



## Quantitative analysis of financial development's impact on economic growth

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### ABSTRACT

*With the continuous development and evolution of economic research, the theoretical results of financial development are fruitful. Based on 1980-2010 annual time series data, by using co-integration and the Granger Causality test, and adopting financial scale expansion, i.e. finance-related ratio indicators, and the financial development efficiency indicators, i.e. deposit-to-loan ratio indicators, this paper studies the causality direction problem between financial development and economic growth of Anhui Province. The conclusion is that there exists bidirectional causality between financial scale expansion and economic growth in Anhui. In addition, the efficiency of financial development is a key factor in economic growth, but in reverse, economic growth does not promote the efficiency of financial development. Finally, through combining the actual situation of Anhui Province, it proposes suggestions conducive to its sustainable economic development.*

**Key words:** Economic Growth, Financial Development, Co-integration, Granger Causality Test

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### INTRODUCTION

Finance is a paid financing of capital between different sectors of the economy, providing capital support to industrial upgrading and economic restructuring, acting as an important backbone for the sustainable development of the market economy. The relationship between economy and finance is becoming increasingly closer and in the economic and social development process the financialization of economy has become an unstoppable trend. Theorists have always been actively exploring the economic growth issue and with the coming of the era of economic globalization and knowledge economy, it is increasingly necessary to study the relationship between financial development and economic growth.

The total economic output of Anhui Province in 2009 reached one trillion Yuan, which means that the economy of Anhui Province has entered a new platform and the relationship between finance and economic development is becoming increasingly closer. How the role of financial development impacts upon economic growth, and of these two which is the "cause" and which is the "effect", is a difficult question for modern theorists to address. Based on this and through using empirical methods this paper examines the relationship between the Financial Development and Economic Growth of Anhui Province, and explores whether the financial development theory also applies to Anhui Province.

### 2. Indicator Selection

#### 2.1 Financial Development Indicator

Generally indicators such as the scale and efficiency of financial development and the development level of financial markets are used to reflect financial development. Goldsmith (1969) in his "*financial structure and financial development*," proposed the concept of financial development and financial structure and pointed out that financial development refers to changes in financial structure, thus studying the financial development is to study

the changing process and trend of financial structure.

He creatively put forward the stock and flow indicators to measure a country's financial structure and the level of financial development, the most important of which is FIR (Financial Interrelations Ratio), the ratio of existing total financial assets (with double counting parts) to national wealth (total physical assets plus net foreign assets) at a certain point in time, usually simplified as the ratio of total financial assets to nominal GDP. Due to the relative lack of financial information relating to Anhui, it is difficult to get data of all financial assets, so this paper selects the deposit and loan balances of financial institutions as a measure of financial assets, and defines financial-related rate as the ratio of total deposit and loan balances of all financial institutions to GDP.

In addition, selects the deposit-to-loan ratio indicator SLR as the efficiency indicator of financial development. Deposit-to-loan ratio describes the efficiency that financial intermediaries transform deposits into loans. In fact, it is the financial intermediary efficiency indicator, but the scale of Anhui's stock market is smaller, so this paper thinks that the deposit-to-loan ratio can better describe financial development efficiency changes.

## 2.2 Economic Growth Indicator

Per Capita GDP is a highly frequently used statistical indicator, and its growth has internal law, different from selecting the GDP growth rate as typical representative of the economic growth with experience analysis. This paper selects the per capita real GDP growth rate IRGDP as an indicator to measure economic growth; all of the years use the Price Index of 1978 for pricing, so that both the interference of human capital and the affect of the price can be excluded. The specific data of Anhui Province is shown in Table 1.

**Table 1 Data of Economic Growth and Financial Development in Anhui Province(1978=100)**

Year	RGDP(Yuan)	IRGDP(%)	FIR(%)	SLR(%)
1980	291.00	108.58	77.50	161.50
1981	346.00	118.90	75.80	163.50
1982	375.00	108.38	75.10	167.70
1983	428.00	114.13	71.10	195.30
1984	523.00	122.20	75.00	195.50
1985	646.00	123.52	74.60	170.00
1986	738.00	114.24	92.50	141.50
1987	842.00	114.09	86.90	168.00
1988	1026.00	121.85	98.80	167.80
1989	1136.00	110.72	103.00	159.30
1990	1182.40	104.08	95.90	159.20
1991	1164.40	98.48	95.80	154.80
1992	1389.60	119.34	112.40	152.00
1993	1785.29	128.48	144.30	141.30
1994	2254.44	126.28	145.30	141.20
1995	3069.70	136.16	134.70	135.10
1996	3524.10	114.80	125.60	124.50
1997	3928.90	111.49	119.30	115.10
1998	4235.44	107.80	126.50	108.00
1999	4495.84	106.15	135.20	111.90
2000	4780.00	106.32	148.20	107.40
2001	5312.90	111.15	150.20	99.70
2002	5736.00	107.96	160.30	96.00
2003	6455.00	112.53	167.60	89.60
2004	7768.00	120.34	179.80	85.30
2005	8675.00	111.68	190.40	80.50
2006	10055.00	115.91	185.90	77.30
2007	12045.00	119.79	191.80	72.00
2008	14485.00	120.26	199.50	72.30
2009	16407.66	113.27	196.20	71.90
2010	20888.00	127.31	194.40	67.40

