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# Empirical Study on the Relationship between the Local Fiscal Revenue and Expenditure and the Development of Financial Industry in Shanghai

***[1]Hong-jiang Li, [2]Zhen Yu, [3]Xiao-yu Zhao**

*[1] School of business, university of shanghai for science and technology, Shanghai, China.
[2]School of business, university of shanghai for science and technology, Shanghai, China.
[3]School of business, university of shanghai for science and technology, Shanghai, China.

Email: *[1]lhjmoye@126.com
[2]yuzhensharon@sina.com
[3]x_yu920@163.com

**Abstract-**The purpose of this paper is to explore the relationship among the local fiscal revenue, local fiscal expenditure and the development of financial industry. The methodologies used in the study include Vector Autoregressive Model, Impulse Response Function, Variance Decomposition, Granger Causality Test, Johansen Cointegration Test and Vector Error Correction Model. Then we come to the conclusion that local fiscal revenue exerts a negative influence on the development of financial industry; on the contrary, local fiscal expenditure can apply a positive impact. Lastly, the reasonable fiscal policies to promote the development of financial industry are put forward.

**Keywords-**Fiscal revenue; Fiscal expenditure; Financial industry; Vector autoregressive model; Johansen cointegration test; Vector error correction model

## 1. Introduction

According to the *2011 Shanghai Economic and Social Development Statistical Bulletin*, on the one hand, over the year of 2011, Shanghai had achieved local fiscal revenue of 342.983 billion yuan, which had increased 19.4% over the previous year; meanwhile, the local expenditure had realized 391.488 billion yuan. On the other hand, it had achieved financial added value of 224.047 billion yuan, which had increased 8.2% comparing to the previous year. We can get the conclusion that the increase rate of gross product of Shanghai's financial industry in 2011 is far behind the increase rate of its expenditure. In addition, according to the data of local fiscal revenue, local fiscal expenditure and gross product of the financial industry in the *Shanghai Statistical Yearbook* from 2002 to 2011, we can also get the same conclusion through calculation. Therefore, it has aroused great interest of us to explore the relationship among local fiscal revenue and expenditure and gross product of financial industry.

What's more, according to the strategic positioning and requirements of the state to Shanghai, till the year of 2020, Shanghai should achieve two grand medium- and long-term development goals while facing the opportunities and challenges which lie in the 21st century. One of them is to complete the initial establishment of the international economic, financial, trade and shipping center which are compatible with the economic strength and international status of China and have the capabilities of global resources allocation. The other is to complete the initial establishment of an international socialist metropolis with economic prosperity, social harmony and beautiful environment, in order to making contribution to the building of world-class city group in Yangtze River Delta with strong international competitiveness. Therefore, it has some practical meanings for Shanghai's building of international financial center to study the influence of local fiscal revenue and expenditure to the financial industry.

## 2. Literature review

A number of studies have been conducted to identify the relationship between local fiscal revenue and expenditure and industry development. The related literature can be classified into three groups.

The first group conducted the studies from the perspective that local fiscal revenue and expenditure could help develop local industries. Wei Liang (2007) held the view that it was imperative for the Chinese government to introduce macro management in the sector of coal industry, and fiscal policies had been recognized as one of the most efficient measures. Youhui Zhong and Zhijiang Yang (2009) pointed out that fiscal expenditure was of great importance to the adjustment and optimization of the agricultural industry structure. Then they suggested that gradually increasing the state's fiscal support for agriculture, optimizing the structure of the fiscal support for agriculture and adjusting the methods of the fiscal support for agriculture were needed to solve the problems in the current fiscal support for agriculture. To study how to improve the independent innovation ability of the Chinese IT industry, Zhensheng Tao(2010) initially analyzed the necessity of improving the innovation ability of the Chinese IT industry, then the theoretical basis for implementing the policies to promote the IT innovation, and lastly the fiscal policy measures of improving the innovation ability of Chinese IT industry. Lars P. Feld, Jan Schnellenbach and Thushyanthan Baskaran(2012) analyzed the rise and fall of the steel and mining industries in the regions of Saarland, Lorraine and Luxembourg. They found that fiscal autonomy of a region subjected to structural change in its private sector is associated with a relatively faster decline of employment in the sectors affected. Contrary to the political lore, fiscal transfers die not appear to be used to speed up the destruction of old sectors, but rather to stabilize them.

