

# Economic Effects of Financial and Fiscal Support for Agriculture in Western China

## An Exemplification from Sichuan-Chongqing economic zone

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### Abstract

Funds factor is crucial for solving the problems facing agriculture, farmers and rural areas in Western China where the economic development lags behind other regions. On the background of the policy of China Western Development has implemented for 10 years, with the purpose of testing whether the economic effects of funds for agriculture are failure, this paper empirically studied the relationships among financial&fiscal support for agriculture and rural GDP, food production and farmers income based on the time-series data of 1985-2008 from Sichuan-Chongqing Economic Zone. The research used some statistical methods such as Cointegration Tests and Vector Error-Correction Model, and revealed that financial support for agriculture had significant long-term economic effects to those three indicators, a mutual causality had be found between financial support for agriculture and farmers income too. Fiscal support for agriculture had economic effects to rural GDP and food production, but not to farmers income. And the economic effects of financial support for agriculture oriented towards market were greater than those of fiscal support leading by government. After analyzing several main reasons of these conclusions, what's more, some suggestions are given to promote the economic effects of funds for agriculture in Western China.

**Keywords** Financial support for agriculture, Fiscal support for agriculture, Economic effect, Sichuan-Chongqing Economic Zone.

### 1. Introduction

Since reform and opening, in the background of stable and rapid growth of national economy, rural economic development in Western China are facing dual dilemmas of east-west regional economic imbalances and urban-rural dual economic structure. On the one hand, during the rapid process industrialization and of urbanization, China urban-rural income scissors are showing growing trend. From 1985 to 2008, the proportion of urban per capita disposable income to rural per capita net income rose to 3.31 from 1.86. And between 2002 and 2008, it always maintained more than 3 times. By the end of 2008, the income gap between urban and rural areas had more than 11,000 yuan. On the other hand, under the joint forces of regional advantages, policy guidance and financial support, economy of Eastern China is growing rapidly, but western's is lagging behind a lot. From 1978 to 2008, the GDP share of Eastern China to the whole country rose from 47% up to 60% as well as those of western from 20% down to 16%. the per capita GDP ratio of eastern to western rose to 2.4 from 1.8. In the

evolution of the dual dilemmas, “three rural” fields of Western China have become disadvantaged fields of backward area as well as those farmers accounting for 70% to the total population have also become vulnerable group in backward region.

According to the vicious cycle of poverty theory (Ragnar Nurkse, 1953) and low-level equilibrium trap theory (R.R.Nelson, 1956), in Western China, the root causes of dual dilemma faced by the “three rural” are low level of per capita income and investment caused by scarcity of capital. A long period after the founding of the P.R.China, this scarcity of capital had a profound institutional factor. In the planned economic system, the role of government finance and financial credit mainly served for national will, capital accumulation brought by agriculture and rural economic development did not widely invest in the extensive reproduction for its own building but supporting exogenous economic resources for national security, heavy industrialization and other macro-strategy. After reform and opening, under the theory of “some people get rice first” and policy guidelines of industrialization and urbanization, the economy of urban economic circles represented by Yangtze River Delta and Pearl River Delta in Eastern China have grown up rapidly. But this growth still can not do without a lot of economic resources from the West to the East and country to urban areas. With the deepening reform of market economy, the use of Chinese economic resources is gradually transforming to the joint decision by government plans and market efficiency selection. However, due to the advantaged economic basis of the eastern China and the higher investment rate of return of secondary and tertiary industries, Western China and “Three Rural” fields have no advantage at all in the market allocation of funds. At the same time, owing to the higher risk of agricultural capital management, state-owned financial institutions have begun to withdraw from rural areas and agriculture in a large-scale since the end of 90s in the 20th century. And even Rural Credit Cooperatives which must operate in rural areas clearly defined by state began the way of scale operation and centralization, merging grass-roots agency and converting rural business for its own turnaround. This resulted in loans to farmers more difficult, and further deteriorated the capital scarce in development of “three rural”.

However, “three rural” issues of Western China, relating to the construction of socialist harmonious society, are the sticking points of China Western Development Strategy. To make them quickly escape from the “vicious circle” and “low-level trap” also can’t do without the exogenous economic resources provided by government finance and financial institutions. The simple accumulation of capital itself is difficult to achieve this economic goal. Since 2004, seven consecutive Central First Document have made “three rural” issues up to the special important position, the level of financial support for agriculture from government and financial institutions have increased significantly. In 2008, national agricultural loans totalled 1762.9 billion yuan, reached 3.6 times to 488.9 billion of 2000. At the same time, in the agriculture loans of Sichuan province which was a great agriculture province in western region totalled 73.182 billion yuan, reached 2.4 times to 31.08 billion yuan of 2000. On the other hand, fiscal expenditure for supporting agriculture from central and local government were also increased several times. But the funds allocation mode that over relies on intervention of programs and policy exists the possibility of government failure at the micro level, and the economic effects of funds yet need to empirically test. Therefore, this paper designed indicators from three dimensions such as economic growth, economic development

and food security to study economic effects of financial and fiscal support for agriculture in Western China from 1985 to 2008. Sichuan-Chongqing economic Zone is selected as the sample scope, because this region represents the most developed economic and agricultural areas in Western China, its GDP accounts for approximately 30% of the west and 6% of the country, food production accounts for approximately 30% of the west and 8% of the country. Among them, the Chengdu-Chongqing Economic Zone is the first test area of coordinating urban-rural reform, Sichuan Province is one of 13 major grain producing areas in China and the only major grain producing areas in the west. This paper will provide further experience basis for the discussion to economic effects of financial&fiscal support for agriculture in Western China and even for the solution of local “three rural” issues.

