Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2014, 6(6):534-538

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Quantitative analysis of financial ecology and social credit system impact on GDP growth

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ABSTRACT

For a long time, the economic growth is influenced by financial system, and economists pay more and more attention to this effect. With China's reform and opening up and the establishment of socialist market economic system, the financial industry plays an increasingly important role in the national economy, which has become the core of modern economy. In this paper, we make an empirical test to analyze how the financial system will effect on the economic growth. The result shows that the financial development increased one percentage can drive economic growth increased by 0.942 percentages, so the effect of financial development to economic growth is obvious. From Johnson co-integration test, the result shows that there exist at least one direct co-integration relationship between financial development and economic growth, which means that there exist a long-term equilibrium relationship between financial development and economic growth.

Keywords: Financial Ecology, Economic Growth, Granger Causality, Vector Auto Regression Model

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INTRODUCTION

Economic growth is the main driving force to social progress, and the financial industry is considered as the leading factor to promote economic growth. For a long time, the economic growth is influenced by financial system, and economists pay more and more attention to this effect. With China's reform and opening up and the establishment of socialist market economic system, the financial industry plays an increasingly important role in the national economy, which has become the core of modern economy [1]. The financial industry not only promotes the development of social investment, but also has beneficial effect to the optimal allocation of capital. Financial development can reduce the capital transaction cost, and promote the optimization and upgrading of industrial structure in China at the same time[2]. As China's financial development and the ceaseless rise degree of opening to the outside, China’s financial internationalization process has been accelerated stage by stage, and financial institutions have began carry out international operations actively[3]. The continuously improvement of financial system has provided a strong guarantee to China's steady and rapid growth of economy, which can be discovered in China's reform and opening-up economic data.

The theoretical study of the relationship between financial development and economic growth mainly include the financial deepening, financial constraints theory, financial structure and financial functions on these aspects. R.I. Mackinnon and E.S. Shaw are representatives of financial deepening theory, and Mackinnon proves that developing countries generally exist government intervention in the financial situation through the model, which has led to the inhibition of financial development in the developing countries and financial system is difficult to achieve its capital allocation function, thus reduced the stimulation effect of economy[4]. Muhammad Shahbaz (2013) investigates the relationship between energy use and economic growth by incorporating financial development, the result shows that there is also bidirectional causality exists between financial development and economic growth [5]. Jeremy Greenwood (2013) test how important is financial development for economic development by using a costly state verification model. The result shows that about

29 percent of U.S. growth can be attributed to technological improvement in financial intermediation; it suggests that financial intermediation is important for economic development [6]. Jake Kendall (2012) investigate the connection between banking sector development, human capital, and economic growth in Indian districts by using unique, district-level, economic growth data. The result shows that the banking sector is an important component of national growth [7]. George Adua and George Marbuahb (2013) investigate the long-run growth effects of financial development in Ghana; they find that the growth effect of financial development is sensitive to the choice of proxy. Both the credit to the private sector as ratios to GDP and total domestic credit are conducive for growth, while broad money stock to GDP ratio is not growth-inducing[8].Muhammad Shahbaz,ect (2013) examines the linkages among economic growth, energy consumption, financial development, trade openness and CO2 emissions over the period of 1975Q1–2011Q4 in case of Indonesia. The results confirm that the variables are co-integrated; it means that the long run relationship exists in the presence of structural breaks[9].

Chinese scholar Meng Meng (2003) proves that China's financial deepening promotes economic growth in the long-term based on the Grainger function[10]. Ran Maosheng, Zhang Zongyi and Feng Jun (2002) point out that China's financial development has limit influence on economic growth, but the more performance is economic growth promote financial development through their empirical research[11-12].For the financial structure theory, Chinese scholars Ai Hongde (2004) find that the eastern region of China financial development has the boost effect to the economy through the study, but economic growth is inhibited by finance in the western area[13]. Xin Xiangjing, Wu Cuifang and Wang Zheng (2008) point out that effective financial structure, which can realize financial function will promote the economic growth; Wan Xinrong, Huang Jingbo and Xu Lijun (2011) raise China's east, medium and western regional financial structure should match the economic structure[14-15]. The scholars' research results show that China's financial development has certain stimulation effect to the economic growth, but the effect of finance development to economy is different in different regions and economic level.

