Financial development, investment in fixed assets and upgrading of industrial structure —— Panel data based on 21 cities (States)

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Abstract: Finance and fixed asset investment are important ways to upgrade industrial structure. This paper first evaluates the level of regional financial development and industrial structure upgrading in the province under two perspectives of 21 cities (states) and 5 major economic zones in Sichuan Province from 2010 to 2020 using entropy value method and industrial structure coefficient, and on this basis establishes a panel data model to study the influence of financial development and fixed asset investment on industrial structure upgrading in each region of the province. The research results show that the level of financial development, fixed asset investment and industrial structure upgrading are significantly and positively correlated, and pass the robustness test, indicating that finance and fixed asset investment have synergistic effects in regulating industrial upgrading. Finally, based on the above findings, this paper puts forward corresponding policy recommendations.

1. Preface

1.1 Background of the selected topic

The Party's 19th National Congress report pointed out that "China's economy has shifted from a stage of high-speed growth to a stage of high-quality development". To maintain a healthy and high-quality economic development in the environment of the "new normal", the core path is to ensure that the industrial structure is constantly optimized and upgraded. The 14th Five-Year Plan mentions that "development must adhere to the new development concept, based on a significant improvement in quality and efficiency to achieve sustainable and healthy economic development, growth potential to full play, a stronger domestic market, a more optimized economic structure, a significant increase in innovation capacity, advanced industrial base, the level of modernization of the industrial chain significantly improved." The essence of industrial structure upgrading is the rational and effective allocation of social resources and the continuous improvement of the production efficiency of the stock capital. Industrial structure can be continuously optimized, will directly determine whether the quality and speed of regional economic development can be guaranteed. The optimization and transformation of regional industrial structure relies on the change of demand in the economy on the one hand, and on the coordination of resources and external factors on the other. Finance is the core of modern economy, playing the function of "blood vessel" for economic growth, and its development level represents the maturity of the economy. The development of the financial system can mitigate the prevalence of ex ante adverse selection in financing (King and Levine, 1993) and ex post moral hazard (Aghion, Banerjee, and Piketty, 1999), thus promoting investment, increasing the capital stock, and ultimately economic growth. In changing the process of capital accumulation, advances in the financial system also help to identify those entrepreneurs and industries most likely to pioneer new production processes and to finance those more promising industries, thus changing the industrial structure and increasing output efficiency (Greenwood and Jovanovic, 1990; King and Levine, 1993).

Sichuan, as the southwest hinterland of China, is the core liaison between the central and western regions, and is also a large economic province that gathers many people and has vast resources. With the rapid development of the financial industry, the scale of financial assets has expanded rapidly, the function of financial agglomeration has been gradually enhanced, and financial services have been

improved, but the problems of regional financial development have also emerged and the unevenness of financial resource allocation has intensified. The most prominent problem of Sichuan's financial development is the large regional differences, with the Chengdu Plain Economic Zone owning almost 60% of the province's financial resources, while the eastern part of Sichuan and the three states have a relative lack of financial resources. The total amount of fixed asset investment in Sichuan has also been increasing in recent years. 2017, the province completed a total social fixed asset investment of 3,190,208 billion yuan, an increase of 10.72% year-on-year. The contribution rate of investment to economic growth reached about 50%, which is the "important engine" driving the province's economic growth. The adjustment of industrial structure now mainly presents the development trend from the dominance of secondary industry to secondary industry and tertiary industry.

1.2 Research significance

How to allocate more financial resources and effective investment in fixed assets to promote the optimization and upgrading of regional industrial structure is a realistic problem to be solved. The current critical period of industrial restructuring and transformation has a significant role to play in financial development, and the rational allocation of limited investment resources is also an important initiative. The findings of this paper will help Sichuan Province to formulate more reasonable macroeconomic policies, thus promoting the rational allocation of financial resources and investment and creating a financial environment conducive to industrial upgrading.

2. Literature Review

2.1 Financial development and industrial structure interrelationship

Initially, some foreign scholars began to study the interaction between financial development and industrial structure.

Patrick (1966) studied the relationship between the two based on the theory of supply and demand, and concluded that the improvement of the financial system and the adjustment of the industrial structure are in a cooperative relationship of mutual synergy development.

