory, that cooperative property rights protection contracts are more efficient in allocation of resources based on the asymmetric information structure. That is if factor markets are based on cooperative contracts, under the incomplete information environment, allocation of resources in the interlinking factor markets would be better off.

In this research, we utilized a survey of Canton in China farmland households to examine problems or issues with rural labor mobility to urban. The objective of this research was to test whether farmland operation of property rights transfer leads to more rural population with farmland contracting right migrate outside and therefore, a higher space spillover effect of rural labor mobility among the neighbor regions. The research hypothesis is that transfer of farmland of property rights leads to rural labor mobility.

The rest of the paper is organized as follows. The economic model is presented in section II. Section III describes the empirical framework. A summary of the data and the result of our analysis are also presented in this section. Finally, conclusion of our main findings is presented in section IV.

2. Model Setup

2.1. Assumption

Following [18]'s infra-marginal model of specialization, let us consider an economy with M identical consumer-producers. There is one consumer good (agricultural product) and one intermediate good (farmland) in this economy. The self-provided amounts of the consumer and intermediate goods are y and x, respectively. The quantities of the two goods sold in the market are y^s and x^s, respectively. The quantities of the two goods purchased in the market are y^d and x^d, respectively.

In order to produce the agricultural product, the farmland is a necessary input. We assume farmland is the intermediate goods to yield final agricultural product and farmer's labor is the initial input contributing into the final agricultural production. So, suppose the farmland operation function is:

$$x + x^s = \max\{0, a_x l_x\} \tag{2.1}$$

Where the amount self-provided of farmland is x, x^s is the quantity of farmland transferred, $a_x \in (0,1)$ denotes the degree of economies of specialization in operating the farmland, $l_x \in [0,1]$ denotes is a farmer's level of specialization in operating the farmland.

Suppose labor and land are complete complementary goods, so we can use the Leontief Production Function to express the relationship between input and output of agricultural factors. A farmer's production function for the agricultural product is

$$y + y^s = \max\left\{0, \min\left\{b_x x + k_x x^d, a_y l_y\right\}\right\} \tag{2.2}$$

Where y denotes the self-provided of agricultural product, y^s denotes the sale of agricultural product, $b_x \in (0,1)$ denotes the farmland operation coefficient of agricultural product, $l_y \in [0,1]$ is the labor share in producing the agricultural product and $y + y^s$ is the output level of this agricultural product. a_y is the labor operation coefficient of the agricultural product, and $k_x \in (0,1)$ denotes the transaction efficiency parameter, The fraction t of x^d disappears in transaction. Hence, $k_x x^d$ is the amount a farmer receives from the purchase of farmland.

It is assumed that labor is specific for a farmer and there is a constraint on the total labor share, given by

$$l_x + l_y = 1 \tag{2.3}$$

The transaction function in rural factor market is:

$$p_x x^s + p_y y^s = p_x x^d + p_y y^d \tag{2.4}$$

Where p_x denotes the price of farmland transferred, p_y denotes the price of agricultural product, y^d denotes the demand for agricultural product. The utility function is identical for all farmers and given by:

$$u = y + k_y y^d \tag{2.5}$$

Where $k_y \in (0,1)$ denotes the transaction efficiency of agricultural product in rural market, $k_y y^d$ denotes is the amount a farmer receives from the purchase of the agricultural product.