The second group explored the topic from the perspective that the development of local industries can contribute to local finance. Yan Xu(2009) viewed that the fact that the secondary industry occupied a relatively small part among the three industries in Dandong City(Liaoning Province, China) affected the stability and sustainable growth of local fiscal revenue. And she argued that making the secondary industry larger and stronger, increasing the size and number of industrial enterprises are the fundamental ways to maintain the local fiscal revenue’s steady and sustainable growth.

The last group suggested that there existed no unidirectional but bidirectional relationship between local fiscal revenue and expenditure and industry development. Taking Yunnan as an example, Zaijin Zou(2007) argued that there was a close relationship between the development of tertiary industry and fiscal revenue and expenditure, which meant that the tertiary industry was an important source of local finance of Yunnan and meanwhile the development of the tertiary industry was dependent on the reasonable fiscal expenditure of Yunnan.

Now, we extract the data of local fiscal revenue and expenditure and gross product of financial industry in Shanghai from 1978 to 2011, and use the Vector Autoregressive Model and Vector Error Correction Model to explore the relationship between them.

## 3. Methodology

### 3.1. Data explanation

We select the local fiscal revenue, local fiscal expenditure and gross product of financial industry from 1978 to 2011 as the index and then explore the quantitative relationship among the three to analyze the influence of local fiscal revenue and expenditure of Shanghai to the financial industry. To eliminate the influence to the data brought by the fluctuation of the price, we deflate the three index data with the CPI (consumer price index) of Shanghai from 1978 to 2011. Besides, we take the natural logarithm of the adjusted data to further ensure the stability of the data. At last, we take respectively the re-adjusted data of local fiscal revenue, local fiscal expenditure and gross product of financial industry as LNRFR, LNRFE and LNRFI. All the data are adopted from the *Shanghai Statistical Yearbook* from 2000 to 2011 and *Shanghai Economic and Social Development Statistical Bulletin of 2011*.

### 3.2. Unit Root Test

In the following text, we have to do Stationary Test to the LNRFR, LNRFE and LNRFI time series. The main method for Stationary Test is Unit Root Test, while the widely used method for the Unit Root Test is Augment Dickey-Fuller Test (ADF Test).

Take LNRFR time series as an example, the ADF Test is completed through the following three models,

Model 1, $\Delta \mathrm{LNRFR}_t=\delta\,\mathrm{LNRFR}_{t-1}+\sum_{i=1}^{n}\beta_i \mathrm{LNRFR}_{t-i}+\varepsilon_t$

Model2, $\Delta \mathrm{LNRFR}_t=\alpha+\delta \mathrm{LNRFR}_{t-1}+\sum_{i=1}^{n}\beta_i \mathrm{LNRFR}_{t-i}+\varepsilon_t$

Model3, $\Delta \mathrm{LNRFR}_t=\alpha+\beta t+\delta \mathrm{LNRFR}_{t-1}+\sum_{i=1}^{n}\beta_i \mathrm{LNRFR}_{t-i}+\varepsilon_t$

The variable $t$ in Model 3 represents the time trend. Model 2 has an additional constant item $\alpha$ compared with model 1, while Model 3 has an additional time trend item $\beta t$ compared with model 2. The null hypothesis for the three models are all $\delta$=0. In the actual test, it is often conducted in the sequence of model 3, 2, 1 rather than the adverse sequence. The inspection stops right after the test refuses the null hypothesis, or in other words, accepts that the tested series is stationary. Otherwise, the inspection should be continued until it finishes the test to model 1. The ADF test models for LNRFE and LNRFI are similar with the above.

### 3.3. Vector Autoregressive Model

The Vector Autoregressive Model (VAR Model) was put forward by Sims in 1980. This model uses a form of simultaneous multi-equation. In each equation in the model, endogenous variables conduct regression to all the lagged values of endogenous variables in the model to estimate the dynamic relationship among all the endogenous variables.

