Financial Development and Industrial Structure Upgrading in Beijing, Tianjin and Hebei Region of China

Fuzhong Chen*
Haifeng Li**
Jingxin Lu***

Abstract: The concept of new development philosophy proposed by China's government in October 2015, has addressed the importance of regional and industrial coordinative development. In this paper, we developed a theoretical model to explore the impact mechanism how financial development influenced on industrial structure upgrading. Financial development may have promotion effect or repression effect on industrial structure upgrading. Based on the theoretical framework, we employed panel data in Beijing, Tianjin and Hebei region of China from 1985 to 2016 to analyze the impact of financial development on industrial structure upgrading. The results indicated that the overall effect of financial development on industrial structure upgrading in Beijing, Tianjin and Hebei region of China was positive. The financial correlation ratio and financial financing size significantly improved service industry productivity. Meanwhile, the impact of financial efficiency on secondary productivity was negative and the effect on tertiary industry productivity was not significant. However, the overall effect of financial development on industrial productivity was nonlinear, since financial promotion and financial repression began to take effect on industrial structure upgrading. Therefore, more attention should be paid to the usage of repression and promotion effect from financial development. For local government, the externality of regional financial policies also should be taken into consideration when planning and implementing specific policy measures. To improve the mobility of production factors, it was suggested to continuously urge the reform of market economy system to accelerate the adjustment pace of industrial structure upgrading in Beijing, Tianjin and Hebei region of China.

Keywords: Financial Development, Industrial Structure Upgrading, Financial Promotion, Financial Repression, Coordinative Economic Development

1. Introduction

The Fifth Plenary Session of the 18th National Congress of Communist Party of China put forward the new development philosophy of innovation, coordination, green, openness and sharing development, and put the coordination, openness and sharing development in a relatively important position, which highlighted the magnitude of coordinative development. In April 2015, China's government passed of the "Beijing-Tianjin-Hebei Coordination and Development Plan", which made the regional coordinative development in Beijing, Tianjin and Hebei region be a national development strategy. In this plan, it indicated that the reform of production factor market and integration of financial market were considered to be key elements to increase regional mobility of factors and capital. To integrate financial market, the regional economic

*School of International Trade and Economics, University of International Business and Economics
**The Graduate School of East Asian Studies, Yamaguchi University
***School of International Trade and Economics, University of International Business and Economics

coordination and labor division should be further strengthened. To achieve the objective of coordination development in Beijing, Tianjin and Hebei region, the plan made three stages development processes. In the short term, structure upgrading and interregional transferring for industrial development should be achieved. In the middle term, it should make great progress in industrial comovement and development. Finally, more adequate economic structure in Beijing, Tianjin and Hebei region should be formed in long term, and hence to enhance international competitiveness and influence.

To further promote the coordinated development of financial markets, and thus to accelerate the pace of industry structure adjustment and upgrading in Beijing, Tianjin and Hebei region of China, the state has implemented series of measures and policies. In 2005, the People's Bank of China set up the Bohai Sea Circle Financial Cooperation Forum, and in 2011, the Banking Regulatory Bureau of the Beijing, Tianjin and Hebei jointly signed a cooperation memorandum in banking supervision. In April 2012, Beijing and Hebei signed a regional financial cooperation agreement with regard to science and technology financial innovation, credit system construction, financial background service base, financial risk prevention and comprehensive financial reform and other aspects, to strengthen the cross-regional financial cooperation. In order to promote the coordinated development in Beijing, Tianjin and Hebei region, the Beijing branch of ICBC has adopted measures such as easing loans to provide financial support for economic development (Zu and Lu, 2016). On August 30 in 2016, the guiding foundation to Beijing, Tianjin and Hebei industrial structure adjustment was formally established in the Tianjin Free Trade Area Center business district. This foundation was an important start to implement coordination strategy and promote industrial structure transition and upgrading in Beijing, Tianjin and Hebei region. It is of great significance to integrate the advantages of resources, enhance the traditional industries, accelerate the conversion of kinetic energy and enlarge the financial credit. Therefore, the full use of financial development effect has an important role in speeding up the upgrade of industrial structure in Beijing, Tianjin and Hebei region, and thus to accelerate the integration pace of Beijing, Tianjin and Hebei economic development. Industrial upgrading is to adjust the industrial structure through technological progress, and to improve industrial development quality and efficiency. It also promotes the development of regional economy in Beijing, Tianjin and Hebei region. Optimal adjustment of industrial structure is able to promote industrial upgrading, so that the economy has been further developed. The continuous optimization of the industrial structure in Beijing, Tianjin and Hebei region is positive to improve the layout and spatial structure, so as to promote the regional economic development (Yu and Tao, 2016). In addition, selecting appropriate technology will improve the ratio of capital to labor, and it will promote the upgrade of industrial structure and economic growth to a certain degree (Huang and Li, 2009). However, in the process of industry

adjustment, it is necessary to pay both attention to adequacy and upgrade on industrial structure. Hence, when injecting new developing power into the economy, it should avoid the repression effect of excessive upgrading in industrial structure as well (Gan et al, 2011).