Early domestic scholars mainly conducted theoretical studies on the relationship between both financial development and industrial structure. Some believe that financial development has a facilitating effect on industrial structure upgrading. Liu Shijin (1996) argued that the formulation of relevant financial policies in line with industrial development to meet the needs of industrial restructuring. Wang Liangjian and Zhong Chunping (2001) used regional economic theory to analyze and found that financial development has a facilitating effect on industrial structure upgrading, but at the same time financial inhibition can also form obstacles to industrial restructuring. Some scholars also believe that industrial structure optimization can improve the level of financial development by adjusting the financial structure.

In recent years, scholars have begun to combine empirical evidence to study the intrinsic linkage between the two in depth. Zeng Guoping and Wang Yanfei (2007) collected 54 years of time series data in China and used co-integration analysis and Granger causality to conduct empirical analysis, and the results showed that the level of financial development in China had a significant impact on the primary industry, but the interaction with the secondary and tertiary industries was not significant, and financial restructuring did not play a positive role in upgrading the industrial structure. Based on the statistics of 285 cities and states, Yu Binbin (2017) examined the spatial spillover effect of financial agglomeration on industrial structure upgrading, and the conclusion showed that there are two main limitations of financial industry agglomeration on industrial structure upgrading: industrial development stage and city scale. Financial agglomeration has a positive effect on industrial structure upgrading in the east and central regions, but the effect on the west is not significant.

2.2 Interrelationship between fixed asset investment and industrial structure

Liu Jinquan and Yu Huichun (2002) conducted an empirical analysis of the relationship between economic growth and fixed asset investment in China based on VAR model, and the analysis showed

that there is a significant two-way influence on the fluctuation components of real output and fixed asset investment in China's economy, and the fluctuation of investment affects the fluctuation of output in the current economic state. Fan Decheng and Liu Xisong (2003) study the relationship between investment structure and industrial structure and propose that the problem of economic management system is the root cause of the rigidity of investment and industrial structure. Zhang, Peng and Chen, J. (2005) analyzed the relationship between economic growth and industrial investment in Chongqing, and proposed to pay attention to the optimization of inter-industry and intra-industry investment structure to avoid "industrial hollowing out". Fan Decheng and Wang (2008) used multiple regression analysis to quantitatively analyze the relationship between the two, on the basis of which they proposed countermeasures for optimizing the investment structure of China's three industries in a targeted manner. Zhang Jugang (2010) studied the internal investment structure of the tertiary industry in Shijiazhuang and compared it with national data, analyzed the problems of unreasonable investment structure of the tertiary industry in the region and made corresponding suggestions.

2.3 Financial development and fixed asset investment interrelationship

Zhou (2007) used the panel data of China from 1990-2003 and deposit and loan as the measure to study the relationship between financial development and fixed asset investment, and found that financial development has a promotional effect on fixed asset investment, but the magnitude of the effect varies in different regions. Su (2012) selected financial indicators such as loans from financial institutions, non-bank loans to establish a regression equation to analyze the relationship between financial development and fixed asset investment in Gansu Province, and found that the amount of credit from financial institutions has a significant effect on the internal structure of fixed asset investment.

2.4 Review of the literature

The financial system can change economic growth through two paths: capital accumulation and efficiency improvement, of which the second path is mainly realized by changing the allocation of capital among different industries and promoting industrial structure upgrading. Most of the existing studies on finance and growth have focused on the first path, i.e., finance for capital accumulation, ignoring the path through which finance changes the allocation of capital to different industries and changes output efficiency, which ultimately affects economic growth. Moreover, most studies are based on the national or inter-provincial level, studying financial development and industrial structure at a more macro level, lacking consideration of a single region. In this paper, we hope to study the impact of financial development on economic growth through both capital input and industrial structure. Based on this idea, this paper explores the impact of financial development on industrial structure using entropy and panel regressions for a sample of 21 cities and states in Sichuan Province, and verifies the second path of financial development affecting economic growth. The innovation of this paper is to use financial development and fixed asset investment as bivariate variables to jointly study the effect on industrial structure, and will study the influence mechanism of the three on major economic zones in Sichuan Province based on basic data at city and state level.