## **2. Literature Review**

### **2.1. Relative Researches on Financial Support for Agriculture**

Current researches on financial support for agriculture are mostly based on financial development theory(Gurley and Shaw, 1955; Goldsmith, 1969; Mckinnon, 1973; King and Levine, 1993).The theory puts forward some insights to the interrelationship between finance and economy development, and to the finance development in developing countries or regions. It also states that the active operation of the finance system can effectively improve the allocation of resources, promoting capital accumulation and technological innovation, and enhancing the level of output. Simultaneously, Well-developed economy can stimulate the development of financial sector by the growth of national income and financial needs. In the end, finance and economy can promote each other in a favorable cycle. Over last 20 years, after plenty of study of the pattern and efficiency of Financial support to agriculture in developing countries, many foreign scholars concluded that developing countries were short of effective market system of rural finance in economic transition, the allocation efficiency of capital in financial sector was low. Only on the condition of a more perfect financial market could economic resource be effective under the optimizing allocation in market and reduce the income gap between urban and rural areas(Galor and Zeira, 1993; Ulrich Koester, 2000). For another, the mechanism and direction of credit in developing countries are most led by government, the rural financial system is not independent. In the researches whether the agricultural credit led by government distorted financial market, some found the circumstance of policy-rural credit in developing countries was non-competitive. This pattern of financial support to agricultural could commonly increase the manage risk of rural finance and reduce the economic efficiency compared with market-oriented financial pattern in developed countries (Jensen, 2000; Townsend, 2001) .

Domestic researches on financial support for agriculture have gradually shift from the early capital formation to efficiency and the research methods from the qualitative analysis to quantitative study. Qian(1991) made theoretical analysis of China's agricultural capital formation and holds that the main obstacle if capital formation in agriculture are the low level of financial support for agriculture, lack of investment demand, as well as the urban-rural dual structure. Zhang(2003) held the economic effect that financial support for agriculture led by government in developing countries was feeble and lower return rate of credit in

agriculture resulted in policy-finance's weakness at the same time. He and some foreign scholars such as Townsend hold the same view. In the quantitative study, many researchers empirically studied the correlation between level of finance development and agricultural GDP or farmers income with using nationwide data. Their results most showed that finance development could promoted the growth of agricultural GDP, but the causality between them was not distinct. Financial Deepening was lack of economic effect to the growth of farmer's income and hard to become a reason of it(Wen *et al.*,2005; Ji, 2008; Tan *et al.*,2009). To some extent, these results testified some foreign scholars' views that agricultural credit system leading by government in developing countries had a negative effect on rural economy and became a obstacle for farmers to increase income.

## **2.2. Relative Researches on Fiscal Support for Agriculture**

Paul A Samuelson(1954) put forward it was the Pareto optimal supply when the marginal conversion rate of public goods and corresponding private goods equalled to the marginal conversion rate of all the private goods. And public goods' supply were efficient. Restricted to the different constraints in real economy, however, lots of scholars held different point of views on economic effect of rural development resulted from public goods for rural areas supplied by government. Goodwin and Ligia(2007) proposed that fiscal support for agriculture from the government would disturb the work system of market economy and bring risks to the long-term development of agricultural production. But others, such as Carlo (2007) proposed that food relief from fiscal funds supporting agriculture could strengthen the fundamentals of agricultural production and volatile market fundamentals, thus fiscal support for agriculture was an effective tool of regulation.

Domestic researches are mostly based on the national condition and current economic system, so there is no controversy on the necessity of fiscal support for agriculture. Their researches focused on the system and efficiency of fiscal support for agriculture, and the association between agricultural production and fiscal support for agriculture. Many scholars studied the efficiency of fiscal support for agriculture (Xu, 2006; Li 2008; Peng, 2008; Liu 2009). Among them, Xu analyzed the time-varying marginal effect and elasticity by using Local linear non-parametric kernel regression model to find that the level of fiscal support for agriculture in comparatively developed provinces was higher than the average level around the country. Peng found Fiscal and monetary policies working separately resulted in a fragmented pattern of financial support for agriculture and failure of effective leverage role, and recommended on integrating financial and fiscal support for agriculture. In the research of the association of agricultural production and fiscal support for agriculture (Wei, 2007; Liu, 2008; Liu, 2008; Wang *et al.*, 2009.etc), many scholars came to the same conclusion that raising the level of local financial support for agriculture was indeed conducive to agricultural and economic growth, but all agriculture expenditure needed to be optimized. Wei(2006) and Xu(2008), In addition, made research on the contribution of economic growth on the western agricultural economy and the comparison between the eastern and western regions, which concluded that the dependence on fiscal support for agriculture of western region is higher ,while the efficiency of eastern region is higher.

Reviewing literatures above, most domestic scholars of China's financial and fiscal support for agriculture are in line conclusions that China's finance or rural finance development can not effectively promote an increase in farmers income, fiscal support for

agriculture occupies an important place in agricultural development but lacking efficiency. It is approximative same with foreign standpoint. However, existing studies most focused on the whole nationwide condition, few considered the unbalance between regional economy, different resource gifts or emanative industry directions, and obviously insufficient concern on the less-developed western region. In the literatures mentioned here, only Wei and Xu examined the relationship between the level of financial support for agriculture and the increase in agricultural output in western regions. In view of this, this paper selected representative Sichuan-Chongqing Economic Zone from Western China as sample space, designed more comprehensive economic indices, make further empirical research on the economic effects of financial and fiscal support for agriculture at the "West Development" 10 anniversary.

### **3. Theoretical Models, Index designing and Research Methods**

#### **3.1. Index Designing**

The so-called "three rural" issues refers to agriculture, rural areas and farmers. The resolve of "three rural" issues, mainly depends on whether carried out stable and rapid growth of rural social output value, number of agricultural products and farmers income. Among them, rural social output value reflects on the rural economic growth in the number, the number of agricultural products relates to national food security and social stability, income level of farmers is the most important indicator of rural economic development as the core of "three rural" issues. According to the relation discussed above, this paper designs explained variables from three dimensions, economic growth, food security and economic development. These are rural per capita GDP(AO), agricultural population per capita food production(GY) and rural per capita net income(RI). Among them, AO is equal to the ratio between the output value of Agriculture Animal Husbandry and Fishery and gross population in this region. GY is equal to the ratio between gross food production and gross population. RI equals to the weighted average of the two areas' own farmers net income according to the different population.