Source: data in the table are from China Statistical Yearbook, China Financial Yearbook and Statistical Yearbook of Anhui Province, and from conversion.

## 3. Empirical Test Results

### 3.1 Unit Root Test

Almost all of the macroeconomic variables which signify absolute indicators are non-stationary and have time trends, therefore usually stationary tests on the variables must be performed before the co-integration test and only in the condition that variables are stable at order  $t$  ( $I(t)$ ), then the co-integration analysis can be made. Adopting the commonly used test statistics ADF to test the stationary of variables: per capita real GDP growth rate IRGDP, financial-related rate FIR, deposit-to-loan ratio SLR. The specific test results are shown in Table 2.

**Table 2 Unit Root Test Result of Variables**

Variables	ADF Test Statistic	(c,t,k)	1%critical value	5%critical value	10%critical value	Stationary
IRGDP	-2.851	(c,0,1)	-4.308	-3.573	-3.220	No
FIR	-0.249	(0,0,0)	-3.666	-2.962	-2.620	No
SLR	-1.576	(0,0,0)	-2.642	-1.952	-1.622	No
$\Delta$ IRGDP	-4.428	(0,0,0)	-2.645	-1.953	-1.622	Yes
$\Delta$ FIR	-3.787	(0,0,0)	-2.645	-1.953	-1.622	Yes
$\Delta$ SLR	-4.616	(0,0,0)	-2.645	-1.953	-1.622	Yes

Note: *c* and *t* mean with constant term and trend term, *k* is the lag intervals for endogenous,  $\Delta$  represents first order difference of a variable, the sample interval is 1980-2010.

It can be seen from Table 2 that in the original sequence level none of the test results rejected the unit root hypothesis, thus indicating that the variables IRGDP, FIR, SLR are all non-stationary time series and have a time trend. But the first differences of all of the variables reject the unit root assumption, which shows that the differential variables are stationary. Thus, we believe that these three variables above are integrated of order one, that is I (1). Therefore, for these non-stationary economic variables, we cannot use a traditional linear regression analysis method to examine the correlation between them, but should use the co-integration method to test and analyze.

### 3.2 Co-integration Test

If there is a smooth linear combination in a group of non-stationary time series i.e. the combination does not have a stochastic trend, then the group of series is co-integrated, and the linear combination is called a co-integration equation, indicating a long-term equilibrium relationship. There are a variety of kinds of methods in a co-integration test. This paper uses the Johansen co-integration test to examine the co-integration relationship between variables. Because during the unit root test we already know that all of the variables are integrated of order one, the test of the co-integration relationship between the variables can be done directly. The test results are shown in Table 3.

**Table 3 Co-integration Test Result**

Number of co-integration vectors under original hypothesis	Eigen value	Trace Statistics	5%Significance Level	1% Significance Level
0	0.635581	42.97516	29.68	36.65
$\leq 1$	0.375467	13.70109	15.41	20.04
$\leq 2$	0.001699	0.049309	3.76	6.65

Draw the corresponding co-integration equation:

$$\text{IRGDP} = 7.056263\text{FIR} + 7.472549\text{SLR} - 1989.005$$

(19.0989)      (20.2676)

①

Table 3 shows that there exists a co-integration vector between variables, that is, no matter how they form a combination, there is a long-term relationship among the finance-related rate, deposit-to-loan ratio and per capita real GDP growth rate. From the corresponding co-integration equation, it can be seen that there is a positive correlation between the finance-related rate and IRGDP, for every one percent increase of finance-related rate, IRGDP will increase 7.056263 percent; there is also a positive correlation between deposit-to-loan rate and IRGDP, and for every one percent increase of deposit-to-loan rate, IRGDP will increase 7.472549 percent. However, a co-integration relationship can only show that there exists at least a one-way causal relationship between variables, being unable to explain what is cause or what is effect or reciprocal causation, we need to further test the causal direction between Anhui's financial development and economic growth.