3. Study Design

3.1 Variables Selection

In this paper, we intend to choose industrial structure as the explanatory variable and use the industrial structure coefficient to measure it. In the past studies, many scholars have adopted the financial correlation ratio to measure the level of financial development, and for the determination of the indicator of financial correlation ratio, they all refer to the financial correlation ratio proposed by Goldsmith (1969). This paper follows the indicator of financial correlation ratio to represent the level of financial development. In view of the lack of authoritative statistics on all financial assets of the region in China, and considering the availability and accuracy of data, this paper intends to choose the ratio of the sum of deposits and loans of financial institutions to GDP to represent the financial

correlation ratio of the region. The fixed asset investment rate is adopted as a proxy for fixed asset investment, and the ratio of fixed asset investment amount/GDP is used to represent the level of fixed asset investment in the region. Since there are many factors influencing industrial structure and different factors affect industrial structure in different ways. Therefore, it is necessary to control for other variables in the study. After reviewing the relevant literature, the following variables will be selected as control variables in this paper.

(1) Fiscal expenditure level, fiscal expenditure is the activity of the state to realize its various functions by the fiscal department in accordance with the budget plan to disburse the fiscal funds concentrated by the state to relevant departments and parties. The direction of fiscal expenditure affects the industrial structure of regions, for example, the rapid development of real estate industry under land finance in recent years has led to the increase of the proportion of tertiary industry. This paper measures the level of fiscal expenditure by the amount of fiscal expenditure per capita in each region.

(2) The higher the level of urbanization, the higher the level of urbanization, the more it will promote the development of related service industries, and therefore can drive the optimization of industrial structure. According to the international general measurement standard, this paper selects the population urbanization rate to measure the urbanization level, which is equal to the ratio of urban resident population to the total regional population.

(3) Employment level, this paper chooses the number of people employed in the secondary and tertiary industries and the share of total employment to measure the employment level, so as to control the influence of employment factors on industrial transformation and upgrading.

(4) R&D level, the level of scientific and technological research and development is also an important influence factor on the upgrading and transformation of industrial structure, and this paper chooses per capita R&D expenditure to measure the level of R&D.

(5) Location differences, taking into account the regional development variability in Sichuan province, dummy variables are introduced to divide the 21 cities (states) in Sichuan into five major economic zones.

Variable Types	Variable Name	Variable Metrics	Letter Definition	Calculation formula
Dependent Variable	Industry Structure	Industrial structure optimization factor	Ind	(Value added of secondary industry + value added of tertiary industry)/Gross regional product
Independent variables	Level of financial development	Financial Related Ratios	Fin	(Deposits + Loans)/GDP
	Fixed Asset Investment	Fixed asset investment rate	Inv	Amount of fixed asset investment/GDP
Control variables	Financial Expenditures Degree of urbanization Employment Level Technology level	Per capita financial expenditure Urbanization rate Employment rate of secondary and tertiary industries R&D expenditure per capita	Exp Urb Emp Sci	Natural logarithm of fiscal expenditures/total population Resident urban population/total population Number of people employed in secondary and tertiary industries/total employed population Natural logarithm of R&D expenditure/total population

Table.1. Variable selection table.

3.2 Model Design

In order to test the influence of financial development and fixed asset investment on industrial structure, the following model is set in this paper.

$$\text{Industry}=\text{pseudo}+\beta_1\text{fin}+\beta_2\text{inv}+\sum(\gamma\text{CV})+\mathcal{E} \tag{1}$$

Where: dusty is the explanatory variable and pseudo is the constant term; fin is the 1st explanatory variable, indicating the level of financial development; inv is the 2nd explanatory variable, indicating fixed asset investment; CV is the control variable, β_k is the correlation coefficient, and $\mathcal{E}$ is the disturbance term.

3.3 Data source

In this paper, we will select relevant data from 2010 to 2016 from each city and state in Sichuan, and conduct an empirical analysis of the impact of financial development and fixed asset investment on industrial structure by conducting descriptive statistical analysis, correlation coefficient analysis, and analysis of the results of multiple linear regression models. The original data used in the study were obtained from the statistical yearbooks of each city and state, Sichuan Statistical Yearbook, and China Statistical Yearbook.