Industrial structure upgrading is positive to alleviate the contradiction between economic development and environment resources in Beijing, Tianjin and Hebei region, and further to provide an important impetus to economic development. At present, there are many developing problems in Beijing, including extremely scarce water resource, traffic congestion, large population and poor air condition, which cause great pressure to the ecological environment. Tianjin's economy mainly depends on the development of heavy chemical industry. In recent years, Tianjin's economic development was restricted by natural resources and environment, thus industrial upgrading and transition has become to be one of the main tasks in economic development process. Moreover, the economic development in Hebei province is mainly based on resource processing and capital-intensive industries, and the development mode mainly relies on investing natural resources (Zhu, 2009).The contradiction is becoming to be more serious between economic development and the excessive exploit environment resources in Beijing, Tianjin and Hebei region. Hence, sustainable and rapid economic development is subject to accelerate the transition of economic development mode and promote industrial optimization and upgrading. To improve the environmental conditions in Beijing, Tianjin and Hebei region, Beijing is suggested to reduce carbon emissions by adjusting its industrial structure and promoting industrial upgrading. Zhang et al. (2016) suggested that it was necessary for Beijing to speed up internal industrial upgrading and inter-industrial coordination, which was positive to enhance utilizing efficiency of natural resources and production factors specific to the service industry. According to Han et al. (2015), they indicated that industrial structure was closely correlated to the construction of ecological civilization, since industrial structure adequacy and upgrading was positive to improve environmental quality. Therefore, speeding up industrial structure upgrading and adjusting is an important starting point to improve the environmental conditions in Beijing, Tianjin and Hebei region, and thus to promote coordinated economic development in this area.

In 1950s, Solow (1957) put forward the production factors, including capital, labor and technology, which were positive to economic growth. With social and economic development, financial capital has become an important means to support industrial restructuring, transition and upgrading. The development of the capital market has promoted the adjustment of regional economy, and thus to optimize and upgrade industrial structure. As a national development strategy for China, the plan of coordinative development in Beijing, Tianjin and Hebei region should make the investment and financing institutions play a leading role. Additionally, make the financial capital play its sufficient role in promoting

industrial structure optimization and upgrading. According to Yi and Liu (2015), financial economy was positive to promote industrial transition through horizontal and structural effect of technological innovation, which had important policy implications for industrial structure upgrading in Beijing, Tianjin and Hebei region. Based on the experience of other developed countries, the increase of investment was positive to promote economic structure optimization, and then to promote the upgrading of the industrial structure (Liu, 2016). Empirical studies also provided evidence to support that the development of financial markets had a significantly positive role in promoting specific industries, especially for high-tech and R&D industries (Wang and Li, 2010). Taking Chinese stock market for example, at the end of July 2016, there were 270 listed companies in Beijing, which was up to 9.36 percent in Chinese stock market. For those companies, the total market capitalization was over 11.5 trillion, which was up to 25 percent of Chinese stock market capitalization. Nevertheless, the financial markets in Tianjin and Hebei still needed to be further developed, which was positive to form synergy with Beijing, and thus to serve coordinated economic development in Beijing, Tianjin and Hebei region.

In sum, we focused on the impact of the financial development on the industrial structure upgrading in Beijing, Tianjin and Hebei region of China in this paper. The remainder of the paper proceeds as follows. Section 2 reviews related literatures with respect to the impact of financial development on industrial structure upgrading. Section 3, to explore the impact mechanism of financial development on industrial structure upgrading, we develop existing theoretical model and deduce proposition I and II, and the data is described as well in this part. Section 4 presents and discusses the empirical results, and robustness test is also included. Section 5 offers conclusions and policy implications.

2. Literature Review

2.1 The Definition of Financial Development and Industrial Structure Upgrading

Although there has been no precise definition on financial development, many scholars have used some indicators to measure its developing level of financial sector (Goldsmith, 1975; Zhu and Ni, 2014). Specifically, if financial development is measured from quantity perspective, financial correlation ratio is often employed. In addition, financial efficiency and financial agglomeration are usually used to measure the quality of financial development. Goldsmith (1975) firstly proposed the concept of financial correlation ratio, and defined it as the ratio of total assets to GDP, which was considered to be an important indicator to measure financial institution's efficiency. The banking sector is the dominant sector in Chinese financial industry, so financial correlation ratio is identically suggested to be measured by the ratio of bank loans to GDP in numerous prior studies (Hao, 2006; Lu, 2009; hang et al., 2012). Zhu and Ni (2014) used the ratio of loan to deposit to measure financial efficiency, and meanwhile employed financial industry employment population to measure financial

agglomeration level.

For the concept of industrial structure upgrading, the identically accepted definition is that industrial structure has a general trend to change from low to higher level (Jiang, 2010; Yang and Liu, 2016).Yang and Zhou (2013) used industrial adequacy and upgrading as indicators of industrial structure upgrading in China. Shan and Luo (2013) suggested that technology diffusion and integration was positive to promote industries integration and upgrading, and hence the government should encourage technological innovation in the process of industrial structure upgrading. Meanwhile, Shan and Luo (2013) also considered comparative advantage to specific industry to be one of the key factors to accelerate industrial structure upgrading, and therefore they suggested the government to implement policies to encourage innovation based on comparative advantage. Indigenous innovation has been demonstrated to be positive to industrial structure upgrading, and Wu and Liu (2013) got exact evidence from the analysis of the relationships between Chinese regional technology innovation and industrial structure upgrading. Nevertheless, due to the differentials of regional economic development, Wu and Liu (2013) found that the impact mechanism was various as well. According to the process of industrial structure upgrading, prior studies basically concluded that there were three modes of industrial structure upgrading, which were the advance of industrial structure, the sophistication of processing process and the optimization of value chain (Cheong & Wu, 2014; Ozawa, 2005). Especially, the key task for Beijing, Tianjin and Hebei region was to upgrade industrial structure and optimize value chain (Chen and Zhu, 2011).