Financial support for agriculture (RF) and fiscal support for agriculture (PF) are main Explanatory variables. About the previous designs of RF, many adopted the ratio between total agricultural loans of financial institutions and output value of Agriculture Animal Husbandry and Fishery to reflect the action of financial support for agriculture in rural economic growth. In this paper, RF is the ratio of long-term and medium-term loans issued by financial institutions for agriculture to gross loans for reflecting the power of support. And this method can avoid multicollinearity between the explained variables; PF is the ratio of fiscal support for agriculture to gross expenditure of government for reflecting the power of fiscal support.

Fixed assets investment in agriculture (FI) be assumed main funds factor else that influenced rural economic growth and development, and food production. Due to can't obtain the integrity time-series data of fixed assets investment in agriculture from 1985 to 2008 in this region, this paper selects the ratio of all social fixed assets investment to GDP in the Sichuan-Chongqing economic zone as a control variable.

#### **3.2. Theoretical Models**

Drawing on the experience of previous literatures, this study also bases on the theory of financial development, which contains many models to explain financial support, financial development and economic growth, such as AK Model, the Dynamic Two-sector Model, Schumpeterian Growth Model. In this paper, we take Odedokun(1996) the Dynamic Two-sector Model of economic efficiency as a framework. Considering financial supporting funds, fiscal supporting funds and investment in fixed assets as production input items, the function of integration the production should be:

$$Y_t = F (F I_t, R F_t, P F_t, L_t) \quad (1)$$

$Y_t$ : total agricultural output.  $K_t$  (former capital input)=  $F I_t$  (fixed assets investment in agriculture)+  $R F_t$  (financial support for agriculture)+  $P F_t$ (fiscal support for agriculture);  $L_t$ : input of agricultural laborers. Based on Economic Efficiency Model, economic growth depends on the increase of capital investment or the increase of economic efficiency, or changes of both factors at the same time, that is

$$\Delta Y_t / Y_t = IOCR(\Delta K_t / Y_t) \quad (2)$$

Let  $\Delta K_t / Y_t$ , IOCR be change of investment, conversion rate of investment, namely economic efficiency change respectively. The current capital  $K_t$  is composed of former capital  $K_{t-1}$  and the amount of capital conversion, so combined with function (2), without consideration of depreciation, the agricultural investment can be:

$$K_t = K_{t-1} + IOCR(F I_t, R F_t, P F_t) \quad (3)$$

$IOCR(F I_t, R F_t, P F_t)$  are economic efficiency or allocation efficiency of agricultural investment, which indicates that the enhancement of the level of investment in fixed assets, financial support for agriculture and fiscal support for agriculture will increase the amount of total capital in agriculture and thereby promote the development agricultural economics. Put (3) into(1) and linearity process, then:

$$Y_t = K_{t-1} * L_t + IOCR(F I_t, R F_t, P F_t) * L_t + C \quad (4)$$

Put the approximation of one step Taylor function into (4), then multiply L on the both sides of the function, thus

$$Y_t / L_t = K_{t-1} + IOCR(0,0,0) + IOCR_{F I} '(0,0,0) F I_t + IOCR_{R F} '(0,0,0) R F_t + IOCR_{P F} '(0,0,0) P F_t + C' \quad (5)$$

In the assume of (1), if we defined  $Y_t$  was food production( $Y_{t1}$ ) or farmers net income( $Y_{t2}$ ) we could conclude another two equations:

$$Y_{t1} / L_t = K_{t-1} + IOCR(0,0,0) + IOCR_{F I} '(0,0,0) F I_t + IOCR_{R F} '(0,0,0) R F_t + IOCR_{P F} '(0,0,0) P F_t + C_1 \quad (6)$$

$$Y_{t2} / L_t = K_{t-1} + IOCR(0,0,0) + IOCR_{F I} '(0,0,0) F I_t + IOCR_{R F} '(0,0,0) R F_t + IOCR_{P F} '(0,0,0) P F_t + C_1 \quad (7)$$

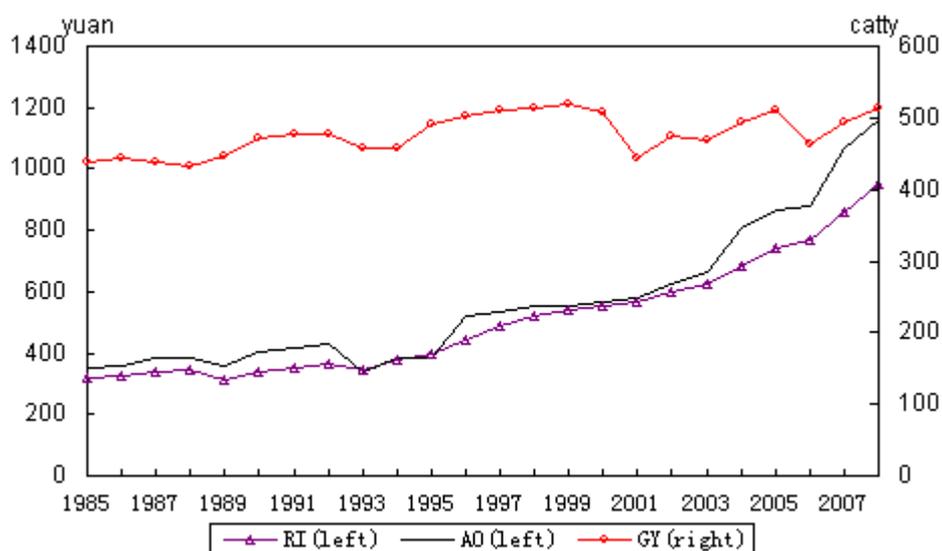
For facilitating description, we defined (5)~(7) to the basic expression of models 1~3. And we can see that agriculture capital stock, fixed assets investment, financial and fiscal support for agriculture all influence output, income and their change. Besides, their efficiency such as  $IOCR_{F I} '(0,0,0)$ ,  $IOCR_{R F} '(0,0,0)$  and  $IOCR_{P F} '(0,0,0)$  are main factors also. In this research, we classify these variables as funds allocation efficiency factors. We can also say that the growth of agriculture output value, food production and farmers income depend on the efficiency of supporting funds. Theoretically, if financial and fiscal support for agriculture could produce economic effects, their coefficients in equation (5)~(7) would be greater than zero. Otherwise, it manifested economic effects were feeble or invalid. Simultaneously, the comparison

between their coefficients would show the relative intensity of financial and fiscal support for agriculture.