EXPERIMENTAL SECTION

2.1 Data collection and evaluation index

In order to analyze how the financial development effect on the economic growth, we use STATA 12.0 software and make a statistical analysis of financial ratios and total domestic economic data from the year of 1990 to 2013.The main indicator to gauge a country or regional financial development level is financial interrelation ratio (FIR), which refers to a country's total financial assets and economic volume ratio, and the formula can be expressed as:

$$FIR = F_r / W_r = \beta_r^{-1} \cdot \left[(\gamma + \pi + \gamma\pi)^{-1} + 1 \right] \cdot \left[k\eta + \phi(1+\lambda) + \xi \right] + \theta \left[1 + \varphi \right]^{\frac{n}{2}} - 1 \quad (1)$$

Economic significance of each symbol is represented by the formula is:F represents the area of financial assets;W represents region economy gross; usually use GDP for calculation;β represents capital output ratio, and the output is equal to the ratio of capital, namely "capital coefficient ";γ represents the growth rate of GDP;π represents the rate of inflation;η represents external financing ratio;ϕ represents ratio of stock, bonds, options and other financial products to GDP;λ represents financial institutions to non-financial institutions financial products assets ratio;ξ represents foreign net creditor rate, which is expressed as the ratio of foreign financial capital to the financial amount;θ represents price sensitive financial assets ratio;φ represents asset price fluctuation ratio.

So that we can get the financial development index based on this method. The data of GDP is collected from Beijing statistic year book and Caixin database, period from 1990 to 2013. We also undertake log processing to data, noted as LnFIR and LnGDP.

2.2 ADF unit root test

The unit root test was first put forward by David Dickey & Wayne Fuller, so it is also called DF test. DF test is a basic method in stationarity test, if we have a model as:

$$Y_t = \rho Y_{t-1} + \mu_t \quad (2)$$

DF test is the significance test to the coefficient. If $\rho<1$, when $T\to\infty$, $\rho^{T}\to 0$, that means the impulse will be reduced when the time is increased. However, if $\rho\geq 1$, the impulse will not be reduced with the time, so that this time-series data is not stable. The basic DF test model can be written as:

$$Y_t = \beta_1 + \beta_2 t + (1+\delta)Y_{t-1} + \mu_t \quad (3)$$

If we add the lagged variable of ΔY_t in formula 10, then it will be called the augmented Dickey-Fuller test, so that ADF test model can be written as:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_t \quad (4)$$

Data stable is the premise of establishing VAR model, an augmented Dickey–Fuller test (ADF) is a test for a unit root in a time series sample. We use ADF unit root test to inspect LnFIR and LnGDP, the result as is shown in table 1. Through the test results we can see that LnFIR and LnGDP are non-stationary,then we test on d.LnFIR and d.LnGDP and demonstrate that they are stable, so we can build the VAR model and use granger test and cointegration test.

Table 1: Augmented Dickey–Fuller test (ADF)

Variable	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	Result
LnFIR	-1.677	-3.709	-2.983	-2.623	Unstable
LnGDP	0.585	-3.709	-2.983	-2.623	Unstable
D.LnFIR	-3.721	-3.709	-2.983	-2.623	Stable
D.LnGDP	-3.569	-3.709	-2.983	-2.623	Stable

2.3 VAR model

Vector auto regression (VAR) is a statistical model used to capture the linear interdependencies among multiple time series. An estimated VAR model can be used for forecasting, and the quality of the forecasts can be judged.VAR model is the simultaneous form of autoregressive model, A VAR (p) model of a time series y (t) has the form:

$$A_0 y_{(t)} = A_1 y_{(t-1)} + \cdots + A_p y_{(t-p)} + \varepsilon_{(t)} \quad (5)$$

