RESEARCH ON THE RELATIONSHIP BETWEEN FINANCIAL INNOVATION AND INDUSTRIAL STRUCTURE UPGRADING: DYNAMIC EMPIRICAL ANALYSIS BASED ON VAR MODEL

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ABSTRACT: *This paper selects the relevant data from 1992 to 2011 to empirically analyse the relationship between financial innovation and industrial restructuring. The results show that the degree of financial innovation can promote the upgrading of industrial structure to a certain extent; and the degree of financial deepening is inefficient. It may even bring about the reverse expected effect. The higher the proportion of financial assets in GDP, the more likely it may be to hinder the adjustment and upgrading of industrial structure. This further proves that the funds brought by China's financial innovation have not flowed more to the real economy, and have not met the funding requirements of enterprise development, and the conclusion that China's financial market and industrial structure development are not coordinated.*

KEYWORDS: Financial Innovation, Industrial Structure, VAR Model

INTRODUCTION

In the modern economic society, the upgrading and optimization of industrial structure has always been an important driving force for economic growth. In order to achieve the healthy and sustainable development of the Chinese economy, it is necessary to promote the optimization of China's industrial structure. The continuous upgrading of the industrial structure is mainly based on the advancement of technology and the support of funds. The essence of industrial structure optimization and upgrading is that funds are transferred from low value-added and low-tech sectors to high value-added and high-tech sectors. Financial markets are often an important medium for the flow of funds. Financial intermediaries can realize the transformation of funds between savings, investment or loans, and provide financial support for the upgrading of industrial structure. The rapid development of China's financial industry is based on financial innovation within finance. Financial innovation is the intermediary between the supply side and the demand side of the financial market, mainly by adjusting the proportion of funds invested in different sectors to solve the problems in China's emerging industries. The problem that the income and risk do not match, and thus promote the continuous adjustment and optimization of the industrial sector.

Since the reform and opening up, China's financial industry has flourished, the financial system has gradually improved, and financial markets have basically formed. However, compared with the development of China's economy, China's financial innovation level is still low, innovative products are single, and financial derivatives are lagging behind the West.

country. China's financial industry pays more and more attention to financial innovation, and financial innovation has entered a development commanding height. How to use financial innovation to promote the upgrading of industrial structure, change the mode of economic growth, and improve the country's overall national strength need to be given enough attention. Therefore, based on the real economy, deepening financial innovation and achieving organic integration of financial innovation and industrial structure have become the focus of attention. Based on the above background, this paper takes the data related to financial innovation and industrial structure adjustment from 1992 to 2011 as the research object, and attempts to explore the relationship between financial innovation and industrial structure adjustment through empirical research, in order to grasp the regional finance in China more scientifically and effectively. The direction of structural optimization meets the needs of industrial structure upgrading in various regions, with the goal of promoting regional coordinated development, and provides ideas and methods for accelerating financial innovation and promoting the development of the real economy.

EMPIRICAL REVIEW

Financial innovation was developed and developed from Schumpeter's (1912) innovation theory. Innovation in the process of economic development includes many aspects, summed up with new appearances and new applications of products, methods, markets, raw materials, organizations, that is, new components and parts appear in the economic system, they are applied to economic activities. in. Abroad, Greenbaum and Haywood (1973) argue that the emergence of financial innovation is not accidental, but also has inevitable factors. Mainly when accumulating too much social wealth, consumers have a strong desire to avoid risks.[1] Darin and Hellmann (2002) suggest that banks, while promoting the development of emerging industries, will accelerate the exit of declining industries and optimize the industrial structure to some extent.[2] Laeven and Levine (2007) analyze the impact of financial innovation on economic growth from a theoretical perspective, introduce it into the IS-LM model for theoretical analysis, and further expand into a dynamic model.[3]

Domestic scholars Deng Guangya and Tang Tianwei (2010) believe that although there is a long-term cointegration relationship between the two, it does not reflect good interaction and effect in practice. [4] Jiang Ruibo (2012) analyzed the relationship between regional financial innovation and economic growth. The empirical results show that China's regional financial innovation level is insufficient and can not effectively promote economic growth, but it is conducive to the development of other service industries. [5] Tan Huihui (2014) draws the specific impact of different financial support methods on the development of strategic emerging industries. [6] Zhang Mengmeng (2015) examined the supporting role of the financial industry in industrial restructuring. [7] Li Yuanyuan et al. (2015) believe that financial innovation can not only positively influence the adjustment of industrial structure through the development of its own industry, but also through other factors. However, as far as the research results are concerned, the degree of influence needs to be further improved. [8]