### 3.3 Granger Causality Test

About the causal direction test between Anhui's financial development and economic growth, that is to judge which is the cause and which is the effect, we use the Granger causality test method under non-stationary series to analyze and test. The Granger causality test was first put forward by the famous American econometrician C. W. Granger in 1969 and further developed by Hendry and Richard. Under the time series, the Granger causality test examines whether there is a causal relationship between the two economic variables, *x* and *Y*.

Determined by the following definitions: under the condition that contains the past information of variables *x*, *Y*, if the forecast effect of *Y* after plus the *x* lag variable is better than that separately predicted by the past information of *Y*, i.e. the variable *x* will help significantly improve the prediction accuracy of *Y*, then the variable *x* can lead to variable *Y*, and there exists a causal relationship between the two. There is a difference between Granger causality and philosophical causal relationship, if we say "*x* is a Granger cause of *Y*", it only indicates that *x* contains efficient information for forecasting *Y*. In fact, the official name of "Granger causality" should be "Granger non-causality",

because the original assumptions of the Granger causality test is that X does not have Granger causal relationship towards Y. Granger causality test type and null hypothesis that x does not have Granger causality to Yt are as follows:

$$Y_t = \sum_{i=1}^k a_i Y_{t-i} + \sum_{i=1}^k \beta_i X_{t-i} + U_{it} \quad (2)$$

$$H_0: \beta_1 = \beta_2 = \dots = \beta_k = 0$$

Obviously, if in the test the regression parameter estimates of X1's lagged variable are all non-significant, the above assumptions cannot be rejected; on the contrary, if the regression parameter estimate of any lagged variable of x is significant, the conclusion should be that x1 has Granger causality to Y1. The above test can be done by statistic F.

$$F = \frac{(SSE_r - SSE_u) / k}{SSE_u / (T - 2k)} \quad (3)$$

Among them,  $SSE_r$  represents the residual sum of squares of model after being imposed constraint conditions (zero assumption).  $SSE_u$  represents the residual sum of squares of model without imposing constraint conditions. K represents the maximum lag. T represents the sample size. Under the null hypothesis, the statistic F asymptotically obeys F (k, T—2k) distribution. If the F value calculated by samples falls within the critical value, accept the null hypothesis, i.e.  $X_t$  does not have Granger causality to  $Y_t$ . Based on the above theory, the Granger causality test results are shown in Table 4.

**Table 4 Granger Causality Test Result of Financial Development and Economic Growth of Anhui during 1980—2010**

Original Hypothesis	Number of Observed Value	Statistic F	P Value	Conclusion
IRGDP does not Granger Cause FIR	23	30.4372	0.00026	Refuse
FIR does not Granger Cause IRGDP	23	5.19556	0.02308	Refuse
SLR does not Granger Cause FIR	23	7.18120	0.01358	Refuse
FIR does not Granger Cause SLR	23	2.57348	0.13289	Accept
SLR does not Granger Cause IRGDP	23	4.45833	0.04251	Refuse
IRGDP does not Granger Cause SLR	23	3.84206	0.05911	Accept

*Note: in this test the lag phase of variables is 8.*

From Table 4 we know: Granger causality test rejects the hypothesis that FIR is not the Granger cause of IRGDP, IRGDP isn't the Granger cause of FIR, SLR is not the Granger cause of IRGDP and SLR is not the Granger cause of FIR, which shows that there is a reciprocal causation between the finance-related rate and economic growth, that is, there exists a bi-directional causality between Anhui Province's finance-related rate and economic growth. Meanwhile the efficiency of financial intermediaries i.e. efficiency indicator of financial development deposit-to-loan ratio is one of the reasons for economic growth; in addition, deposit-to-loan ratio is also the reason for the changes of finance-related rate.

### 3.4 Analysis Conclusion of Financial Development's Impact on Economic Growth in Anhui Province

Based on 31 years since reform and opening, we use the co-integration relationship test and the Granger causality test method to respectively test on the correlation and Granger causality between Anhui's financial development and economic growth. Different from the existing empirical analysis which focuses only on the country analysis and ignores the regional analysis or focuses on region correlation and ignores the causal directionality, this paper not only takes into account that we need be specific to regional studies for the uneven regional development, but also makes in-depth study on the causal directionality of the regional financial development and economic growth, thus having more practical significance. As for the selection of the indicators of financial development, we examined the expansion of scale and changes of efficiency of financial development in Anhui, reflecting the comprehensive features. The conclusion of this study is as follows.