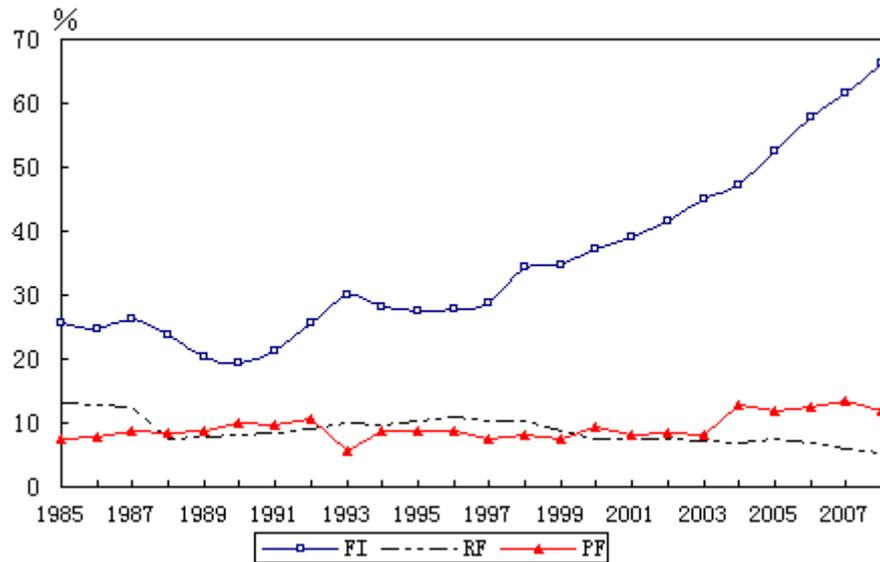
### 3.3 Research Methods

This paper uses the empirical studies. Specific steps are as follows: First, in order to avoid spurious regression phenomenon, using ADF unit root test shows these variables' stability and Single-order integer. Second, If the variables are all on the same order, than using above theoretical model to execute cointegration tests, analysing whether exist long-term stability of the equilibrium relationship among these variables. Third, Using vector error correction model (VEC) and Granger causality test to determine their short-term effects. Constraction of VEC model can analyse the speed and direction of short-term adjustment of above models. Granger causality test can discuss whether the early stage of information among the variables would contribute to their MSE, and judge their causalities. Fourth, making further analysis to their dynamic relationship by variance decomposition. Data processing and quantitative analysis use Excel 2003 and Eviews 5.0.

All the data come from relevant volumes of "Sichuan Statistical Yearbook", "Chongqing Statistical Yearbook", "China Fiscal Yearbook" and "China Financial Yearbook". Owing to "Sichuan Statistical Yearbook" didn't publicize food production of Sichuan province in 2007 and 2008, and statistics caliber of "China Statistical Yearbook" are different from those of provinces, so this research uses relevant data Sichuan Provincial Agriculture Department provided. For eliminating price factors, AO and RI separately are deflated by consumer price index and rural consumer price index of Sichuan province. GY doesn't influence by price index, so it needn't be deflated. Because FI, RF, PF are all relative value index, their price factors had be balanced out (Figure 1~2). The price index we used are based on 1985 and are all from Sichuan province because Chongqing municipality was ruled by Sichuan province before 1997 when it was Established as a municipality. At the same time, consumer price indices of these two regions are closer. What' more, in order to avoid violent fluctuations and heteroscedasticity, AO, GY, and RI are used a log processing. After this processing, they are expressed by LNAO, LNGY and LNRI.



**Figure1:** Rural per capita GDP(AO), agricultural population per capita food production(GY) and rural per capita net income(RI), 1985~2008.



**Figure2:** fixed assets investment (FI), financial support for agriculture (RF) and fiscal support for agriculture (PF), 1985~2008

## 4. Empirical Analysis Process and Results

### 4.1. Stationary Test of Variables

The paper applies Augmented Dickey-Fuller Method in testing the stability of variables before Cointegration Analysis to avoid the spurious regression phenomenon caused by the existence of varying trend. The results showed that first-order delay difference of all variables are smooth at the 5% significance level, and they meet the prerequisite for co-integration test (Table 1.).

**Table1.** Unit-Root-Testing results

Variables	Type(c,t,k)	ADF value	1%level	5%level	10%level	Conclusion
LNAO	(C, T, 5)	-1.574611	-4.416345	-3.622033	-3.248592	unstable
LNGY	(C, 0, 5)	-2.191244	-3.752946	-2.998064	-2.638752	unstable
LNRI	(C, 0, 5)	1.844306	-3.752946	-2.998064	-2.638752	unstable
FI	(C, T, 5)	3.817522	-3.817511	-3.029970	-2.65194	unstable
RF	(C, 0, 5)	-2.007048	-3.769597	-3.004861	-2.642242	unstable
PF	(C, 0, 5)	-2.225927	-3.752946	-2.998064	-2.638752	unstable
DLNAO	(C, 0, 5)	-5.118906	-3.769597	-3.004861	-2.642242	stable ***
DLNGY	(C, 0, 5)	-5.308186	-3.769597	-3.004861	-2.642242	stable ***
DLNRI	(C, 0, 5)	-4.106108	-3.769597	-3.004861	-2.642242	stable ***
DFI	(C, T, 5)	-5.671751	-4.532598	-3.673616	-3.277364	stable ***
DRF	(C, 0, 5)	-4.286488	-3.769597	-3.004861	-2.642242	stable ***
DPF	(C, 0, 5)	-7.356563	-3.769597	-3.004861	-2.642242	stable ***

Note: (c,t,k) represents whether there are intercept (c), trend (t) and lag length(k) in ADF testing; \*\*\*, \*\* represent the remarkable levels of 1%, 5%.