The unrestricted VAR with a lag of p phrases model which includes the three variables LNRFR, LNRFE and LNRFI can be expressed as,

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \ldots + A_p y_{t-p} + u_t, \quad (1)$$

In which $y_t = (\mathrm{LNRFR}_t, \mathrm{LNRFE}_t, \mathrm{LNRFI}_t)'$, $c = (\mathrm{c}_1, \mathrm{c}_2, \mathrm{c}_3)'$, $u_t = (u_{1t}, u_{2t}, u_{3t})'$, $u_t$~IID(0, $\Omega$)

$$A_j = \begin{pmatrix} a_{11,j} & a_{12,j} & a_{13,j} \\ a_{21,j} & a_{22,j} & a_{23,j} \\ a_{31,j} & a_{32,j} & a_{33,j} \end{pmatrix}, \quad j=1, 2, \ldots\ldots, p$$

The analysis tools of VAR model include Impulse Responses, Variance Decomposition and Granger Causality Test.

### 3.4. Johansen Cointegration Test

To analyze the long-term relationship among the three variables of LNRFR, LNRFE and LNRFI, we need to conduct Cointegration Test. The commonly used method of the Cointegration Test for VAR model is Johansen Test, which sometimes is also called Johansen-Juselius Test (JJ test).

We assume that $y_t = (y_{1t}, y_{2t}, ..., y_{kt})'$ is a k-dimensional random time series, $t = 1, 2, ..., T$, if

(1) $y_t \sim I(d)$, and each $y_{it} \sim I(d)$, $i = 1, 2, ..., k$;

(2)There exists non-zero vector $\beta = (\beta_1, \beta_2, ..., \beta_k)'$ which meets $\beta' y_t \sim I(d-b), 0 < b \le d$;

Then we label $y_t$ as cointegration time series, and mark it as $y_t \sim CI(d,b)$, $\beta$ is a cointegrating vector. If $y_t$ is cointegrated, then there exists $k-1$ linearly independent cointegrating vectors at most.

After conducting cointegrating transformation to the above VAR model, we can get,

$$\Delta y_t = c + \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + u_t \quad (2)$$

In which $\Pi = \sum_{i=1}^{p} A_i - I, \quad \Gamma_i = -\sum_{j=i+1}^{p} A_j$

If $y_t \sim I(1)$, that is to say LNRFR, LNRFE and LNRFI are all integrated of 1 variables, $\Delta y_t \sim I(0)$ 、 $\Delta y_{t-j} \sim I(0), j = 0, 1, ..., p$, $\sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} \sim I(0)$, therefore, as long as $\Pi y_{t-1} \sim I(0)$, there exists conintegrating relations among $\text{LNRFR}_{t\text{-}1}$, $\text{LNRFE}_{t\text{-}1}$ and $\text{LNRFI}_{t\text{-}1}$, or in other words, $\text{LNRFR}_t$, $\text{LNRFE}_t$ and $\text{LNRFI}_t$. While whether there exists cointegrating relations among $\text{LNRFR}_{t\text{-}1}$, $\text{LNRFE}_{t\text{-}1}$ and $\text{LNRFI}_{t\text{-}1}$ depends on the rank of the $3 \times 3$ matrix $\Pi$, therefore, the test of whether there exists cointegrating relations among $\text{LNRFR}_{t\text{-}1}$, $\text{LNRFE}_{t\text{-}1}$ and $\text{LNRFI}_{t\text{-}1}$ has transformed to the test of the rank of matrix $\Pi$. As $rank(\Pi)$ equals to the number of non-zero eigenvalues of matrix $\Pi$, we can test $rank(\Pi)$ by testing the non-zero eigenvalues of $\Pi$ to judge whether there exists cointegrating relations among $y_t = (\text{LNRFR}_t, \text{LNRFE}_t, \text{LNRFI}_t)'$.

Now we assume that there are three eigenvalues $\lambda_1 > \lambda_2 > \lambda_3$.

Johansen Cointegration Test has two test methods which are Trace Test and Maximum Eigenvalue Test. The two methods are similar, therefore only Trace Test is introduced in the following text.

As we can get $r$ cointegrating vectors from $r$ maximum eigenvalues, while for the other $3-r$ non-cointegrating combination, it should have $\lambda_{r+1} = \lambda_{r+2} = ... = \lambda_3 \equiv 0$, therefore, to test whether $rank(\Pi)$ equals to $r$ has the same meaning to test the assumption $H_{r0}: \lambda_r > 0, \lambda_{r+1} = 0; H_{r1}: \lambda_{r+1} > 0, \quad r = 0, 1, 2$.