4. Empirical Analysis

4.1 Descriptive analysis

The table below gives the results of descriptive statistics for all variables used in the paper, counting a total of five indicators for each variable: number of observations, mean, standard error, minimum and maximum values. All the variables used contain 147 observations for a total of 7 years from 2010 to 2016 for 21 cities and states. As can be seen from the table below, the minimum value of the industrial structure optimization coefficient is 0.709, the maximum value is 0.967, and the mean value is 0.838, with a small standard error. The data selection of financial related ratio, fixed asset investment coefficient, logarithm of per capita fiscal expenditure, urbanization rate, employment ratio of secondary and tertiary industries, and logarithm of per capita R&D expenditure are all reasonable and valid, with no outliers.

Table.2. Descriptive statistics table.

Variable Name	Letter Meaning	Number of observations	Average value	Standard error	Minimum value	Maximum value
Y	Ind	147	0.838	0.055	0.709	0.967
X1	Fin	147	2.228	0.816	1.218	4.960
X2	Inv	147	0.924	0.425	0.448	2.729
Z1	Exp	147	8.643	0.592	7.609	10.273
Z2	Urb	147	0.416	0.099	0.205	0.7147
Z3	Emp	147	0.543	0.123	0.195	0.876
Z4	Sci	147	4.465	1.707	-0.587	7.762

4.2 Correlation Analysis

The following table gives the correlation coefficient matrix between all the variables used in the thesis, and briefly shows the degree of linear correlation between industrial structure and the level of

financial development, fixed asset investment and several other variables. From the table below, the correlation coefficient between industrial structure and financial development level is 0.2210 and indicates a positive relationship between the two variables, while the correlation coefficient between industrial structure and fixed asset investment is 0.3429, indicating a positive relationship between the two variables. However, the correlation cannot indicate causality, and the causal relationship between Y and X needs to be calculated and verified by the econometric model.

Table.3. Correlation analysis.

	Ind	Fin	Inv	Exp	Urb	Emp	Sci
Ind	1.000						
Fin	0.2210*	1.000					
Inv	0.3429*	0.4903*	1.000				
Exp	0.2106	0.6739*	0.6244*	1.000			
Urb	0.8711*	0.2845*	-0.4332*	0.0916	1.000		
Emp	0.7141*	0.1611	-0.5187*	-0.1652*	0.8914*	1.000	
Sci	0.7476*	0.2344*	-0.4158*	0.1597	0.7758*	0.7321*	1.000

Note: * indicates P<0.01, i.e. significant at 1% level of significance

4.3 Regression results and analysis

After the Hausman test, the results indicate that the regression is suitable for the panel data treatment with random effects, and the regional dummy variables are added to the regression. The regression results obtained with the random effects regression model are shown in the table below, and the dependent variable is Y (industrial structure coefficient). Since the two dependent variables explain different degrees of the independent variables, this paper adopts a joint regression of two dependent variables and a single dependent variable and then a separate regression.

From the regression results, it can be seen that whether the two dependent variables are regressed jointly or individually, X1 has a positive coefficient and passes the 1% significance level, indicating that the level of financial development has a significant positive effect on the industrial structure. X2 has a positive coefficient and passes the 5% significance level, indicating that fixed asset investment has a significant positive effect on the industrial structure. Among the control variables, Z1, Z2 and Z4 pass the significance test, while Z3 does not pass the significance level. Fiscal expenditure is negatively related to industrial structure, while urbanization rate, labor force ratio and research expenditure have a significant positive effect on industrial structure. Dummy variables of region and time are introduced in the regressions to divide Sichuan 21 municipalities into five major economic regions (Chengdu Plain: AREA1, South Sichuan: AREA2, Northeast Sichuan: AREA3, West Panxi: AREA4, Northwest Sichuan: AREA5). To avoid multicollinearity, the regression results ignore the dummy variable of Sichuan West, but none of the dummy variables of the regions pass the significance test. In the final regression model, the R2 is 0.7197, indicating that the level of financial development, fixed capital investment, fiscal expenditure, and urbanization can explain 71.97% of the change in industrial structure.

Table.4. Table of regression results.