### 4.2. Johansen Cointegration Test

Johansen—Juselius Cointegration Test with a very good property of small samples, is a

common method of multi-variable cointegration test, so this paper uses JJ cointegration test to prove the relationship of cointegration between variables. According to AIC and SC Standards, the optimal lag order is lag 2. Cointegration Rank Test and Max-Eigen Statistic results(Table 2.) manifest there are cointegration relationships among LNAO, LNGY, LNRI and explanatory variables at the remarkable levels of 5%. Three cointegration functions are created as:

**Table 2.** Johansen Cointegration Rank Test and Max-Eigen Statistic Results

	Eigenvalue	Trace Statistic (P value)	Max-Eigen Statistic (P value)	Hypothesized No.of CE(s)
Model 1	0.955859	107.9596 (0.0000)*	65.52774 (0.0000)*	none
	0.738925	42.43186 (0.0011)*	28.20187 (0.0043)*	At most 1
	0.415676	14.22999 (0.0768)	11.28331 (0.0930)	At most 2
	0.130918	2.94668 (0.0861)	2.94660 (0.0861)	At most 3
Model 2	0.819803	73.96862 (0.0000)*	35.98778 (0.0033)*	none
	0.729342	37.98084 (0.0046)*	27.4449 (0.0056)*	At most 1
	0.255208	10.53594 (0.2417)	6.187655 (0.5892)	At most 2
	0.187030	4.348285 (0.0370)*	4.34285 (0.0370)*	At most 3
Model 3	0.930028	101.1583 (0.0000)*	55.853 (0.0000)*	none
	0.715228	45.30527 (0.0004)*	40.98935 (0.0000)*	At most 1
	0.533945	18.9279 (0.0146)*	21.62929 (0.0029)*	At most 2
	0.128794	2.895404 (0.0888)	2.895404 (0.0888)	At most 3

Note: \* represent that at the remarkable levels of 5%, the hypothesis can be rejected.

$$\text{Model 1: LNAO} = 0.022143\text{FI} + 0.098046\text{RF} + 0.024015\text{PF} \quad (8)$$

(0.00213) (0.00913) (0.00999)

$$\text{Model 2: LNGY} = 0.003236\text{FI} + 0.089789\text{RF} + 0.019285\text{PF} \quad (9)$$

(0.00278) (0.01360) (0.01513)

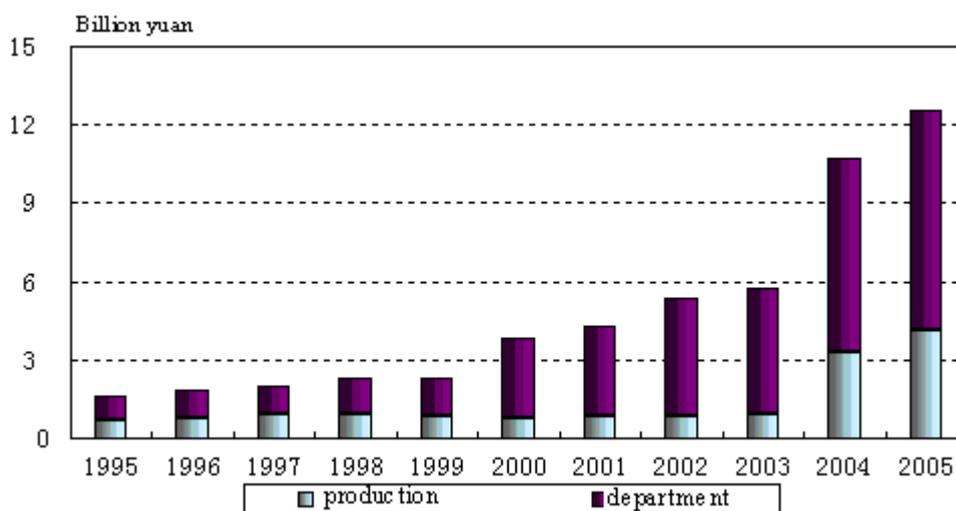
$$\text{Model 3: LNRI} = 0.040236\text{FI} + 0.280958\text{RF} - 0.017721\text{PF} \quad (10)$$

(0.00612) (0.02782) (0.02801)

Functions (8)~(10) represent three cointegration functions in which explained variables are separately rural per capita GDP, agricultural population per capita food production and rural per capita net income. These results indicate that, from 1985 to 2008, there are positive long-term stable cointegration relationships among fixed assets investment (FI) and rural per capita GDP (LNAO), agricultural population per capita food production (LNGY) and rural per capita net income (LNRI) in the economic zone of Sichuan-Chongqing. The relationships among financial support for agriculture (RF) and LNAO, LNGY, LNRI are same to those of FI. Fiscal support for agriculture (PF) have a positive action to LNAO and LNGY, but not to LNRI. From the economic effects of funds, FI and RF have positive economic effects to all the explained variables, PF has positive economic effects to LNAO and LNGY, but feeble to LNRI. Secondly, from model 1 to 3, the most significant positive action to the three explained variables all produce from PF. These coefficient of elasticity are separately 0.098046, 0.089789, 0.280958.

The cointegration testing results above manifest that the long-term stable positive correlations bringing in by fixed assets investment and financial support for agriculture to

rural per capita GDP, agricultural population per capita food production and rural per capita net income are consistent with the general conclusions of the theory of financial development. But the negative relation between fiscal support for agriculture and farmers income is contrary to expectations. The reasons may be that the proportion agricultural production and infrastructure spending to the gross funds of fiscal support for agriculture is too low, and those of department expenditures of agriculture, forestry, water conservancy and meteorology are too high. For instance, department expenditures are always more than productive expenditures from 1995 to 2005 in Sichuan province. Especially after 2000, the proportion of department expenditures to productive expenditures had been between 2 to 6 times (Figure 3.). Owing to department expenditures are not oriented in farmers income and don't have significant action to agriculture production, their economic effects to the growth of farmer income are very feeble or even negative after complicated transmission mechanism. On the other hand, the proportion of productive expenditures to gross funds which have a greater role to the growth of farmers income is too small, so the level of financial support for agriculture can not reflect its economic effects on the measurement results.