Zhang Huili (2015) from the perspective of financial innovation on the advanced and rationalization of industrial restructuring, the paper studies the specific support model of financial innovation for industrial restructuring, but believes that financial innovation can not play a rational role in industrial structure. Positive promotion. [9] Zhuang Lei (2017) found that Internet financial innovation has reduced market interest rates through increased financing efficiency, which indirectly contributes to social investment and consumption growth and promotes overall economic growth. [10] Chen Hao (2018) believes that in the era of big data information, financial innovation should be compatible with the advancement of science and technology. Traditional financial institutions must realize their shortcomings and fully cooperate with high-tech enterprises to realize technology and finance. A win-win situation. [11]

EMPIRICAL RESEARCH

Data Source

China introduced the capital market in the early 1990s.In 1992, China established the Securities Commission of the State Council and the China Securities Regulatory Commission to begin supervision of the securities industry. However, at the same time as the development of China's financial industry, problems have also come one after another. Therefore, in 1994, the State Council concentrated on a series of financial reform measures for the Chinese banking system, financial macro-control system, financial organization system, financial market system and foreign exchange management. The system has undergone a comprehensive reform, and 2016 is the latest available data. Therefore, the data in this paper are selected from 1992-2016. The selected data are from the China Statistical Yearbook, China Financial Yearbook and the National Bureau of Statistics.

Variable design

Financial innovation: Goldsmith (1969) proposed the FIR index to measure the breadth of financial industry development. Chinese scholars use the ratio of total financial assets to GDP to express the development of the financial industry. Patricio Arrau (1995) in the currency demand of developing countries: Assessing the role of financial innovation, the paper uses indicators M_2/M_1 to indicate the proportion of monetary assets that are replaced by monetary aggregates in the process of financial innovation. [12] Dong Yuling (2008) believes that financial innovation can be measured and improved on the basis of Patricio Arrau, that is, the ratio of total money ($M_2 - M_1$) to unit demand deposits ($M_1 - M_0$). [13] This paper refers to Li Yuanyuan (2015). According to the characteristics of financial assets and the actual situation in China, this paper will select financial innovation as a measure of financial innovation: financial innovation = (the total amount of financial assets - the number of financial assets) / The total amount of financial assets, the formula (3.1) is as follows:

$$FIN = \frac{FA - M_1}{FA}$$

(3.1)

Among them, trading financial assets are those that can be used for direct payment. According to the division of monetary level, they can be approximated as narrow money M_1. The financial assets of investment financial assets are poor, but the financial assets with the characteristics of income due to maturity mainly include quasi-currency M_2, stock market capitalization, bond balance and premium income.

Financial deepening: This paper use the financial correlation ratio (FIR) as a quantitative indicator of project research.

$$FIR = \frac{FA}{GDP}$$

(3.2)

Among them, FA is the total amount of financial assets; GDP is the gross domestic product; if the proportion is high, it shows that the proportion of GDP in China's financial assets is relatively high, which means that the scale of China's financial activities FIR is relatively large.

The degree of advanced industrial structure: The industrial structure is advanced. It refers to the development of the industrial structure from a low level to a high level, and is a measure of the upgrading of the industrial structure. This paper uses the ratio of the output value of the tertiary industry to the output value of the secondary industry (TS) as a measure of the advanced structure of the industrial structure. When the value TS is on the rise, it means that the development rate of the tertiary industry is better than that of the secondary industry. The advantages of the tertiary industry are prominent, and the trend of economic service industry is obvious. During this period, the industrial structure is constantly upgrading and the economy is developing facing the service industry direction.

$$TS = \frac{Output\ value\ of\ the\ tertiary\ industry}{Output\ value\ of\ the\ secondary\ industry}$$

(3.3)