2.2. Solution

(1) Autarky(Non-specilization)

Each farmer self-provides all goods, so $x^s = x^d = y^s = y^d = 0$. Assuming this in the decision problem (2.1)-(2.5) yields

$$\max u_1 = y$$
$$s.t. \begin{cases} x = a_x l_x \\ y = \min\left\{b_x x, a_y l_y\right\} \\ l_x + l_y = 1 \end{cases}$$

Because farmland and farmer's labor are complete complementary goods, the ratio between them is a constant, which is $b_x x = a_y l_y$, so we can get the solution:

$$\begin{cases} l_y = \dfrac{a_x b_x}{a_y + a_x b_x} \\ l = \dfrac{a_y}{a_y + a_x b_x} \\ x = \dfrac{a_y a_x}{a_y + a_x b_x} \\ u_1 = y = \dfrac{a_x b_x a_y}{a_x b_x + a_y} \end{cases} \quad \text{and} \quad \begin{cases} u^*_1 = b_x x \\ l_x = \dfrac{1}{a_x b_x} u^*_1 \\ l_y = \dfrac{1}{a_y} u^*_1 \end{cases}$$

(2) Specialization on farmland operation

Farmers specialize in farmland operation, so they do not provide labor in final product. Hence, $l_x = 1,\ l_y = 0$, and $x = x^d = y = y^s = 0$. The farmer's utility maximum problem can be transformed into:

$$\max u_2 = k_y y^d$$
$$s.t.\begin{cases} x^s = a_x \\ p_x x^s = p_y y^d \end{cases}$$

Then, we can get the solution:

$$\begin{cases} x^s = a_x \\ y^d = \dfrac{p_x a_x}{p_y} \\ u^*_2 = \dfrac{k_y p_x a_x}{p_y} \end{cases}$$

(3) Specialization on agricultural product production

Farmers specialize in agricultural product production, so they do not provide labor in operating farmland. Hence, $l_x = 0,\ l_y = 1$ and $x = x^s = y^d = 0$ .The farmer's utility maximum problem can be transformed into:

$$\max u_3 = y$$
$$s.t.\begin{cases} y + y^s = \min\left\{k_x x^d, a_y\right\} \\ p_y y^s = p_x x^d \end{cases}$$

From the previous condition that $b_x x = a_y l_y$, farmers purchase farmland equal to the actual labor contributing into production of agricultural product, and then $k_x x^d = a_y$, so we can obtain the solution:

$$\begin{cases} x^d = \dfrac{a_y}{k_x} \\ y^s = \dfrac{a_y p_x}{k_x p_y} \\ u^*_3 = y = a_y - \dfrac{a_y p_x}{k_x p_y} \end{cases}$$

2.3. Discussion

From the discussion above, in case $xb_x > \frac{k_y p_x a_x}{p_y}$ and $xb_x > a_y - \frac{a_y p_x}{k_x p_y}$, then $u^*_1 > u^*_2$ and $u_1^* > u_3^*$, autarky is better than specialization either on operating farmland or producing agricultural product. In case $xb_x < \frac{k_y p_x a_x}{p_y}$ and $\frac{k_y p_x a_x}{p_y} > a_y - \frac{a_y p_x}{k_x p_y}$,then $u^*_2 > u^*_1$ and $u^*_2 > u^*_3$, specialization on operating farmland is the optimal decision. In case $xb_x < a_y - \frac{a_y p_x}{k_x p_y}$ and $\frac{k_y p_x a_x}{p_y} < a_y - \frac{a_y p_x}{k_x p_y}$, then $u^*_3 > u^*_1$ and $u^*_3 > u^*_2$, specialization on producing agricultural product is the best choice for farmers.

Proposition 1 The transfer of farmland would reduce the farmer's utility in autarky.

Additionally, according to $u^*_1 = xb_x$ in autarky, taking derivative with respect to x, we get $\frac{\partial u^*_1}{\partial x} = b_x > 0$. It means that if farmer transfers his or her farmland to others(x declines), his or her utility decreases.

Proposition 2 The decrease farmer's utility in autarky results in rural labor mobility in non-specialized system.

Now, according to $l_x = \frac{1}{a_x b_x} u^*_1$, $l_y = \frac{1}{a_y} u^*_1$ in autarky, taking derivative with respect to u^*_1, we get $\frac{\partial l_x}{\partial u^*_1} = \frac{1}{a_x b_x} > 0, \frac{\partial l_y}{\partial u_1} = \frac{1}{a_y} > 0$. It means that if farmer's utility level declines, his or her labor contributing to operating farmland and producing agricultural product decrease. The implication of that is more and more rural labor migrate into non-agricultural production industries where would locates in urban.