2.2 The Promotion and Repression Effects of Financial Development on Industrial Structure Upgrading

Prior literatures have not concluded consistent views about the impact of financial development on industrial structure upgrading. Firstly, some studies supported that financial development was positive to industrial structure upgrading, and that was so called financial promotion effect. For instance, Chen (1996) argued that financial market could promote industrial structure to be reconstructed through adjusting saving and investment which would change the volume and direction of capital flowing, and thus industrial structure was optimally upgraded. Based on empirical evidence, Qian and Zhou (2012) employed two steps GMM systematical estimation to explore the influence effect of financial development on industrial structure upgrading, and they found that as one of the most important factors to accelerate industrial structure adjustment, technology progress would be positively promoted under the affiliation of financial development. Additionally, Yang and Dong (2007) also provided empirical evidence to hold the positive impact of capital market on Chinese industrial structure upgrading. Furthermore, Du and Guo (2011) got approximate conclusion that there was positive effect of capital investment on upgrading industrial structure. Technology innovation would be promoted through venture

capital from market and thus to accelerate industrial structure upgrading. From the perspective of econometric nexus, Luo (2016) employed the data from the beginning of reform and openness in 1978 to 2014 with the methods of cointegration test, impulse response and variance decomposition to explore the short and long term effects between financial development and industrial structure upgrading, and got positive evidence as well.

Secondly, many previous studies also provided evidence to support that financial development was negative to industrial structure upgrading, which was so called financial repression effect. For many developing economies, financial repression is significant (Shaw, 1973; McKinnon, 1973). Taking China as one of main representative countries, financial repression has been often caused by government excessive intervention, and hence industrial structure became to be unbalanced (Tan, 1998; Lv and Mao, 2013). Shen and Zhang (2009) found that government preferred to invest capital intensive sectors, which was negative to adjust unbalanced industrial structure. Approximately, Wang and Johansson (2013) found the evidence that government excessive intervention was negative to economic reconstruction and industrial structure upgrading. In fact, Chen (2014) explored the problems with regard to Chinese economic transition and industrial upgrading, and government's negative effect on dominating in economic development was concluded. Under the context of open economy, Huang and He (2011) suggested that the governments of transitional economy inclined to intervene in interest and foreign exchange market, which would distort economic structure and hinder industrial structure upgrading. Besides political factors, higher household savings and inadequate economic structure are considered to be important causes of financial repression (Liu and Yao, 2012). Yang and Zhou (2013) also held the negative effect from financial development, but meanwhile they found a controversial conclusion that financial repression was positive to economic growth in short term.

Besides these two views above mentioned, there still are large number of studies which suggest that differential effects of financial development may be attributed to regional differentials. Zhu and Yu (2014) argued that the impact of financial development on industrial structure upgrading was uncertain. They found that financial correlation ratio was positively correlated to industrial structure upgrading, and financial agglomeration and financial efficiency had various effects specific to region. Zhu and Ni (2014) also provided detailed evidence to support their view. For instance, they analyzed the relationships between financial development and industrial structure upgrading in Beijing, Tianjin and Hebei which was in east of China, and only held conclusions that financial agglomeration and efficiency were positively correlated with industrial structure upgrading.

To sum up, there has been no identical conclusion about the impact effect of financial development on industrial structure upgrading. Actually, there is almost no theoretical model to identify financial promotion and financial

repression. Since the Beijing-Tianjin-Hebei Coordination and Development Plan published in 2015, the nexus between financial development and industrial structure upgrading has been increasingly highlighted. The first limitation of prior studies is that there is no sound theoretical model to give systematic analysis on the impact of financial development on industrial structure upgrading. Secondly, prior literatures get no identical conclusion and there is no widely accepted explanation to fulfill general economic intuition. As a national strategy for China, the coordinative development in the region of Beijing, Tianjin and Hebei needs to accelerate the pace, and the regional financial coordination is one of the most important factors. This study contributes the literature of the impact of financial development on industrial structure upgrading under an important strategy era in Beijing, Tianjin and Hebei region of China. In this paper, we developed theoretical model to explore the potential impact of financial development, including financial promotion and repression, on industrial structure upgrading. In addition, we also gave empirical evidence to test our deduced propositions. This paper can be informative for policy makers to develop effective measures to promote and accelerate the coordinative development process in Beijing, Tianjin and Hebei region of China. For other countries and regions, this study is positive to give some advices to those economies which are of approximate situations as that in Beijing, Tianjin and Hebei region of China.