Rationalization of industrial structure: The rationalization of industrial structure is mainly the improvement of coordination ability and correlation level between industries. Taking into account the actual situation, and drawing on the research of Gan Chunhui, Zheng Ruogu, Yu Dianfan (2011), the Theil index (TL) will be selected as a measure of the rationalization of industrial structure. [14] Its calculation formula (3.3) is as follows:

$$TL = \sum_{i=1}^{n} (\frac{Y_i}{Y}) \ln(\frac{Y_i}{L_i} / \frac{Y}{L})$$

(3.4)

Among them, Y represents the output value, L represents the number of employed people, i represents the NO. i industry, and n represents the number of industrial sectors. When the economy is in equilibrium, $TL = 0$. If $TL \neq 0$, it means that the industrial structure in this period deviates from equilibrium, the industrial structure is in an unreasonable state.

Model Construction

Model one：$\ln TL = \beta_0 + \beta_1 \ln FIN + \beta_2 \ln FIR + \varepsilon_t$ (3.5)

Model two：$\ln TS = \theta_0 + \theta_1 \ln FIN + \theta_2 \ln FIR + \eta_t$ (3.6)

Model Estimation

Descriptive statistics

Table 1-1 ：Descriptive statistical analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
$\ln FIN$	27	-0.288993	0.069541	-0.4128757	-0.1795844
$\ln FIR$	27	0.7516533	0.3552998	0.0932035	1.325534
$\ln TS$	27	-0.1091661	0.1499114	-0.3387813	0.2567795
$\ln TL$	27	-1.485551	0.2931396	-2.146512	-1.132272

It can be seen from Table 1-1 that the average values of $\ln FIN$, $\ln FIR$, $\ln TS$, $\ln TL$ in 1992-2011 are -0.288993, 0.7516533, -0.1091661, -1.485551, and the maximum values are -0.1795844, 1.325534, 0.2527795, -1.132272, respectively. The minimum values are respectively -0.4128757, 0.0932035, -0.3387813, -2.146512, the data required for the visible model has no extreme values, and the dimensional difference between the data is also within the acceptable range.

Relevance Analysis

This paper calculates the variance of the financial innovation degree (FIN), the degree of financial deepening (FIR), the degree of industrial structure (TS), and the degree of industrial structure rationalization (TL). The covariance matrix is shown in Table 1-2.

Table 1-2 : Variance - Covariance Matrix

	ln FIN	ln FIR	ln TS	ln TL
ln FIN	0.004836			
ln FIR	0.023669	0.126238		
ln TS	0.008383	0.046412	0.022473	
ln TL	-0.014938	-0.066334	-0.031928	0.085931

From Table 1-2, we can see that the variance of the degree of financial innovation （ln FIN ）

is 0.004836, the variance of the degree of financial deepening （ln FIR） is 0.126238, and the

variance of the degree of industrial structure is （ln TS ） 0.022473. The industrial structure

The degree of rationalization has a variance of 0.085931 on the value （ln TL), and the

difference in covariance between the variables is also small.

Stationarity Test

In order to avoid the problem of false regression caused by the non-stationarity of time series, the ADF test method is used to test the stationarity of the data, as shown in Table 1-3.

Table 1-3：ADF unit root test results

Variable	Test Type	ADF Test Value	P Value	Threshold at each significant level		
				1%	5%	10%
ln FIN	Trend	-2.289	0.4400	-4.371	-3.596	-3.238
ln FIR	Trend	-2.271	0.4499	-4.371	-3.596	-3.238
ln TS	Trend	-0.858	0.9604	-4.371	-3.596	-3.238
ln TL	Trend	-0.859	0.9603	-4.371	-3.596	-3.238
D.ln FIN	Notrend	-4.117**	0.0009	-3.750	-3.000	-2.630
D.ln FIR	Notrend	-4.738**	0.0001	-3.750	-3.000	-2.630
D.ln TS	Notrend	-3.062*	0.0295	-3.750	-3.000	-2.630
D.ln TL	Notrend	-2.772	0.0624	-3.750	-3.000	-2.630

Note: D. indicates the first-order difference, "*" indicates the test by the confidence level of 5%, and "**" indicates the test by the confidence level of 1%.