Hypothesis: The transfer of farmland would drive rural labor mobility.

The economic explanation of the hypothesis is that farmland transfer market interlinks with rural labor market in a non-specialized production system.

3. Methods and Data

The rural labor mobility econometric model is expressed as follows:

$$M_i = c_0 + \sum_{j=1}^{3} c_j Y_{ij} + c_4 F_i + c_5 L_i + e_{i1} \qquad (3.1)$$

Where M_i is rural labor mobility for the i[th] household, Y_{i1} is agricultural technology extension and education for the i[th] household, Y_{i2} is non-agricultural technology extension and education for the i[th] household, Y_3 is the endowment effect after confirmation of farmland, F is the degree of difficulty the i[th] household to loan from bank. e_{i1} is error term which is assumed to be independently and identically distributed. L_i is amount of farmland transferred from the i[th] household.

In order to estimate the spatial spillover effects of farmland transfer on rural labor mobility using equation (3.2). The spatial probability model specification of rural labor mobility for the i[th] household can now be written as:

$$M = \sum_{l=1}^{3} d_l Y_l^* + d_4 L^* + d_5 F^* + u_4 \qquad (3.2)$$
$$u_4 = d_6 K u_4 + \sigma$$

Where u_4 is the stochastic disturbance term, σ is the probability distribution of stochastic disturbance term, K is the spatial weighted matrix.

Data for the analysis were taken from the Dec 2014 Land Resource Management Study (LRMS). The LRMS is conducted annually by the South China Agriculture University of National Agricultural Institution and Development Institute. The survey collects data from cross sectional data with 547 rural labor mobility observations from 600 households in 60 villages.

The target population of the survey is farm households associated with farmland leasing businesses in 15 representative cities in Guangdong Province of China, including Chaozhou, Meizhou, Jieyang, Heyuan, Shanwei, Huizhou, Shaoguan, Qingyuan, Guangzhou, Zhaoqing, Zhongshan, Zhuhai, Yangjiang, Maoming, Zhanjiang. A farm is defined as an establishment that lease or normally would have transfer rural land use right during the year. Farms can be organized as proprietorships, partnerships, family corporations, nonfamily corporations, or cooperatives. Data are collected from one household per farm, i.e., the head of farm operator. A head farm operator is the operator who makes most of the day-to-day management decisions. For the purpose of this study, operator households organized as nonfamily corporations or cooperatives and farms run by hired managers were excluded. Table 1 presents all the variables and their definitions. These values decided, by household's subjective self-report.

Table 2 presents summary statistics for each of the variables in the analysis. As we know, the sample data in Table 2 exhibit good variability.

4. Basic Empirical Results

The regressions for Logit model and Probit model were statistically significant (Table 3). The main independent variable of interest (L) did have a statistically significant, positive coefficient explaining rural labor mobility from model 1 to model 4 (Table 3). In these models, F Y_1, Y_2, and Y_3 were other unique factor variables that explained reported problems with statistically significant coefficients (Table 3).

Firstly, in order to deal with the endogenous issue, we add regression residual as instrumental variable. Table 3 shows that the significant level of all explanation variables on rural labor mobility arises. Especially for the coefficient of farmland transfer, its magnitude increases most. It means that regression residual is a good instrumental variable in the regression.

Secondly, Table 3 shows that, farmland transfer positively associates with rural labor mobility. That is to say, the marginal effect of farmland transfer on rural labor mobility is positive, which is consistent with the hypothesis.

At last, adding residual as instrumental variable not only eliminates the endogenous issue, but also guarantee the sign of the marginal effect of explanation variables and significance are highly consistent, which shows that the estimation is robustness in the model.