3. Theoretical Model, Variables and Data Description

3.1 Theoretical Model

Industrial structure upgrading is generally considered to be affected by the mobility of production factors and the efficiency of input and output. In this paper, we developed a non-balanced growth model among industrial sectors to address the impact of financial development on industrial structure upgrading. According to Baumol (1967), assume that there are two sectors that are sector 1 and 2, which stand for industry and service sector respectively. Meanwhile, based on the theoretical specification by Baumol (1967) and the estimation on the productivity of manufacturing and service sectors made by Baumol (1985), the technology progress rate of service sector is higher than that of manufacturing sector. For simplicity, assume that technology level of sector 1 remains unit, and the technology progress rate of sector 2 is γ. Meanwhile, labor is assumed to be the only input, and hence the production function can be expressed as:

$$Output_{sect1} = \vartheta * Labor_{1t}^{\lambda} \quad (1)$$

$$Output_{sect2} = \varphi(fin\_d_{it}) * Labor_{1t}^{i*} e^{\gamma t} \quad (2)$$

In equation (1) and (2), *Output* indicates the total output to specific sector, $\lambda \in (0, 1)$, and *Labor* stands for the input of labor in sector 1 and 2. $\varphi(fin\_d_{it})$ is the function to measure the impact of financial development (*fin_d*) on sector output, and i is the subscript of the indicators to measure financial development. According to Wang and Johansson (2013), due to the tiny impacts in two sectors model, the factor of capital is generally ignored. We followed this method for

simplicity as well. Based on the effect of scale of economy, when the size of production input increases over than a threshold value, the marginal revenue for sector output will decrease. For the impact of financial development on sector output, there may be a threshold value which divides the comprehensive impact into promotion and repression effects. Thus, the function $\varphi(fin\_d_{it})$ is not linear by financial development. Hence, we followed the method putting forward by Roubini and Salaimartin (1991), and developed prior two sector model with nonlinear specification. When financial development shows promotion effect, the functional value of $\varphi(fin\_d_{it})$ will increase with the increase of *fin_d*, and decrease with the decrease of *fin_d*. Otherwise, the function value of $\varphi(fin\_d_{it})$ will reversely change with the indicator values of financial development. Let other factors to remain constant, the output of sector 2 is subjected to the function of financial development ($\varphi(fin\_d_{it})$). Moreover, assume that the population is constant, and therefore, population growth rate equals to 0. Thus, the labor allocated to sector 1 and 2 can be represented as follows:

$$Labor_{1t} + Labor_{2t} = L_t \tag{3}$$

In equation (3), L_t stands for the total supply of labor in period *t*. To simplify model, let L to be unit ($L_t = 1$). Thus, the wage of sector 1 and 2 can be expressed as:

$$W_{1t} = \frac{dOutput_{1t}}{dLabor_{1t}} = \vartheta^{*}\lambda^{*}Labor_{1t}^{\lambda-1} \tag{4}$$

$$W_{2t} = \frac{dOutput_{2t}}{dLabor_{2t}} = \varphi(fin\_d_{it})e^{\gamma t}{}^{*}\lambda^{*}Labor_{2t}^{\lambda-1} \tag{5}$$

In equation (4) and (5), W_{1t} and W_{2t} stand for the wage of sector 1 and 2 respectively. In this paper, we assume that labor can flow freely between sectors, so the wage in different sectors inclines to be equal. Thus, social wage in period t can be given as:

$$W_t = W_{1t} = W_{2t} \tag{6}$$

According to equation (6), labor mobility is assumed to be perfect. If there is wage differential, people with lower wage will choose to move to other sectors which can provide higher salary. Therefore, we can get labor return equilibrium between sector 1 and 2 with equation (4) and (5) under the condition given by equation (6).

$$\vartheta^{*}\lambda^{*}Labor_{1t}^{\lambda-1} = \varphi(fin\_d_{it})e^{\gamma t}{}^{*}\lambda^{*}(1-Labor_{1t})^{\lambda-1} \tag{7}$$

$$\left(\frac{Labor_{1t}}{1-Labor_{1t}}\right)^{\lambda-1} = \frac{1}{\vartheta}{}^{*}\varphi(fin\_d_{it})^{*}e^{\gamma t} \tag{8}$$

$$\begin{aligned}\frac{Labor_{1t}}{1-Labor_{1t}} &= \left(\frac{1}{\vartheta}{}^{*}\psi(fin\_d_{it})^{*}e^{\gamma t}\right)^{\frac{1}{1-\lambda}} \\ &= \frac{1}{\left(\frac{1}{\vartheta}{}^{*}\varphi(fin\_d_{it})^{*}e^{\gamma t}\right)^{\frac{1}{1-\lambda}}}\end{aligned} \tag{9}$$

Let $N_t = \left(\frac{1}{\vartheta}{}^{*}\varphi(fin\_d_{it})^{*}e^{\gamma t}\right)^{\frac{1}{\lambda-1}}$, and thus, $Labor_{1t}$, $Labor_{2t}$ and W_t can be rewritten as:

$$Labor_{1t} = \frac{1}{1+N_t} \tag{10}$$

$$Labor_{2t} = \frac{\cdot_t}{1+N_t} \tag{11}$$

$$\begin{aligned}W_t = W_{1t} &= \vartheta^{*}\lambda^{*}Labor_{1t}^{\lambda-1} \\ &= \vartheta^{*}\lambda^{*}\left(\frac{1}{1+N_t}\right)^{\lambda-1} \\ &= \vartheta^{*}\lambda^{*}(1+N_t)^{\lambda-1}\end{aligned} \tag{12}$$

Holding $\lambda \in (0, 1)$, we can get that $\frac{1}{1-\lambda}$ is larger than unit. Therefore, N_t is considered to be a monotonic increasing function of $\varphi(fin\_d_{it})$.