	(1)	(2)	(3)
Fin	0.312***	0.407***	
	(4.38)	(6.73)	
Inv	0.015**		0.016***
	(2.20)		(2.83)
Exp	-0.011*	-0.010*	-0.010*
	(-1.87)	(-1.68)	(-1.91)
Urb	0.420***	0.391***	0.422***
	(7.01)	(6.62)	(7.11)
Emp	0.012	0.031	0.011
	(0.33)	(0.83)	(0.30)
Sci	0.004**	0.004**	0.004**
	(2.03)	(2.07)	(2.02)
area1	-0.017	-0.027	-0.015
	(-0.70)	(-1.18)	(-0.64)
area2	-0.001	-0.009	-0.001
	(-0.03)	(-0.37)	(-0.02)
area3	-0.035	-0.040*	-0.034
	(-1.51)	(-1.81)	(-1.45)
area4	0.016	0.011	0.016
	(0.60)	(0.42)	(0.56)
_cons	0.735***	0.735***	0.728***
	(14.84)	(14.73)	(15.74)
Regional effects	Yes	Yes	Yes
Time effects	Yes	Yes	Yes
N	147	147	147
r2	0.7197	0.7151	0.7200
F	26.381	27.806	29.356

Notes: * $p<0.1$, ** $p<0.05$, *** $p<0.01$

4.4 Robustness tests

To further test whether the regression model is robust, this paper substitutes the coefficient of advanced industrial structure, i.e., value added of three industries/value added of two industries, as a proxy variable to measure capital structure, into the three regression models. The results show that the random effects model should be chosen for the regression after the Hausman test. The level of financial development and fixed asset investment are significantly and positively related to the industrial structure. It indicates that with the improvement of financial development level and the adjustment of fixed asset investment structure, the industrial structure will be optimized and upgraded, further verifying the influence of both on the industrial structure. In addition, the regression results of each control variable and industrial structure are basically consistent.

5. Conclusions and Recommendations

5.1 Conclusions

Through the empirical study of the current situation analysis of financial development, fixed asset investment and industrial structure in Sichuan Province from 2010 to 2016 and the relationship among them, this paper obtains the following conclusions: the level of financial development, fixed asset investment and industrial structure upgrading are significantly positively correlated and pass the robustness test, indicating that finance and fixed asset investment have a positive synergistic effect in regulating industrial upgrading, and a more province-wide The more reasonable allocation of financial

resources and fiscal funds in the province can continue to promote the further optimization and upgrading of industrial structure. At the same time, compared with other literature, even the Chengdu Plain Economic Zone is different from the eastern coastal region in that the impact of its fixed asset investment scale on industrial structure upgrading has not yet reached the critical point of inverted "U" shape.

5.2 Recommendations

(1) Improve the financial market competition mechanism and narrow regional financial differences. As the Chengdu Plain Economic Zone, which has the best development conditions, has a unique geographical advantage, so it should strengthen its radiation effect on the surrounding areas, provide cross-regional financial services, alleviate the status quo of small financial support and slow growth in the surrounding areas, focus on supporting the development of high-quality enterprises in each region, give financial and tax preferences, encourage financial institutions to lower the credit threshold for high-quality enterprises in each region, increase the combination of industry and finance In addition, we will actively guide the flow of capital to the backward areas and drive the coordinated development of regional finance in the province, thus promoting the upgrading of industrial structure.

(2) Reasonably adjust the structure of fixed asset investment and guide the upgrading of industrial structure. Combine the characteristics and features of each region's industrial gathering to arrange investment resources, for example: in the primary industry, focus on investing in infrastructure such as special agriculture and mechanized production; in the secondary industry, further cooperate with the supply-side reform, guide the transformation of high pollution and high energy-consuming enterprises, increase the investment in new industries, and grow new industries; in the tertiary industry, adjust the internal investment structure and invest in the development of a variety of service industries. Through guidance, under the premise of highlighting its own industrial characteristics, accelerate the optimization and upgrading of the industrial structure of each region.

(3) Pay attention to the synergistic regulatory role of financial and fiscal policies on industrial structure upgrading. On the one hand, combined with the advantageous characteristic industries of each economic zone, explore the mode and mechanism of financial funds to optimize industrial structure through fixed asset investment and its coordination with financial services according to local conditions; on the other hand, based on the fact that the influence of finance on industrial upgrading is greater than the influence of fixed asset investment on it, therefore, we should innovate the path and way of financial guidance and financial services for industrial structure adjustment, and promote the depth of finance, finance and industrial integration.

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