From the results of the ADF test, it can be seen that the ADF test values of $\ln FIR$, $\ln FIN$, $\ln TS$, $\ln TS$ at the 5% confidence level are greater than the critical value. Therefore, the null hypothesis is accepted, and the four variables are considered to have unit roots, which are non-stationary sequences; the ADF test values of $D.\ln FIN$, $D.\ln FIR$ are less than the critical value of 1% of the confidence level; the ADF test value of $D.\ln TS$ is less than the critical value of 5% of the confidence level, so the null hypothesis is rejected, and it is considered that at the 5% confidence level, the three variables $D.\ln FIN$, $D.\ln FIR$, $D.\ln TS$ do not have a unit root. At the 5% confidence level, the ADF unit root test of $D.\ln TL$ has not yet passed, so the original hypothesis is accepted and it is considered to be unstable. Therefore, $D.\ln FIN$, $D.\ln FIR$, $D.\ln TS$ are first-order single-sequence sequences, which satisfy the necessary conditions for establishing a VAR model for cointegration test, and there may be a cointegration relationship between them. However, $D.\ln TL$ is a second-order single-sequence sequence. The economics of model one is of little significance, so this paper retains model two: $\ln TS = \theta_0 + \theta_1 \ln FIN + \theta_2 \ln FIR + \eta_t$

Johansen Cointegration Test

In this paper, the Johansen cointegration test is used to test the relationship between financial innovation and industrial structure rationalization, and to verify the cointegration relationship of the indicators of $\ln TS = \theta_0 + \theta_1 \ln FIN + \theta_2 \ln FIR + \eta_t$. The results are shown in Table 1-4.

Table 1-4 : Analysis results of lag order

Lag	LL	LR	FPE	AIC	HQIC	SBIC
0	81.4567		5.2e-08	-8.2586	-8.23336	-8.10948
1	146.142	129.37	1.5e-10*	-14.1202	-14.0193	-13.5237*
2	155.007	17.73	1.7e-10	-14.106	-13.9294	-13.0622
3	160.924	11.833	3.0e-10	-13.7815	-13.5291	-12.2903
4	179.45	37.051*	1.9e-10	-14.7842*	-14.4561*	-12.8456

From Table 1-4, we can conclude that according to the information criterion, for the second model, the optimal lag order is determined to be 4th order. On this basis, the paper further determines the cointegration rank. The results are shown in Table 1-5.

Table 1-5 Model two co-column analysis results

Maximum Rank	Parms	LL	Eigenvalue	Trace Statistic	5% Critical Value
0	30	148.14274	.	62.6138	29.68
1	35	173.99633	0.93422	10.9066*	15.41
2	38	178.78496	0.39593	1.3293	3.76
3	39	179.44963	0.06757		

From Table 1-5, it can be seen that under the 5% confidence level, the null hypothesis is rejected, and the logarithm of the degree of financial innovation $\ln FIN$, the logarithm of the degree of financial deepening $\ln FIR$, and the logarithm of the degree of industrial structure $\ln TS$. There is a cointegration relationship.

Granger causality test

In order to further verify the causal relationship between financial innovation and industrial restructuring, this paper uses Granger causality test.

Table 1-6: Granger causality test

Dependent variable	null hypothesis	Observation number	F value	P value
TS	$\ln FIN$ does not Granger Cause $\ln TS$	22	8.32	0.0095
	$\ln TS$ does not Granger Cause $\ln FIN$	22	0.04	0.8481
	$\ln FIR$ does not Granger Cause $\ln TS$	22	0.05	0.8329
	$\ln TS$ does not Granger Cause $\ln FIR$	22	2.00	0.1739

It can be seen from Table 1-6 that under the remarkable level of 5%, the degree of financial innovation is the Granger reason for the advanced industrial structure. The industrial structure is not the Granger reason for the degree of financial innovation. This shows that China's financial innovation is beneficial. Further promoting the development of industrial structure, the promotion of financial innovation has promoted the development of tertiary industry such as service industry. However, the advanced industrial structure has not caused further improvement of financial innovation, which indicates that China's financial innovation level is still at a low level.