Thus, when N_t increases, the supply of $Labor_{1t}$ will decrease while $Labor_{2t}$ will increase. With the movement of labor flowing from sector 1 to sector 2, the output of sector 1 will decline, but the output of sector 2 will increase. With the definition of sector 1 and 2, they stand for industry and service sector, respectively. Thus, we get proposition I as follows:

Proposition I: When financial development shows promotion effect on industrial structure upgrading, production factors as labor will flow from industry sector to service sector with improvement of financial developing level, otherwise, production factors will flow away from service sector to industry sector.

The adjustment and upgrading of industrial structure, direct impact on sector output is the increment of relative output ratio of service sector over industry sector. Assume that $\Re(\bullet)$ is the function of relative output ratio to specific sectors. Thus, the relative output ratio $\frac{Output_{2t}}{Output_{1t}}$ can be computed as:

$$\Re(Output_{1t},\ Output_{2t}) = \frac{Output_{2t}}{Output_{1tt}} = \frac{\varphi(fin\_d_{it})*Labor_{2t}^{\lambda}*e^{\gamma t}}{\vartheta*\lambda*Labor_{1t}^{\lambda}} = \frac{1}{\vartheta}*\vartheta(fin\_d_{it})e^{\gamma t}*N_t \quad (13)$$

Since $\frac{1}{1-\lambda}>1$, we can get $\frac{1}{1-\lambda}+1>1$, and hence, $\Re(\bullet)$ is a monotonic increasing function of $\varphi(fin\_d_{it})$ as well. Thus, we get proposition II as follows:

Proposition II: When financial development shows promotion effect, the relative output ratio of service sector will increase comparably to industry sector with the improvement of financial developing level, otherwise financial repression effect will cause the increment of the relative output ratio of industry sector rather than that of service sector. Thus, financial promotion rather than financial repression is positive to industrial structure upgrading.

3.2 Econometric model and Variables

Based on the theoretical model and propositions, this paper examines the impact of financial development on industrial structure upgrading empirically with the panel data from Beijing, Tianjin and Hebei region in China. The basic regression model is specified as follows:

$$Indstr\_upgd_{it} = \alpha_0 + \sum_{j=1}^{n}\alpha_j fin\_d_{jit} + \sum_{k=1}^{m}\beta_k X_{kt} + \varepsilon_{it} \quad (14)$$

In equation (14), the dependent variable of *indstr_upgd* stands for industrial structure upgrading and j is the subscript of independent variables to measure financial development. X_{jt} represents related control variables in period t, and k is the number of control variables. In addition, i is the subscript of various regions including Beijing, Tianjin and Hebei. The process of industrial structure upgrading, in fact, is the process of continuous upgrading from primary industry to secondary industry and then to tertiary industry[1]. Accordingly, the method of standard structure proposed by Chenery et al. (1986)

1) Because many industry sectors are in secondary industry, and most of the service sectors are in tertiary industry as well, in the following part, this paper use secondary industry and tertiary industry to replace industry sector and service sector, respectively.

has been generally used to measure the advance of industrial structure based on Clark's Law, and some indicators such as output ratio of tertiary industry relative to secondary industry, Moore structure index, output ratio of non-agriculture industry relative to agriculture industry, hierarchical coefficient of industrial structure and the proportion of hi-tech industry to total output. For instance, Fu et al. (2013) employed output ratio of new products relative to total output to measure the advance of industrial structure. Moreover, Gan et al. (2011) used output ratio of tertiary industry relative to secondary industry to measure the advance of industrial structure empirically. In this paper, we followed the methods proposed by Fu et al. (2013) and Gan et al. (2011), and used the ratio of regional GDP of tertiary industry to that of secondary industry to measure industrial structure upgrading by the advance of industrial structure. In order to measure the productivity specific to secondary and tertiary industry, we used the logarithm ratio of regional GDP over employment population.

To explore the impact effect of financial development in detail, the indicators using to measurement were divided into two aspects, namely quantity and quality perspective. According to Zhu and Ni (2014), financial correlation ratio and financing size indicators were chosen to reflect financial development from quantity perspective, and financial agglomeration and efficiency indicators were used to measure financial development from quality perspective. Goldsmith (1975) firstly put forward to use the ratio of total financial assets to GDP to measure financial institution efficiency. Since banking sector was considered to be the leading part of Chinese financial industry, Hao (2006), Lu (2009) and Zhang et al. (2012) argued that financial correlation ratio approximately equaled to the proportion of bank loans to GDP, and we followed this measurement in this paper. Financial financing size generally reflected the capital flowing from financial institution to real economy, so the ratio of loan balance of financial institution to regional population was used. In addition, Shen and Bai (2013) employed financial human capital to measure financial agglomeration indicator, which was approximate to Zhu and Ni (2014) that they employed population in financial sector as an agent indicator. In this paper, we used the ratio of employment population in financial sector to regional total employmed population. For financial efficiency, the indicators that investment saving rate, saving rate, credit and loan ratio of private firms and capital allocation efficiency were often used as approximate measures. For instance, Wang and Sun (2003) used investment saving rate, and Shen and Bai (2013) employed the ratio of credit loan to GDP by private firms. In order to get more accurate estimation, we used the balance ration of financial institution deposit to loan to measure financial efficiency.