The trace statistics for test is

$$\xi_r = -T \sum_{i=r+1}^{3} \ln(1-\lambda_i), \quad r = 0, 1, 2$$

The specific test procedures are as follows,

When $\xi_0$ is smaller than the Johansen distribution critical value at a certain significant level, that is to say, it is not significant, then we accept $H_{00}(r=0)$, which means that there is no cointegration vector.

When $\xi_0$ is larger than the Johansen distribution critical value at a certain significant level, that is to say, it is significant, then we refuse $H_{00}(r=0)$, which means that there is at least one cointegration vector. Under this condition, we have to continue to the test of $\xi_1$.

When $\xi_1$ is smaller than the Johansen distribution critical value at a certain significant level, that is to say, it is not significant, then we accept $H_{10}(r=1)$, which means that there is one cointegration vector.

When $\xi_1$ is larger than the Johansen distribution critical value at a certain significant level, that is to say, it is significant, then we refuse $H_{10}(r=1)$, which means that there is at least two cointegration vectors.

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When $\xi_r <$ is smaller than the Johansen distribution critical value at a certain significant level, that is to say, it is not significant, then we accept $H_{r0}$, which means that there are r cointegration vectors.

### 3.5. Vector Error Correction Model

If there exits cointegration relation among $y_t = (\text{LNRFR}_t, \text{LNRFE}_t, \text{LNRFI}_t)'$, then we can conclude that $\Pi y_{t-1} \sim I(0)$ in equation (2). Under this condition, equation (2) can be expressed as,

$$\Delta y_t = \alpha \beta' y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + u_t \quad (3)$$

In which $\beta' y_{t-1} = ecm_{t-1}$ is the error correction term which reflects the long-term equilibrium relations among the variables. Equation (3) can be expressed as,

$$\Delta y_t = \alpha ecm_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + u_t \quad (4)$$

Equation (4) is the Vector Error Correction Model (VEC Model), in which each equation is an Error Correction Model.

## 4. Empirical result

### 4.1. Unit root test

To analyze the stationarity of the time series of LNRFR, LNRFE and LNRFI, we do Augment Dickey-Fuller Test to the three time series in turn. In the software EVIEWS6.0, the output result of ADF test to LNRFR time series is shown in Table 1. At 5% confidence level, we can conclude that LNRFR itself is not stationary, but its first-order difference is stationary, so LNRFR is integrated of 1 variable, that is to say, LNRFR~$I(1)$.In the same way, we can get the conclusion that LNRFE and

LNRFI are also integrated of 1 variables, or in other words, LNRFE~$I$(1), LNRFI~$I$(1).

**Table 1.** Stationary test

| Time Series | Test Model | Prob. |
|---|---|---|
| LNRFR | Model 3 | 0.99 |
| | Model 2 | 0.99 |
| | Model 1 | 0.89 |
| D(LNRFR) | Model 3 | 0.00 |
| | Model 2 | 0.01 |
| | Model 1 | 0.00 |

### 4.2. Vector Autoregressive Model

For the established VAR model (1) of LNRFR, LNRFE and LNRFI, on the basis of comprehensive consideration of the characteristics of the data, the requirements of economic theories and Akaike Information Criterion, we choose the lag of three. Enter the data of the three variables of LNRFR, LNRFE and LNRFI in the software EVIEWS6, open the dialogue box of VAR Specification, check "Unrestricted VAR" in the "VAR Type", and put "Endogenous Variables", "Lag Intervals for Endogenous" and "Exogenous Variables" respectively as "LNRFI LNRFR LNRFE", "1 3"and "c", then we can get the following VAR model,

$$y_t = \begin{pmatrix} 0.74 \\ 0.22 \\ -0.11 \end{pmatrix} + \begin{pmatrix} 0.85 & -0.02 & 0.56 \\ -0.25 & 0.96 & 0.21 \\ -0.05 & 0.28 & 1.14 \end{pmatrix} y_{t-1} + \begin{pmatrix} 0.04 & -0.30 & -0.66 \\ 0.19 & 0.07 & -0.03 \\ 0.28 & -0.05 & -0.32 \end{pmatrix} y_{t-2} + \begin{pmatrix} -0.30 & 0.10 & 0.59 \\ -0.06 & -0.17 & 0.05 \\ -0.06 & -0.12 & -0.06 \end{pmatrix} y_{t-3} + u_t \quad (5)$$

In which $y = \begin{pmatrix} \text{LNRFI} \\ \text{LNRFR} \\ \text{LNRFE} \end{pmatrix}$

The Adjusted R-squared in the three equations in VAR model (5) are respectively 0.99, 0.95 and 0.99, which indicates that the goodness of fit of the equations to the variables are all very high; the F-statistic of the three equations are respectively 277.42, 68.50 and 537.52, which suggests that the overall linearity of the three equations are all very good. Besides, the result of stationary test to model (5) is shown as Table 2 and graph 1, which indicates that the model meets the requirements of stationarity. Therefore the analysis of Impulse Response, Variance Decomposition and Granger Causality Test can be conducted.