In this paper, I use AIC, SC criterion to identify the lag length. From the result, we can get that the minimum AIC is in lag 2, so I choose lag 2 as the lag length. Then, we bulid the VAR model of LnFIR and LnGDP as:

$$LnGDP = 1.325 + 2.05LnGDP_{t-1} - 1.187LnGDP_{t-2} + 0.942LnFIR_{t-1} - 0.457LnFIR_{t-2} \quad (6)$$

$$LnFIR = -1.25 + 0.233LnFIR_{t-1} + 0.204LnFIR_{t-2} + 0.448LnGDP_{t-1} + 0.59LnGDP_{t-2} \quad (7)$$

According to the formula (16), it can be seen that the effect is financial development promotes economic growth. LnFIR at lag 1 period increased one percentage can drive LnGDP growth by 0.942 percentage, LnFIR at lag 2 period increased one percentage can drive LnGDP growth by -0.457 percentage, so the effect of financial development on economic growth is obvious. Financial development will promote the growth of the GDP in short time, but financial development will decrease the growth of the GDP in the long time. According to the formula (17), it can be seen that the economic growth can also promote financial development, and LnGDP at lag 1 period and the 2 period increased 1 percentage will drive the LnFIR increased by 0.448 and 0.59 percentage respectively. Therefore, financial development and economic growth have direct mutual promotion effect.

In order to analyze the relations between financial development and economic growth, we use granger causality test to analyze this VAR model, the result is shown in table 2.From Table 2, we can get that LnFIR is the reason to LnGDP, which means financial development is the reason to economic growth increase. At the same time, LnGDP is not the reason to LnFIR, so that economic growth is also the reason to financial development; this is also same to the conclusion above.

Table 2: Granger causality test

Equation	Excluded	chi2	df	Prob > chi2
LnFIR	LnGDP	17.716	2	0.000
LnGDP	LnFIR	32.897	2	0.000

At the same time, we take Johnson co-integration test to analyze the long-term relations between financial development and economic growth, the results is shown in table 3.Co-integration is a statistical property of time series variables. Two or more time series are co integrated if they share a common stochastic drift, if two or more

series are individually integrated but some linear combination of them has a lower order of integration, then the series are said to be co integrated.

Table 3: Johnson Co-integration test

Rank	Parms	LL	Characteristic Value	Statistic	5% Significant level
0	6	66.98959		20.9545	15.41
1	9	76.801423	0.64400	1.3309*	3.76

According to the results, there exist at least one direct co-integration relationship between financial development and economic growth, which means that there exist a long-term equilibrium relationship between financial development and economic growth.

2.4 Impulse-response analysis

According to the results above, we can get that there exist a long-term equilibrium relationship between financial development and economic growth, and financial development and economic growth is the reason to economic growth, also the VAR model is stable. In order to analyze the VAR model, I use Impulse-response function and cholesky variance decomposition, the results is shown in figure 1 and figure 2.