#### 3.4.1 The Result of Co-integration Test

There is a significant long-term relationship among the finance-related rate, the deposit-to-loan ratio and real per capita GDP growth rate, indicating the close relationship between Anhui's financial development and economic growth, and this relationship is all-round, including the financial scale expansion, the efficiency changes and the development of financial markets.

### 3.4.2 The Result of Granger Causality Test

There is bidirectional causal relationship between Anhui's finance-related rate and economic growth, indicating that the scale expansion of Anhui's financial development plays a role in promoting economic growth, in turn, Anhui's economic growth has led to the expansion of the financial scale. In addition, the improvement of the efficiency of financial development in Anhui is also one of the important reasons for economic growth, but economic growth does not in turn play a role in improving the efficiency of financial development. Finally, we found that the efficiency improvement of Anhui's financial development is the Granger cause for the financial scale expansion, but in turn, the financial scale expansion does not promote the improvement of the efficiency of financial development, there is a one-way causal relationship between them.

## 4. Policy Recommendations for Speeding up Financial Development in Anhui Province

It's derived from the above analysis that there exists financial repression in Anhui Province, i.e. financial development fails to become a favorable pushing hand for economic growth. Combined with the actual situation of Anhui Province, this paper proposes following policy recommendations in order to help speed up financial development, and strengthen the role of financial development in promoting economic growth.

### 4.1 Improving the Efficiency of Financial Systems based on the Principle of "Giving Priority to Efficiency with Due Consideration to Fairness"

First, establish a regional development bank in Anhui Province, adopt a more flexible policy to promote economic development, strengthen the integration of financial resources in the province, and to a certain extent ensure the tendency of fund usage to avoid the loss of funds.

Secondly, develop non-state-owned financial institutions and small and medium-sized financial institutions, guide the joint-stock banks and foreign banks to establish branches in the province, and form a multi-level, diversified, competitive and orderly financial organization system in which state-owned financial institutions are the foundation and a variety of financial institutions coexist.

Again, encourage financial innovation, promote financial structural optimization, and push financial development. The regulatory authorities should update the concept of regulation; it is necessary to prevent innovation risks through proper regulation, and pay attention to protect and stimulate the innovative enthusiasm of the micro-finance entities.

Finally, promote and guide private investment. Private capital investment is not only conducive to the improvement of the efficiency of the financial system, but also plays a huge role in stimulating the whole economy, consumption, investment and employment. Compared to other more economically developed provinces, Anhui Province has less private investment, thus need to encourage and develop private capital investment.

### 4.2 Deepen the Financial System Reform, Rationalize the Financial Structure, and Promote the Coordinated Development of Economy and Finance

#### 4.2.1 Optimize the Financial Geographical Structure; Promote the Coordinated Development of Urban and Rural Finance.

Anhui is a major agricultural province. There is a great potential in the rural financial market, and the financial development in urban and rural areas is very uncoordinated, therefore we should set up Anhui rural commercial banks or rural cooperative banks as a breakthrough, and give full play to the rural financial advantages, accelerate rural development, increase the residents level of demand for consumption in the province, thus contributing to the province's urbanization and economic development.

#### 4.2.2 Optimize the Social Financing Means Structure, Coordinate Development of Indirect Financing and Direct Financing.

Through the survey, it is found that the major financing channel of Anhui Province is still limited to bank credit. Therefore we should accelerate the development of the corporate bond market and establish a standardized OTC market, providing a broad financing platform for many SMEs which do not meet the listing standards of SME.

#### 4.2.3 Optimize the Structure of Financial Liberalization, Promote the Coordinated Development between Internal and External Financial Opening up.

Financial openness is the booster for financial development, including the internal opening up and external

opening-up. While promoting the external financial opening up, actively promote the external financial opening up. We should eliminate trade monopolies and discriminatory access policy, provide a level playing platform for non-state-owned capital, especially private capital entering into the financial sector, and appropriately relax the control of financial operations, and encourage business competition between financial institutions.

Above all, finance is at the core of economic development. In view of the status of financial development and economic growth in Anhui Province, the necessity and urgency of financial deepening is extremely prominent. We need to make financial reforms, give up the excessive intervention of government finance, change the government control of the financial sector into effective management, rely on the market mechanism to improve the operational efficiency of the financial system, optimize the rational allocation of financial resources, eliminate price distortions, market segmentation and single structures, form the positive effect of savings, investment, income and structural optimization, and establish a virtuous circle of financial and economic development, and promote stable and rapid economic development.

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