**Table 2.** AR Roots Table

| Root | Modulus |
|---|---|
| 0.962560 - 0.013158i | 0.962650 |
| 0.962560 + 0.013158i | 0.962650 |
| 0.599896 - 0.523024i | 0.795882 |
| 0.599896 + 0.523024i | 0.795882 |
| -0.393308 - 0.287260i | 0.487042 |
| -0.393308 + 0.287260i | 0.487042 |
| 0.431729 - 0.069791i | 0.437333 |
| 0.431729 + 0.069791i | 0.437333 |
| -0.249697 | 0.249697 |

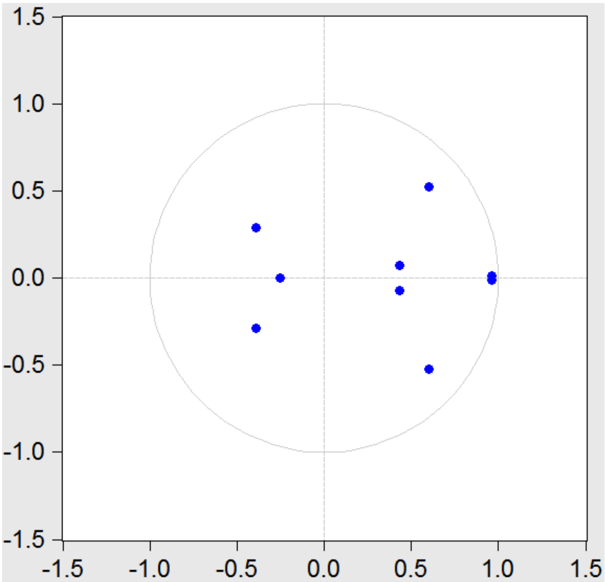


**Figure 1.** AR Roots Graph

**4.2.1. Impulse Responses:** As coefficients can merely reflect local dynamic relations, they can't catch the comprehensive and complex dynamic relations. Whereas researchers always pay attention on the whole influential process that the changes of one variable bring to another variable. Under this condition, we can make Impulse Responses Function which depicts the dynamic influence to the endogenous variables' current and future values after imposing an impulse with the value of a standard deviation on the random error item. Open the dialogue box of Impulse Responses in the software EVIEWS6.0, and check "Combined Graphs" in the "Display Format", set "Impulses", "Responses" and "Periods" respectively as "Impulses", "LNRFI" and "10"; then check "Cholesky-dof adjusted" in the "Decomposition Method", and set "Cholesky Ordering" as "LNRFI LNRFR LNRFE". The output result is shown in graph 2. Facing up to a positive impulse of a standard deviation to LNRFI, LNRFI itself decreases from the very beginning, then reaches the minimum value at phase 7 and lastly begins to increase. Facing up to a positive impulse of a standard deviation to LNRFR, LNRFI rises during phase1 and phase 2, then begins to decrease, and reaches the minimum value at phase 5, then begins to rise again; Facing up to a positive impulse of a standard deviation to LNRFE, LNRFI rises from zero, and reaches the maximum value at phase 6, and then begins to decrease.

Its economic significance can be stated as follows. By the positive impact of itself, the gross product of financial industry will fluctuate in the same direction, and the volatility will be smaller and smaller; by the positive impact of local fiscal revenue, the gross product of financial industry will fluctuate firstly in the same direction, then in the opposite direction and lastly in the same direction again; by the positive impact of local fiscal expenditure, the gross product of financial industry will fluctuate in the same direction, and the volatility will firstly get lager and then get smaller.