Meanwhile, the control variables in our empirical specification were as follows. Firstly, we followed Wang and Zhao (2013) to measure investment size by the ratio of completed investment in total social fixed assets to regional population. Secondly, the ratio of government fiscal expenditure to regional GDP was employed to

measure government expenditure level, and foreign investment level was measured by the ratio of foreign effective investment to regional GDP in USD. In addition, the basic variables to reflect transportation, education, and science and technology level were included as well, and which were measured by the ratio of freight volume, college student number and fiscal expenditure on science and technology to regional population. We also added population growth level which was indicated by natural population growth rate into our empirical estimation. Table 1 describes all the variables in detail.

3.3 Data Source and Statistical Description

This paper addressed the impact of financial development on industrial structure upgrading, and the research data was collected from the Statistical Yearbook of Beijing, Tianjin and Hebei, China Statistical Yearbook, China Urban Statistical Yearbook, Wind Database and the website of Hexun.com. Due to the limitations of data, the panel data covers from 1985 to 2016. However, the data of financial agglomeration indicator only could be collected from 1997 to 2016. Table 2 presents the data statistical description.

Table 1 Description of relevant variables

Variable name	Variable code	Variable calculation or related instructions
Advance of industrial structure	*aindstr*	Ratio of regional tertiary industry GDP to region secondary industry GDP
Secondary industry productivity	*indps*	Natural logarithm of the ratio of regional secondary industry GDP to regional secondary industry employment population
Tertiary industry productivity	*indpt*	Natural logarithm of the ratio of regional tertiary industry GDP to regional tertiary industry employment population
Financial correlation ratio	*fincr*	Balance ratio of financial institutions deposit loan to Region GDP
Financial financing size	*finsr*	Natural logarithm of the ratio of financial institution loan balance to regional population
Financial agglomeration	*finar*	Ratio of employment population in financial sector to regional employment population
Financial efficiency	*finer*	Ratio of financial institution loan balance to financial institution deposit balance
Investment size	*invstsr*	Ratio of completed investment in total social fixed assets to regional population
Government expenditure level	*gexpr*	Ratio of government fiscal expenditure to regional GDP
Foreign investment level	*finvstr*	Ratio of foreign effective investment to regional GDP in USD
Transportation level	*tpr*	Ratio of freight volume to regional population
Education level	*edur*	Ratio of college student number to regional population
Science and technology level	*str*	Natural logarithm of the ratio of fiscal expenditure on science and technology to regional population
Population growth level	*npgr*	Natural population growth rate

Note: The contents of the table were collected by the authors.

Table 2 Statistical Description

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
aindstr	96	1.170	0.919	0.417	4.190
indps	96	10.469	1.246	8.103	12.426
indpt	96	10.322	1.237	7.756	12.230
fincr	96	1.256	0.519	0.000	2.560
finsr	96	9.649	1.686	6.174	12.589
finar	60	0.014	0.012	0.005	0.069
finer	96	0.818	0.328	0.406	1.738
invstsr	96	8.678	1.550	5.296	11.310
gexpr	96	0.120	0.030	0.067	0.201
finvstr	96	0.044	0.040	0.000	0.165
tpr	96	2.966	0.441	2.156	3.808
edur	96	0.016	0.011	0.001	0.036
str	96	3.015	2.232	-1.150	7.190
npgr	96	5.308	3.727	-0.100	16.500

Note: The results of the table were computed and arranged by the authors.

4. Empirical Test and Analysis

4.1 Tests of Model Specification

In this paper, we used the panel data of Beijing, Tianjin and Hebei from 1985 to 2016 to empirically investigate the impact of financial development on industrial structure upgrading. The data is of long panel characteristics that there is with small size of cross-section and large size of time series. Thus, it is necessary to test the stationary of panel variable series. In order to comprehensively investigate the serial stationary, we employed the methods of common unit root test, individual unit root test and Hadri test simultaneously. The results are presented in Table 3.

According to the results of panel unit root test, the original series of tertiary industry productivity (*indpt*) and foreign investment level (*finvstr*) with intercept in test equation, and investment size (*invstsr*) with intercept and trend in test equation, are stationary without being differenced. Under first order difference, most of the variable series are stationary. In detail, the results of the LLC test, the Breitung test, the IPS test with regard to common unit root test, and Fisher-ADF test and Fisher-PP test with respect to individual unit root test significantly support stationary panel data. Hence, although the results of Hadri test partly reject the null hypothesis of no unit root, it still shows strong evidence to hold that the variable series which are added into empirical model are identical with I (1) process.