Table 1. Variable Definitions (n=547)

Market Type	Items(Variable)	Definition
farmland market	farmland transfer (L)	1=yes, 0=no
	rural labor mobility (M)	1=yes, 0=no
Rural labor market	Standardization of labor training	Experience on agricultural technology extension and education (Y1)：1=yes, 0=no Experience on Non-agricultural technology extension and education (Y2)：1=yes, 0=no
	endowment effect after farmland confirmation(Y3)	1=strongly disagree, 2=disagree, 3=indifferent, 4= agree，5=Strongly agree
rural financial market	The degree of difficulty for farmer to loan from bank (F)	1=very easy；2=easy, 3=indifferent, 4= difficult，5=very difficult

Table 2. Descriptive statistics

Variable	Maximum	Minimum	Mean	Std. Dev.	Skewness	Kurtosis
farmland transfer (L)	1	0	0.1554	0.3626	1.9024	4.6193
rural labor mobility (M)	1	0	0.7294	0.4447	-1.0329	2.0669
Experience on agricultural technology extension and education (Y1)	1	0	0.1609	0.3678	1.8460	4.4076
Experience on non-agricultural technology extension and education (Y2)	1	0	0.2322	0.4226	1.2686	2.6095
endowment effect after farmland confirmation(Y3)	5	1	3.2687	1.0105	-0.2791	2.6917
The degree of difficulty for farmer to loan from bank (F)	5	1	2.2285	1.0728	0.4894	2.4284

Source: 2014 Land Resource Management Survey (LRMS).

Table 3. Regression Results for Logit and Probit model (dependent variable=M)

	Logit model		Probit model	
variable	Model 1 (without resid)	Model 2 (with resid)	Model 3 (without resid)	Model 4 (with resid)
L	0.1109**(0.2981)	0.8130***(1.5292)	0.1052**(0.1721)	0.6560***(0.8740)
F	0.0334*(0.0935)	0.0524***(0.1034)	0.0315*(0.0552)	0.0424***(0.0602)
Y_1	-0.1142**(0.2601)	-0.1615***(0.2825)	-0.1081**(0.1576)	-0.1313***(0.1686)
Y_2	0.0907*(0.2501)	0.0933**(0.2518)	0.0839*(0.1451)	0.0753**(0.1461)
Y_3	0.0334*(0.0967)	0.0445**(0.1004)	0.0315*(0.0577)	0.0361**(0.0594)
resid	/	-0.7258**(1.5415)	/	-0.5847**(0.8840)
Observed value	547	547	547	547
R^2	0.0250	0.0354	0.0249	0.0351
LR χ^2/F	15.9640	22.5954	15.8882	22.4456
Prob> χ^2/F	0.0069	0.0009	0.0072	0.0010

Note: (1) Standard errors in parentheses.

(2)* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

5. Spatial Regression Extension

In order to further observe the spatial spillover effect of farmland transfer on rural labor mobility, we conduct the spatial econometric test. Considering the data from 15 cities of Guangdong Province, therefore, to construct the spatial weighted matrix, the value of element in spatial weighted matrix is 1, if the cities are adjacent. And the value of element in spatial weighted matrix is 0, if the cities are not adjacent. That is to say, in this part, we divide the sample of 547 observations into 15 groups. The calculation rule is that if the value of variable is 0 and 1, then the ratio of the city equals "1"; if the values of variable are 1,2,3,4 and 5, then we calculate the ratio of city's value which is higher than the average value.

The independent variable is the rural labor mobility (M), the dependent variable are the proportion of farmland transfer (L^*), the ratio of degree of difficulty for households to loan from bank (F^*), the ratio of agricultural technology extension and education (Y_1^*), the ratio of non-agricultural technology extension and education (Y_2^*), and the ratio of endowment effect after farmland confirmation (Y_3^*).