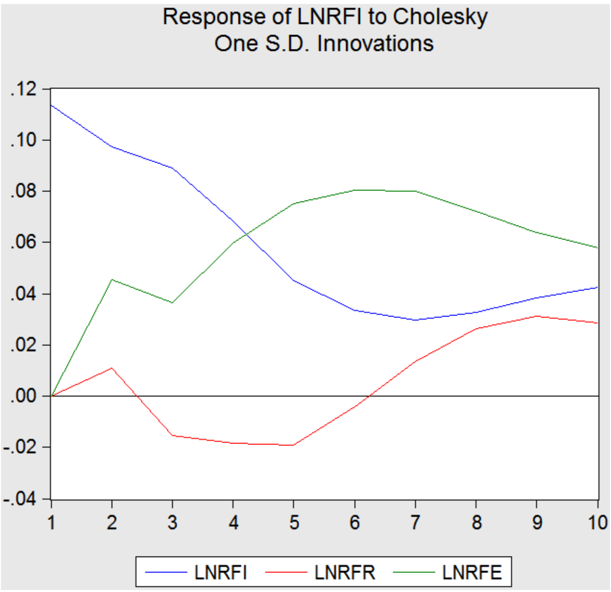

**Figure 2.** Impulse Responses

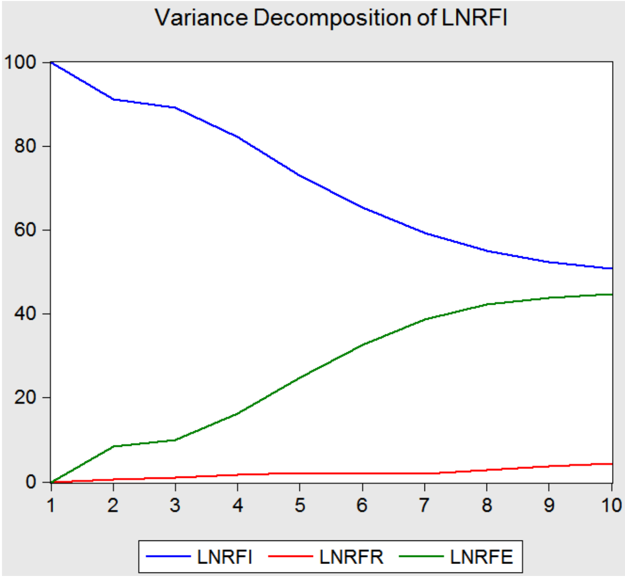

**Figure 3.** Variance Decomposition

**4.2.2. Variance Decomposition:** For VAR model, we can also adopt the variance decomposition method to study its dynamic characteristics. Variance Decomposition can decompose the variance of one variable in the VAR model to evaluate the contribution degree of each endogenous variable to the predictive variance of the variable. Open the dialogue box of Variance Decompositions in the software EVIEWS6.0, check "Combined Graphs" in the "Display Format"; check "Cholesky Decomposition" in the "Factorization"; set "Decompositions of", "Periods" and "Ordering for Cholesky" respectively as "LNRFI", "10" and "LNRFI LNRFR LNRFE". The output result is shown in graph 3, from phase 1 to phase 10. The variance of LNRFI cause by its own change decreased from 100% to 50%, and still has the trend of continually decrease; the proportion of the changes caused by LNRFE's change increases from zero to about 45%, and has the trend of continually increase; while the proportion of the changes caused by LNRFR's change slowly increases from zero to about 5%.

Its economic significance can be stated as follows. Fluctuation of the gross product of financial industry resulted from its own changes gets smaller and smaller; the same fluctuation resulted from the changes of local fiscal expenditure gets lager and larger; while the same fluctuation resulted from the changes of local fiscal revenue stays small.

**4.2.3. Granger Causality Test:** Granger Causality can be used to test whether the lagging item of certain variable has impact on the current value of another or some other variables. If the impact is significant, it indicates that the variable has Granger Causality relation with another or some other variables; if not significant, it suggests that the variable has no Granger Causality relation with another or some other variables. The output result of Granger Causality Test based on VAR model (5) is shown as Table 3.