Table 3 Unit root test

Variable	*(I, T)*	Common unit root process		Individual unit root process			
		LLC	Breitung	IPS	Fisher-ADF	Fisher-PP	Hadri
aindstr	(1,0)	2.158	——	2.247	3.796	2.277	6.699***
	(1,1)	0.318	-1.435	-0.068	5.496	2.829	2.735***
D*aindstr*	(1,0)	-4.987***		-4.327***	29.137***	33.325***	1.111
	(1,1)	-4.580***	-3.560***	-3.401***	21.549***	28.244***	2.819***
indps	(1,0)	-2.979***		-0.375	6.758	5.690	6.646***
	(1,1)	4.016	3.453	4.521	0.085	0.259	4.029***
D*indps*	(1,0)	-5.125***		-4.330***	28.802***	29.097***	1.766**
	(1,1)	-6.022***	-3.159***	-4.499***	28.258***	27.943***	2.218**
indpt	(1,0)	-4.505***		-2.032**	13.505**	12.300*	6.580***
	(1,1)	1.475	2.663	2.964	1.210	1.192	4.666***
D*indpt*	(1,0)	-2.893***		-3.437***	23.999***	35.841***	2.883***
	(1,1)	-6.576***	-4.962***	-6.219***	40.204***	40.160***	0.941
fincr	(1,0)	1.951		2.029	3.454	3.908	5.365***
	(1,1)	2.756	4.052	2.630	5.199	3.024	1.509*
D*fincr*	(1,0)	-4.832***		-5.174***	35.428***	35.571***	-0.273***
	(1,1)	-1.301*	-0.403	-3.382***	21.081***	36.368***	0.823
finsr	(1,0)	-3.038***		-0.194	6.907	5.082	6.676***
	(1,1)	1.696	2.081	2.514	2.276	2.332	4.313***
D*finsr*	(1,0)	-4.630***		-5.185***	35.789***	37.024***	1.379*
	(1,1)	-4.364***	-3.188***	-4.903***	31.102***	31.658***	0.976
finar	(1,0)	0.545		1.841	1.452	1.109	6.335***
	(1,1)	-1.611*	-1.677**	-0.897	7.760	7.241	3.180***
D*finar*	(1,0)	-10.728***		-9.336***	68.581***	71.629***	0.645
	(1,1)	-10.081***	-5.444***	-8.618***	57.656***	74.764***	3.248***
finer	(1,0)	-2.556***		-1.074	8.413	9.283	5.089***
	(1,1)	0.961	2.234	2.059	3.084	3.105	4.803***
D*finer*	(1,0)	-5.482***		-4.753***	38.154***	51.853***	2.365***
	(1,1)	-7.629***	-3.630***	-6.950***	45.922***	117.697***	1.300*
invstsr	(1,0)	-1.373*		0.774	3.447	2.776	6.590***
	(1,1)	-1.291*	0.990	-3.587***	28.740***	3.294	2.771***
D*invstsr*	(1,0)	-3.532***		-3.588***	23.558***	23.582***	-0.013
	(1,1)	-3.141***	-3.724***	-2.735***	17.625***	17.560***	0.141
gexpr	(1,0)	2.213		2.464	0.718	0.874	2.603***
	(1,1)	-0.496	4.208	1.754	1.537	0.706	5.156***
D*gexpr*	(1,0)	-6.831***		-8.451***	61.730***	63.050***	3.077***
	(1,1)	-4.670***	0.000	-9.905***	69.553***	555.372***	3.505***
finvstr	(1,0)	-1.791**		-1.572*	11.219*	8.356	0.551
	(1,1)	-1.132	-1.748**	-0.215	5.945	2.923	3.318***
D*finvstr*	(1,0)	-5.641***		-5.662***	40.410***	50.946***	0.315
	(1,1)	-4.923***	-5.236***	-4.723***	31.547***	86.289***	1.518*
tpr	(1,0)	1.124		1.113	2.576	4.149	4.559***
	(1,1)	-2.731***	0.119	-2.635***	26.157***	29.683***	4.136***
D	(1,0)	-9.619***		-11.542***	82.175***	82.536***	1.642**
	(1,1)	-8.670***	-1.710**	-11.473***	86.499***	88.027***	1.963**
edur	(1,0)	-0.262		0.839	3.649	1.227	4.531***
	(1,1)	-2.311**	-0.825	-1.833**	13.506**	1.878	1.791**
D*edur*	(1,0)	-0.854		-1.108	8.544	5.438	-0.173
	(1,1)	0.208	-1.545*	0.375	4.174	1.898	2.512***

str	(1,0)	0.680		2.757	0.394	0.388	6.462***
	(1,1)	0.525	-1.110	0.218	3.761	4.039	2.608***
D*str*	(1,0)	-8.508***		-7.398***	53.374***	53.375***	-0.740
	(1,1)	-7.648***	-5.784***	-6.366***	41.119***	41.152***	0.509
npgr	(1,0)	-1.021		-0.081	4.644	4.234	3.560***
	(1,1)	1.156	-0.275	1.961	0.746	1.108	4.579***
D*npgr*	(1,0)	-4.019***		-6.452***	45.962***	60.528***	0.599
	(1,1)	-6.794***	-2.189**	-8.315***	55.629***	56.228***	0.308

Note: *I* stands for individual intercept included in test equation, and *T* stands for individual intercept and trend included in test equation. In parenthesis, 0 indicates that there is specific item, vice versa. D before related variables means the treatment of first order difference. According to LLC, Breitung, IPS, Fisher-ADF and Fisher-PP test, H0: there is unit root and H1: there is no unit root. For Hadri test, H0: there is no unit root. ***, ** and * represent 1%, 5% and 10% significance level, respectively. The lag order is chosen based on Schwarz information criterion, and the bandwidth is determined based on Newly-West method to determine the bandwidth, all of estimation is run under Bartlett kernel method. In addition, since the panel unit root Breitung test needs to include trend item in test equation, it does not report any results when test equation only including intercept item.