**Figure 3.** Productive expenditures and department expenditures in Sichuan province, 1995~2005  
Data source, " Sichuan Statistical Yearbook ".

It is worth noting that the results can not prove that the overall fiscal policy support for agriculture is invalid in the Sichuan-Chongqing Economic Zone because the overall fiscal policy in addition to directly supporting agriculture spending, but also including transfer payments (such as allowance for each mu of land grants ) and tax relief, and both are directly related to the income of peasants, but not within the scope of this study examined.

### 4.3. Vector Error Correction Model (VEC)

Cointegration between variables means that long-term equilibrium relationship, but does not show that the short term will not be a temporary departure from equilibrium. Short-term relationship between variables are determined by Error Correction Model to illustrate. Engle and Granger had combined cointegration with Error Correction Model to establish the vector error correction model (VEC). As long as there is cointegration between the variables, we can use the autoregressive distributed lag ADL model to derive ECM. The VAR model is an ADL model for each equation, so that the VEC model is a constrained VAR model with

cointegration. After repeated testing, we selected lag 2, with intercept but no time trend term, separately established VEC models of three groups of variables. The results are as follows:

$$DLNAO=0.016VECM^1_{t-1}-0.05D(LNAO(-1))+0.16D(LNAO(-2))-0.015D(FI(-1))+0.013D(FI(-2)) \\ +0.034D(RF(-1))-0.01D(RF(-2))-0.002D(PF(-1))+0.01D(PF(-2))+0.061 \quad (11)$$

$$DLNGY=-0.02VECM^2_{t-1}-0.24D(LNGY(-1))-0.08D(LNGY(-2))-0.012D(FI(-1))+0.006D(FI(-2)) \\ +0.009D(RF(-1))+0.002D(RF(-2))-0.0005D(PF(-1))-0.003D(PF(-2))+0.024 \quad (12)$$

$$DLNRI=0.006VECM^3_{t-1}+0.35D(LNRI(-1))+0.25D(LNRI(-2))-0.006D(FI(-1))+0.008D(FI(-2)) \\ +0.03D(RF(-1))-0.012D(RF(-2))-0.008D(PF(-1))-0.002D(PF(-2))+0.030572 \quad (13)$$

In functions (11) to (13), VECM are items of vector error correction.

$$VECM^1 = LNAO(-1) -0.022FI(-1) -0.098RF(-1) -0.024PF(-1) -4.426 \quad (14)$$

$$VECM^2 = LNGY(-1) -0.003FI(-1) -0.089RF(-1) -0.019PF(-1) -5.1 \quad (15)$$

$$VECM^3 = LNRI(-1) -0.04FI(-1) -0.281RF(-1) +0.018PF(-1) -2.508 \quad (16)$$

According to functions (11) to (13), we can separately obtain their error correction coefficients as 0.015783, -0.021686 and 0.005995, and they are all statistically significant. The error correction coefficient of VEC model among LNGY and FI, RF, PF is a minus, so this model has reverse adjustments role. When the per capita food production deviated from long-run equilibrium state, the error correction would adjust it negatively with the speed of -0.021686 until it returned to equilibrium. But this short-term adjustment is feeble as its role to DLNGY needs 46 years. The error correction coefficients of model DLNAO and model DLNRI are bigger than zero, so there are not short-run adjustment roles among rural per capita GDP, rural per capita net income and fixed assets investment, financial and fiscal support for agriculture. It is obvious that, there are lots of important factors influencing rural GDP, food production and net income of farmers. Although there are positive long-run cointegrations between financial&fiscal support for agriculture and those three indices above, this kind of relation is not close enough. And financial&fiscal support for agriculture are not main factors influencing their short-term change, it is not possible to make swift adjustment for those three indices just via financial&fiscal support for agriculture.

#### 4.4. Granger Causality Test

The co-integration test and vector error correction model above show the long-run equilibrium relationship and short-term adjustment mechanism of these variables. In order to analyse whether there was a causal relationship between the variables, or study their direction and intensity of this causality, we use Granger causality test here. This test essentially studies whether a variable's lag variable could be introduced into other variables to improve the extent of explanation. Lag length selection of causality test is sensitive, AIC, SC, and HQC criteria methods and so forth all have their respective deficiencies, and there is a great relationship between the selection of optimal lag length and which period researchers want to study. To more clearly reflect the causal relationship between variables related, taking into account the characteristics of small samples data used in this paper, we separately test the causality of model 1~3 beginning from a larger lag length 4 to 3 and 2. The result of Granger Causality Test in lag length 2~4 is:

**Table 3.** Result of Granger Causality Test Between Variables (lag 2~4)

	Lag length	FI doesn't	Y doesn't	RF doesn't	Y doesn't	PF doesn't	Y doesn't
		Granger	Granger	Granger	Granger	Granger	Granger
		Cause Y	Cause FI	Cause Y	Cause RF	Cause Y	Cause PF
Model 1	2	0.0796* (2.9471)	0.0035** (8.0188)	0.5773 (0.5676)	0.0791* (2.9559)	0.8339 (0.1836)	0.2594 (1.4624)
	3	0.0170** (4.7782)	0.0095** (5.6517)	0.7432 (0.4175)	0.0231** (4.3474)	0.8543 (0.2581)	0.4450 (0.9459)
	4	0.1570 (2.0465)	0.0194** (4.6392)	0.5990 (0.7148)	0.0007** (11.299)	0.9621 (0.1436)	0.4631 (0.9678)
Model 2	2	0.2182 (1.6670)	0.0967* (2.6883)	0.6750 (0.4023)	0.7478 (0.2957)	0.8717 (0.1384)	0.8627 (0.1490)
	3	0.3455 (1.2009)	0.2370 (1.5870)	0.9426 (0.1270)	0.8794 (0.2222)	0.6514 (0.5579)	0.7708 (0.3773)
	4	0.4042 (1.0997)	0.2743 (1.4783)	0.9564 (0.1557)	0.0867* (2.6981)	0.6615 (0.6139)	0.2977 (1.3976)
Model 3	2	0.7441 (0.3007)	0.0441** (3.7715)	0.0198** (4.9860)	0.0666* (3.1907)	0.7237 (0.3297)	0.2135 (1.6930)
	3	0.6433 (0.5710)	0.1168 (2.3473)	0.0793* (2.7889)	0.0231** (4.3510)	0.8477 (0.2675)	0.3599 (1.1599)
	4	0.8735 (0.2977)	0.3191 (1.3296)	0.0763* (2.8461)	0.0044** (7.1374)	0.8242 (0.3715)	0.2199 (1.6993)

Note: 1.Brackets are F statistics. 2.\*, \*\* represent that at the remarkable levels of 5%,10% the hypothesis can be rejected. 3.In the table above, Y separately represent LNAO, LNGY and LNRI in model 1~3.

Table 3 shows the Granger causalities of three groups of variables at the remarkable level of 10% from lag length 2 to 4 of. In model 1, FI becomes a reason for change of LNAO from lag length 2 to 3. LNAO becomes a reason for change of FI and RF from lag length 2 to 4. In model 2, the causal relationships between variables are rather weak, only LNGY becomes a reason for change of FI and RF in lag length 2 and 4. In model 3, LNRI becomes a reason of FI in lag length 2, LNRI and RF show a mutual causality from lag 2 to 4. Can be seen Simultaneously, the test results are not sensitive to the lag length(ie selecting different lag lengths can basically obtain the same conclusion), so the test results for the qualitative analysis are highly credible.

Can be seen from the results above, from 1985 to 2008, financial&fiscal support for agriculture didn't enhance the level of per capita GDP directly in the Sichuan-Chongqing economic zone, both short-term promoting effect to GDP growth were not obvious. However, rural GDP growth significantly improved the level of financial support for agriculture in the short term, there was a good short-term relationship in promoting with each other between the level of investment and GDP growth. Secondly, there were not significant short-term causalities between per capita food production and financial&fiscal support for agriculture or even the level of investment. Although these three Explanatory variables could promote food production in the long term, but in the short term they were exogenous, not the main factors for increasing production of agricultural products. Thirdly, a significant short-term mutual causality was showed from financial support for agriculture and farmers income.

The mutual causality between rural GDP and fixed assets investment which is considered as an important engine of national economy growth is consistent with some classical theory of economic growth such as multiplier-accelerator model and Solow model. At the same time, the causal relationship between financial support for agriculture and farmers income reflects a virtuous circle of funds operation on rural financial market in the Sichuan-Chongqing Economic Zone: Agricultural credit leading by market allocation provide external funding for farmers to expand reproduction → increase of farmers incomes and farmer financial credit → scale-up of agricultural credit. And then it proves the effectiveness of agricultural credit mechanism of financial institutions in this region. On the other hand, there should be a causal relationship between fiscal support for agriculture and food production in our anticipation, because funds used for direct production expenditures such as irrigation infrastructure occupy a significant proportion of financial support for agriculture. However, the empirical results are opposite, even no causal relationship with the other two indicators (FI, RF). This indicates that the relationship between food production and level of financial support for agriculture is not very close. An important reason for this is that the proportion of productive expenditure to total expenditure for supporting agriculture is too low, so that the structure and intensity of fiscal support for agriculture need to be further adjusted and upgraded.

#### 4.5. Variance Decomposition Testing

Variance Decomposition Testing is to value the importance of different structures impact through analyzing the contribution of every structural impact to the change of endogenous variables (through differential equations). Thus the decomposition results are Table 4. The result of each arrange separately represents the contribution of equation information to forecast mean square error of each period. And each row adds up to 100.

**Table 4.** The Variance Decomposition of RF and PF on LNAO, LNGY, LNRI (%)

	Model 1				Model 2				Model 3			
	LNAO	FI	RF	PF	LNGY	FI	RF	PF	LNRI	FI	RF	PF
1	100.0	0.00	0.00	0.00	100.0	0.00	0.00	0.00	100.0	0.00	0.00	0.00
2	94.82	0.94	4.23	0.01	87.66	10.33	2.01	0.00	82.32	3.56	12.73	1.39
3	96.08	1.03	2.87	0.02	82.19	9.71	5.88	2.22	82.89	3.27	11.42	2.42
4	96.05	1.15	2.79	0.02	80.73	9.171	7.71	2.39	82.18	2.50	11.90	3.42
5	96.64	1.08	2.26	0.02	76.34	11.41	10.01	2.24	84.10	2.08	10.34	3.48
6	96.90	1.01	2.07	0.02	73.60	12.18	11.58	2.64	85.79	1.62	8.98	3.61
7	97.17	1.00	1.81	0.02	71.49	13.00	12.70	2.82	87.19	1.31	7.97	3.53
8	97.33	0.96	1.69	0.02	68.95	14.03	14.03	2.99	88.38	1.08	7.10	3.43
9	97.47	0.96	1.56	0.02	67.06	14.57	15.21	3.16	89.22	0.91	6.51	3.36
10	97.6	0.93	1.45	0.02	65.27	15.29	16.24	3.21	89.90	0.78	6.03	3.30

Table 4 shows, in model 1 LNAO variance decomposition, the contribution of its own is biggest in the future period 1 to 10, the peak value is 100% in period 1 and valley value is 96.05% in period 4. The contribution of the three independent variables are not very significant. In contrast, the contribution of financial support to agriculture (RF) is larger than others, its peak value is 4.23% in period 2 and valley value is 1.45% in period 10. In model 2, RF and FI shows more obvious contribution rate on LNGY, the average contribution rate of them are all more than 10% during periods 2 to 10. In model 3, the greatest contribution is

from RF in addition to LNRI own factors. Its peak value is 12.73% in period 2 and valley value is 6.03% in period 10. Compared with RF, the contributions of FI and PF is much smaller. To sum up, from model 1 to 3 above, the variance decomposition results show that the contributions of financial support for agriculture are all higher than those of fiscal support for agriculture on the three indicators including rural per capita GDP, per capita food production and per capita net income in the next 10 years. And it is consistent with the results of cointegration and Granger causality test. In other words, the long-term economic effects, short-term correlation degree and the future contribution rate of financial support for agriculture on the three indicators such as rural per capita GDP are all greater than those of fiscal. From review of empirical research findings above, we can conclude that financial support for agriculture should be a major policy to develop for solving the “three rural” issue in this region.