**Table 3.** Granger Causality Test

| Dependent Variable | Null Hypothesis | Chi-sq | df | Prob. |
|---|---|---|---|---|
| LNRFI | LNRFR does not Granger cause LNRFI | 5.92 | 3 | 0.12 |
| | LNRFE does not Granger cause LNRFI | 11.02 | 3 | 0.01 |
| | LNRFR&LNRFE don't Granger cause LNRFI concurrently | 12.99 | 6 | 0.04 |
| LNRFR | LNRFI does not Granger cause LNRFR | 1.37 | 3 | 0.71 |
| | LNRFE does not Granger cause LNRFR | 1.17 | 3 | 0.76 |
| | LNRFI&LNRFE don't Granger cause LNRFR concurrently | 6.33 | 6 | 0.39 |
| LNRFE | LNRFI does not Granger cause LNRFE | 5.52 | 3 | 0.14 |
| | LNRFR does not Granger cause LNRFE | 6.47 | 3 | 0.09 |
| | LNRFI&LNRFR don't Granger cause LNRE concurrently | 8.99 | 6 | 0.17 |

Under the confidence level of 10%, we refuse the Null Hypothesis that "LNRFE does not Granger cause LNRFI", "LNRFR&LNRFE don't Granger cause LNRFI concurrently" and "LNRFR does not Granger cause LNRFE". That is to say local fiscal expenditure Granger causes the gross product of financial industry; local fiscal revenue and expenditure Granger cause the gross product of financial industry concurrently; local fiscal revenue Granger causes the local fiscal expenditure. That is consistent with the usual economic theory. With the increase of local fiscal expenditure, the proportion of the expenditure invested in the financial industry will also increase, therefore local fiscal expenditure can boost the gross product of financial industry. The combination of local fiscal revenue and expenditure policies will affect the changes in the gross product of financial industry. The increase of the local fiscal revenue will cause the increase of local fiscal expenditure. The other Granger causalities can not be established.

### 4.3. Johansen Cointegration Test

Previously we have sentenced that LNRFR, LNRFE, and LNRFI are all integrated of one variables, therefore we can conduct cointegration tests to the three variables in order to explore the long-term relationship among them. Open the dialogue box of Johansen Cointegration Test in the software EVIEWS6.0, check "Intercept (no trend) in CE-no allow for quardratic deterministic" in the "Deterministic trend assumption of test"; set "Lag Intervals" as "1 2"; the other settings keep the default value. The output result of Trace Test is shown in Table 4. Under the confidence level of 5%, Trace Statistics indicates that there exits a cointegration relation among LNRFR、LNRFE and LNRFI. The conclusion of Maximun Eigenvalue test is in accordance with Trace Test.

**Table 4 .**Johansen Cointegration Test(Trace)

| Hypothesized Number of Cointegration Equations | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob. |
|---|---|---|---|---|
| None | 0.55 | 44.42 | 35.19 | 0.00 |
| At most 1 | 0.40 | 19.32 | 20.26 | 0.07 |
| At most 2 | 0.11 | 3.61 | 9.16 | 0.47 |

The specific cointegration equation is as follows,

$$\text{LNRFI} = -0.59\text{LNRFR} + 1.21\text{LNRFE} + 1.83 \quad (6)$$

According to the cointegration equation (6), we can get the long-term relation among LNRFR, LNRFE and LNRFI, once LNRFR increases 1%, then LNRFI decreases 0.59%; once LNRFE increases 1%, LNRFI increases 1.21%. This conclusion is consistent with the usual economic theory, local fiscal revenue , especially the tax revenue brought by financial enterprises, to some extent hinders the development of the financial industry; local fiscal expenditure , especially the expenditure on the financial industry, in some degree promotes the development of financial industry.

### 4.4. Vector Error Correction Model

Since we have testified that there exists cointegration relation among LNRFR, LNRFE and LNRFI, Vector Error Correction Model of the three time series can be further established. Open the dialogue box of VAR Specification in the software EVIEWS6.0, set "Endogenous Variables", "Lag Intervals for D(Endogenous)" and "Exogenous Variables" respectively as "LNRFI LNRFR LNRFE", "1 3" and blank； set "Number of cointegrating" as "1"; check "Intercept (no trend) in CE-no allow for quardratic deterministic" in the "Deterministic trend assumption of test".