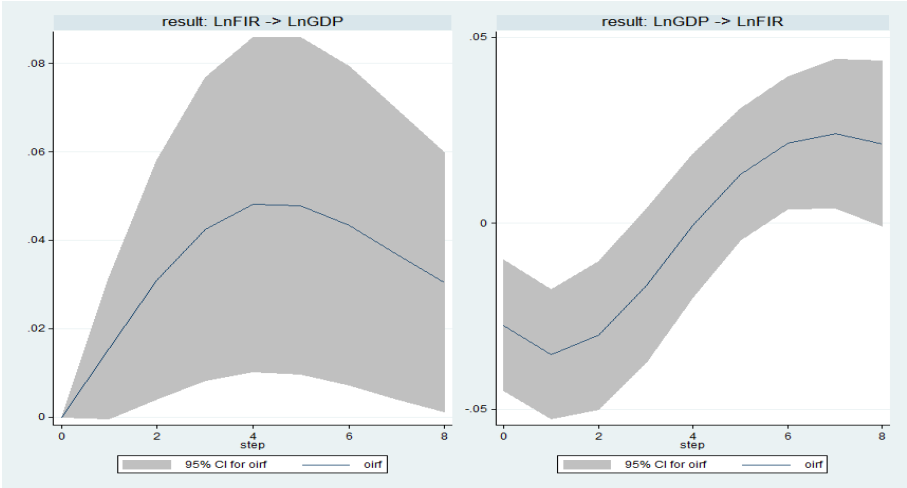

Figure 1. Impulse-response analysis

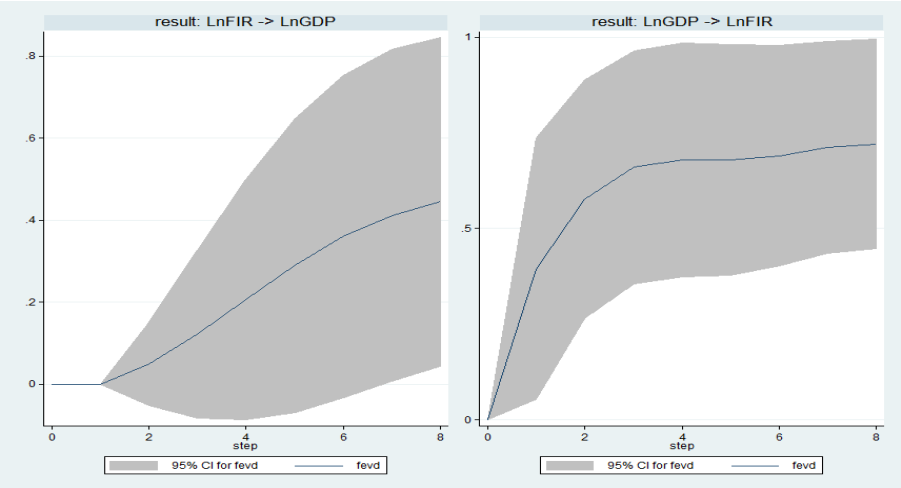

Figure 2. Cholesky variance decomposition

From figure 1, we can get that when LnFIR received one unit impact, it will lead LnGDP increase currently, LnGDP will reach the max at t=4 period and begin to be stable then. It illustrates there is long-term effect between financial development and economic growth. At the same time, when LnFIR received one unit impact, it will lead LnGDP decrease currently, and return to the basic situation at t=4 period. According to the impulse analysis results, we can

get that financial development will significant influence economic growth, so that it is important to enhance the innovation of financial development. The cholesky variance decomposition also shows the same result, the contribution degree of LnFIR to LnGDP is gradually increased. From figure 2, we find the contribution degree of LnFIR to LnGDP at t=1 period is 0, and then increased gradually from setp 2, finally increased to 44.2% at t=8 period. At the same time, the contribution degree of LnGDP to LnFIR is 39.52% at t=1 period, then increased and become stable from step 2, the contribution degree in t=8 period is 72.13%.This means that financial development has a important contribution degree to economic growth, and can be used to explain the economic growth.

CONCLUSION

Above all, there are long-term interaction effects between China's financial development and economic growth. Financial development can promote economy to grow continuously, and the economic growth can also promote the development of finance, and financial development and economic growth have long-term stability of mutual promotion relationship. According to the data of 1990 to 2010, it can be figured out that effect of financial development prompting economic growth in 2005 can be found gradually after 2006. Financial development has a certain lag effect to economic growth. Considering the importance of financial development, it is necessary to pay more attention to the development of financial industry, and optimize capital configuration, improve the new technology industry and improve policy oriented industry financing capacity, in order to promote China's financial structure optimize ceaselessly. China also needs to pay attention to the degree of financial development should be suitable for the local economic development level in different regions, and avoid excessive financial development at the same time.

Because there is long-term interactive relationship between financial development and economic growth, we should support financial industry, and draw lessons from international financial crisis at the same time, and ensure that the speed of financial development and economy is coordinated. Otherwise China need to strengthen financial supervision, optimize the financial structure constantly and continue to promote financial reform, in order to improve the efficiency of the financial system, and drive economy steady, fast development.

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