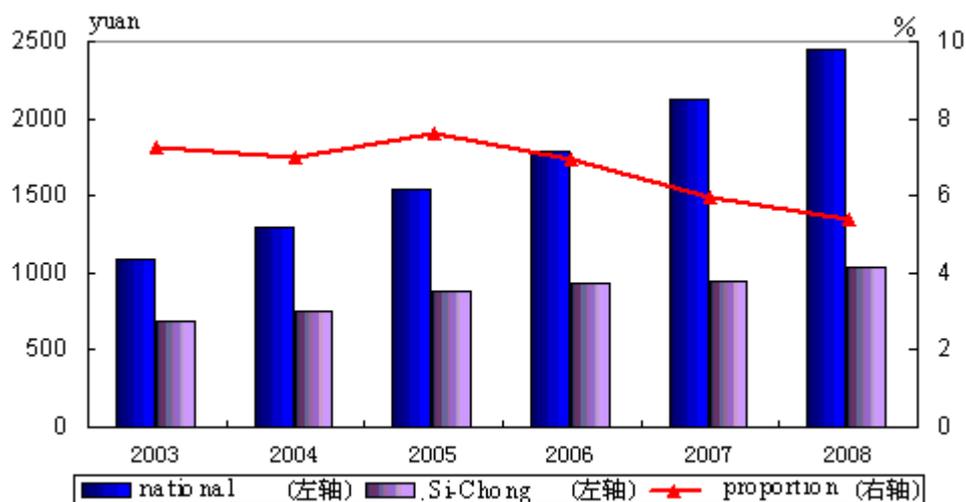
## **5. Conclusion and Policy Enlightenments**

The empirical results show that, from 1985 to 2008, financial support for agriculture had a stable long-term economic effects to rural GDP, food production and farmers income in Sichuan-Chongqing Economic Zone of Western China, and there was a significant short-term mutual causality between the growth of farmers income and financial support for agriculture. Fiscal support for agriculture had long-term economic effects to rural GDP and food production, but lack of efficiency to farmers income, while the short-term role of fiscal support to the three indicators was weak. In the comparative analysis, we found the long-term economic effects of financial support for agriculture to rural production, food production and farmers income were greater than those of fiscal support as well as the short-term interactions. In the next 10 years, the contributions of financial support for agriculture on these three indicators will also be greater than those of fiscal support. Due to Chinese agricultural credit system has been led by market supply and demand in the micro-level while fiscal support for agriculture has mainly reflected the government planning in policy practice since Reform and Opening, the conclusion above also verifies previous point of view that efficiency of fund for agriculture led by market allocation is greater than those led by government plan intervention.

Based on the conclusions above, some suggestions are given to promote the policy effects of financial and fiscal support to agriculture in Western China:

First, reinforcing financial support for agriculture is most important to relieve the scarcity of funds in the development of “three rural” in Western China. The empirical research reveals that financial support for agriculture has remarkable economic effects to rural GDP, food production and farmers income, and obviously greater than the effects of fiscal support, so the government should reinforce the lever of financial support no matter which indicators (GDP, income and food production) became the policy direction. However, the level of financial support for agriculture in western China is always below the national average for a long time, so it needs to be paid more attention. As shown in the figure 4, from 2003 to 2008, the ratio of the loan per peasant in Sichuan-Chongqing to the loan per peasant in China declined from 0.63 to 0.43, and the absolute difference was over 1400 yuan in 2008. On the other hand, with the deepening of advance of China Western Development, the proportion of agricultural credit to the total credit declined from 7.3% to 5.4% from 2003 to 2008 while the amount of

agricultural loans was increasing. Thus the level of rural finance in Western China is remarkable below the national average level, and it needs to be paid more attention under the strategy of China Western Development. Therefore, the government in Western China should promote the innovation of the rural financial institutions through carrying out related policy, design corresponding financial products according to the real demand of peasants from different aspects such as credit limit and payment method, provide the imperative fund for the development of “three rural”.



**Figure 4.** The per capita loan of farmers (national and Sichuan-Chongqing), and the proportion of agricultural loans to total loans in Sichuan-Chongqing Economic Zone.

Data source, " Sichuan Statistical Yearbook ".

Second, expand the proportion of production expenditure of fiscal support for agriculture and concentrate fiscal resources on the direct production expenditures and irrigation infrastructure. The economic effects of fiscal support for agriculture is less than financial support and even invalid to increase of farmers income, its major reason is the low proportion of productive expenditure. If the productive expenditure would be increased substantially, we can further improve conditions of agricultural production, promote growth of crop yield, and ultimately make it play a greater role in increasing farmers income and rural economic growth. At the same time, we must see that the amount of fiscal support for agriculture in Western China and even the whole country is much lower than those of developed countries. In the United States, Canada, UK, Australia and so on, the proportions of fiscal support to agricultural GDP are nearly more than 25%. In Japan, Israel and some other countries, these proportions are 45% to 95% (Zhu *et al.*, 2000). But this proportion is less than 10% in Western China and even the whole country. Therefore, if expanding the proportion of productive expenditure while continuing to strengthen the total funds of fiscal support for agriculture can we promote the development of “three rural” on a higher efficiency level.

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