There is no Granger causality between the degree of financial deepening and the industrial structure. This shows that the proportion of China's total financial assets to GDP has increased. The expansion of financial activities will not necessarily promote the upgrading of industrial structure, and the expansion of financial assets will not It must bring about the optimization of industrial structure; at the same time, the development of the tertiary industry and the development of the economy to the service industry will not necessarily lead to an increase in the proportion of China's financial assets.

In general, the increase in the total amount of financial assets in transactional financial assets contributes to the industrialization of industrial services. However, the effect of the increase in the proportion of financial assets on industrial upgrading is not obvious in the short term, and the upgrading of industrial structure to the development of China's financial industry. The promotion effect is not significant. This shows that China's financial market system is still not perfect. Financial innovation does not meet the funding requirements for enterprise development. Industrial development and financial market development are not coordinated.

Model Correction

In this paper, the correlation analysis between the two independent variables ($\ln FIN$ and $\ln FIR$) of the model shows that the correlation between the two explanatory variables is high. Therefore, in the regression, we must consider the intersection of the two, modify the model, and get the function:

$$\text{Model 2: } \ln TS = \theta_0 + \theta_1 \ln FIN + \theta_2 \ln FIR + \theta_3 \ln FIN \times \ln FIR + \eta_t \tag{3.7}$$

Then the model is subjected to OLS regression, and the various parameters are shown in Table 1-7.

Table 1-7: Least Squares Regression Results

Obs=	23			R-squared=		0.9290
F(3,19)=	82.89			Adj R-squared=		0.9178
Prob>F=	0.0000			Root MSE=		0.0438
ln*TS*	Coef.	Std. Err.	T	P>|t|	[95% Conf. Interval]	
$\ln FIN$	1.4051	0.2511	5.60	0.000	0.8795	1.93073
$\ln FIR$	-3.3211	0.9732	-3.41	0.003	-5.3580	-1.2842
$\ln FIN \times \ln FIR$	2.6587	0.6988	3.80	0.001	1.1962	4.1213
_cons	-1.6022	0.3430	-4.67	0.000	-2.3202	-0.8842

$\ln TS = 1.4051 \times \ln FIN \text{-} 3.3211 \times \ln FIR + 2.6587 \times \ln FIN \times \ln FIR - 1.6022$ is proved to be true. Therefore, it can be seen from the regression that the R-square is 0.9290, and the

adjusted R-square is 0.9178. The model has strong explanatory power; the positive coefficient of $\ln FIN$ is very significant, indicating that the degree of financial innovation promotes the industrial structure's advancedization; And the coefficient of $\ln FIR$ is very significant, indicating the improvement of financial deepening.

CONCLUSION AND RECOMMENDATIONS

At present, China's financial innovation level is highly efficient. To a certain extent, it has promoted the industrial structure to the development of the tertiary industry. The proportion of non-trading financial assets has increased, which has promoted the upgrading of industrial structure. However, the degree of financial deepening is inefficient and even has **the effect of reverse anticipation. The higher the ratio of financial assets to GDP, may** hinder the adjustment and upgrading of industrial structure, which is also related to the "deployment of financial assets". Risks may be linked. If financial assets are not properly regulated, it will lead to divergence between money and economic operations, financial growth and investment efficiency divergence, virtual investment expansion, and crowding out effects on the entity's financing market, thereby damaging the real economy. development of. Therefore, the conclusions of the Granger causality test are further verified. The funds brought by China's financial innovation have not flowed more to the real **economy**, and have not met the funding requirements for enterprise development. China's financial market and industrial structure development are not coordinated.

In order to ensure that the development of financial innovation is based on the real economy, to prevent abnormal fluctuations in the virtual economy caused by excessive development, and to achieve coordination between industrial restructuring and financial innovation, China should strengthen and implement the innovation-driven development strategy in the future, and strive to implement and Technological innovations in industrial structure development and financial system improvement: First, strengthen financial product innovation, activate financial markets, and promote industrial structure upgrading. The second is to strengthen financial market innovation, broaden the financing channels for industrial upgrading, diversify financial assets, and diversify financial services demand to promote the emergence and development of capital markets. The third is to strengthen financial system innovation and enhance financial innovation capabilities. Financial system innovation includes innovations in financial organization systems and financial regulatory systems.

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