Table 4. Descriptive statistics of spatial econometrics

variable	Maximum	Minimum	Mean	Std.dev	Skewness	kurtosis
the rural labor mobility (M)	0.95	0.475	0.7324	0.1359	-0.1859	2.2624
the proportion of farmland transfer (L^*)	0.375	0	0.1541	0.1184	0.7210	2.2425
the ratio of degree of difficulty for households to loan from bank (F^*)	0.6410	0.275	0.4114	0.0965	0.8045	3.3688
the ratio of agricultural technology extension and education (Y_1^*)	0.5313	0	0.1699	0.1451	1.0697	3.5532
the ratio of non-agricultural technology extension and education (Y_2^*)	0.5	0.075	0.2321	0.1260	0.7092	2.7918
the ratio of the endowment effect after farmland confirmation(Y_3^*)	0.6364	0.3421	0.4542	0.0913	0.4945	2.0787

The results of Moran index test and the Geary coefficient test are as follows:

Table 5. Spatial Autocorrelation Test

	Two-side test			One-side test		
Moran test	Moran index	P-value	Z	Moran index	P-value	Z
	-0.385	0.107	-1.610	-0.385	0.054	-1.610
Geary coefficient test	Geary coefficient	P-value	Z	Geary coefficient	P-value	Z
	1.460	0.051	1.954	1.460	0.025	1.954

The Table 5 shows that, the P values of the one-sided test in Moran test is less than 10 percent and P values of the one-sided test in Geary coefficient test is less than 5 percent, indicating the existence of spatial dependence.

Table 6 shows that the ratio of the endowment effect after farmland confirmation had no significant effect and the ratio of agricultural technology extension and education has significant negative effect, indicating that the more the agricultural extension is, the less the probability that household move outside agriculture is. The rural labor mobility has significant positive effect, which does not reject the hypothesis. It means farmland transfer market interlinks with rural labor market in a non-specialized production system.

Table 6. SEM Estimated Results

variable	coefficient	Z -statistic	P-value
L^*	0.4862**(0.2047)	2.38	0.018
F^*	1.1370***(0.1543)	7.37	0.000
Y_1^*	-0.3328***(0.0932)	-3.57	0.000
Y_2^*	0.3165**(0.1506)	2.10	0.036
Y_3^*	0.1944 (0.2378)	0.82	0.414
K	-0.5940***(0.0723)	-8.21	0.000

Note: the values in parentheses are robust standard errors

6. Conclusions

This research examined whether farmland transfer impacted rural labor mobility. The results of theoretic models proved that: (1) The transfer of farmland would reduce the farmer's utility in autarky. (2) The decrease farmer's utility in autarky results in rural labor mobility in non-specialized system. (3) The transfer of farmland would drive rural labor mobility, which means farmland transfer market interlinks with rural labor market in a non-specialized production system.

The econometric results show that agricultural technology extension and education, non-agricultural technology extension and education, the degree of difficulty to loan from bank and amount of farmland transferred were the variables that explain reported problems with statistically significant coefficients. The coefficient for variable endowment effect after confirmation of farmland was not statistically significant.

Additionally, the spatial regression results demonstrate that the ratio of the endowment effect after farmland confirmation had no significant effect and the ratio of agricultural technology extension and education has significant negative effect, indicating that the more the agricultural extension is, the less the probability that household move outside agriculture is. The rural labor mobility has significant positive effect. It means farmland transfer market interlinks with rural labor market in a non-specialized production system.

Future research avenues include development of an infra-marginal model of agricultural production system specialized. This model would require an in-depth analysis of specialization of agricultural attributes along with specially developed non-linear programming. In addition, a similar empirical framework could be extended to cover farmland market, rural financial market, and rural labor market using logistic regression method. Finally, field experiment coverage could be conducted to encompass states with rural factor markets interlinked. This strategy would enable researchers to examine whether or not rural labor market structure and rural financial market reform are altered when farmland transfer market are expanded.

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