According to the output result, we can firstly get the error correction item $ecm_{t-1}$,

$$ecm_{t-1} = \text{LNRFI}_{t-1} + 0.62\text{LNRFR}_{t-1} - 1.25\text{LNRFE}_{t-1} - 1.64 \quad (7)$$

Then we can further get the Vector Error Correction Model,

$$\Delta y_t = \begin{pmatrix} -0.54 \\ -0.40 \\ 0.07 \end{pmatrix} ecm_{t-1} + \begin{pmatrix} 0.41 & 0.25 & -0.04 \\ -0.16 & 0.27 & -0.19 \\ -0.01 & 0.21 & 0.68 \end{pmatrix}$$

$$*\Delta y_{t-1}+\begin{pmatrix} 0.47 & -0.08 & -0.67 \\ 0.23 & 0.32 & 0.09 \\ 0.29 & 0.05 & -0.05 \end{pmatrix}\Delta y_{t-2}+$$

$$\begin{pmatrix} 0.19 & -0.17 & -0.01 \\ 0.23 & 0.06 & -0.45 \\ 0.00 & -0.10 & -0.02 \end{pmatrix}\Delta y_{t-3}+u_t \quad (8)$$

In which $\Delta y=\begin{pmatrix} \Delta\text{LNRFI} \\ \Delta\text{LNRFR} \\ \Delta\text{LNRFE} \end{pmatrix}$

The meanings of the estimated coefficients of error correction item $ecm_{t-1}$ in the VEC model (8) are as follows. The first coefficient -0.54 indicates that the changes of LNRFI in phase *t* can eliminate 54% of the non-equilibrium error of the previous phase in the case that LNRFR and LNRFE stay unchanged ; the second coefficient -0.40 suggests that the changes of LNRFR in phase t can eliminate 40% of the non-equilibrium error of the previous phase in the case that LNRFR and LNRFE stay unchanged ; the third coefficient 0.07 indicates that the changes of LNRFE in phase t will increase 7% of the non-equilibrium error of the previous phase in the case that LNRFR and LNRFE stay unchanged .

## 5. Conclusion and Implication

The Augment Dickey-Fuller Test shows that time series LNRFR, LNRFE and LNRFI are all integrated of 1. Then we create a Vector Autoregressive Model including the three variables. The goodness of fit, linearity and stability of the model are all good. The further Impulse Responses Function indicates that with the positive impact of itself, the gross product of financial industry will fluctuate in the same direction, and the volatility will be smaller and smaller; with the positive impact of local fiscal revenue, the gross product of financial industry will fluctuate firstly in the same direction, then in the opposite direction and lastly in the same direction again; with the positive impact of local fiscal expenditure, the gross product of financial industry will fluctuate in the same direction, and the volatility will firstly get lager and then get smaller. The Variance Decomposition indicates that the fluctuation of the gross product of financial industry resulted from its own changes gets smaller and smaller; the same fluctuation resulted from the changes of local fiscal expenditure gets lager and larger; while the same fluctuation resulted from the changes of local fiscal revenue stays small. The Granger Causality Test indicates that local fiscal expenditure Granger causes the gross product of financial industry; local fiscal revenue and expenditure Granger cause the gross product of financial industry concurrently; local fiscal revenue Granger causes the local fiscal expenditure. The Johansen Cointegration Test shows that there is a cointegration equation among the three variables. In the long run, when local fiscal revenue increases by 1%, it will make the gross product of financial industry decrease by 0.59%; when local fiscal expenditure increases by 1%, it will make the gross product of financial industry increase by 1.21%. The Vector Error Correction Model indicates that the changes of the gross product of financial industry and local fiscal revenue in the *t* interval can respectively eliminate 54% and 40% of the non-equilibrium error in the *t-1* interval; while the changes of local fiscal expenditure can make the non-equilibrium error in the *t-1* interval increase by 7%.

Considering all the tests and models, we can safely conclude that local fiscal revenue and expenditure have a great impact on the gross product of financial industry in Shanghai. Precisely, local fiscal revenue exerts a negative influence on the development of financial industry; on the contrary, local fiscal expenditure can apply a positive impact. Taking the goal of building an international finance center into account, it is essential for the Shanghai Municipal Government to take some reasonable fiscal policies to promote the development of financial industry. From the perspective of local fiscal revenue, the tax rate related to the financial industry should be cut down, especially for the enterprise income tax, value added tax and business tax. On the other hand, the local fiscal expenditure could be tilted to the finance industry. For instance, the local government could increase the investment in the infrastructure construction related to the financial industry, pay more attention to the cultivation of local financial personnel, and set special fund to attract overseas talents. Our future work will apply the proposed model to other industrial fields [10-19].

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