Due to the limitation of sample size and variable quantity, Kao residual test and Fisher panel test are used to test variables cointegration. According to the results of Kao test, *t* statistic is -2.334, and the probability to accept null hypothesis without cointegration is 0.013. Moreover, in order to determine exactly whether there are cointegration relationships among variables in the model, both no trend in data and linear trend in data are taken into consideration. Under the specification of no trend in data, there are two situations as follows: first, there is no intercept or trend in cointegration and vector auto-regression equation, and the second is that there is only intercept in cointegration and vector auto-regression equation. Under the specification of linear trend in data, there also are two situations give by: firstly, there is intercept (no trend) in cointegration and auto-regression equation, and secondly, there is intercept and trend in cointegration equation and there is only intercept in vector auto-regression equation. The results are presented in Table 4. Based on the results of cointegration test, there are at least six cointegration variables in empirical analysis model constructed in this paper. Combined with the results of Kao residual cointegration test, it strongly suggests that there are significant cointegration relationships among the related variables in the empirical specification model.

Table 4 Cointegration Test

Numbers of cointegration variables	There is no trend in data				There is a linear trend in data			
	I		II		III		IV	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
None	242.80***	84.24***	249.10***	80.12***	233.50***	75.98***	258.70***	91.84***
At most 1	137.20***	63.81***	156.60***	63.03***	132.90***	65.43***	180.60***	71.84***
At most 2	90.08***	22.60***	118.80***	32.53***	86.83***	30.96***	135.40***	52.76***
At most 3	72.42***	25.63***	84.84***	25.65***	60.21***	21.51***	78.86***	22.49***
At most 4	52.57***	22.78***	67.46***	24.21***	43.44***	16.48**	59.54***	19.35***
At most 5	37.40***	20.26***	48.87***	19.66***	31.05***	18.10***	44.19***	18.10***
At most 6	25.36***	20.46***	37.39***	23.99***	19.34***	19.74***	31.38***	18.21***
At most 7	13.17**	13.17**	22.76***	22.76***	5.29	5.29	20.53***	20.53***

Note: (1) and (2) represents the Fisher statistic of Trace test and Max-Eigen test. I, II, III and IV respectively represent following four situations. Under the specification of linear trend in data, there also are two situations give by: firstly, there is intercept (no trend) in cointegration and auto-regression equation; secondly, there is intercept and trend in cointegration equation and there is only intercept in vector auto-regression equation.

In order to obtain more accurate estimation results, the random effects, fixed effects and pooled panel effects are tested, respectively. Firstly, whether there is significant difference between cross-sectional individuals was tested, and the result shows that $F(2, 86) = 15.140$ with the probability to accept null hypothesis at the significance of 0.000. Secondly, the result of Hausman test is that $Chi^2 = 47.86$, and the probability to accept null hypothesis at the significance of 0.000. Therefore, it is suggested controlling cross-sectional fixed effect when constructing the empirical analysis model with panel data in this paper.

4.2 Correlation

Table 5 presents the results of correlation between financial development and industrial structure upgrading. According to the results, industrial structure upgrading is positively associated with the secondary and tertiary industry productivity, and the correlation coefficients are 0.557 and 0.610, respectively. Thus, the increase of the secondary and tertiary industry productivity can promote the upgrading of industrial structure, and the coefficient regarding to tertiary industry productivity is larger than that of secondary industry. Liu (2015) suggested that one of the main reasons resulting in Chinese current low economic growth rate was the decrease of productivity. Hence, it is necessary to accelerate productivity to promote Chinese economic restructuring and industrial structure upgrading.

The correlation between the advance of industrial structure and financial development related variables are positively correlated except for financial efficiency that the correlation coefficient is significantly negative. In detail, the coefficients that industrial structure upgrading correlating to financial correlation ratio, financial financing size, financial agglomeration, and financial efficiency, are 0.704, 0.663, 0.715 and -0.550, respectively. The results are consistent with Zhu and Ni (2014), and they found that

financial correlation ratio was significantly and positively associated with industrial structure upgrading. Therefore, Zhu and Ni (2014) concluded that from the quantity perspective, financial development was strongly correlated to industrial structure upgrading. Accordingly, financial agglomeration is also positively correlated to industrial structure upgrading from the quality perspective. Actually, Yu et al. (2013) provided evidence to hold that financial agglomeration would increase industrial productivity and then to promote industrial structure upgrading. However, financial efficiency is negative to industrial structure upgrading.

Meanwhile, the correlation results show that financial efficiency is also negatively associated with secondary and tertiary industry productivity. Therefore, it implies that there may be nonlinear effects of financial development on industrial structure upgrading, and thus, financial repression effect has begun to appear. This is basically consistent with the prior studies. Zhu and Ni (2014) suggested that financial efficiency would promote industrial structure upgrading in the eastern region, in which the level of economy development and openness was relative higher than that of the mid and west of China. However, this study is to address the impact of financial development on industrial structure upgrading in Beijing, Tianjin and Hebei region, and there is a negative correlation that indicates repression effect of financial development on economic and industrial development has begun to appear. It is consistent with the conclusions in prior studies. For instance, Wang and Johansson (2013) found that excessive government intervention would hinder economic restructuring and industrial structure upgrading. In addition, Yang and Zhou (2013) also argued that financial repression would promote economic growth in

Table 5 Correlation between Financial Development and Industrial Structure Upgrading

	Advance of industrial structure	Secondary industry productivity	Tertiary industry productivity	Financial correlation ratio	Financial financing size	Financial agglomeration
Secondary industry productivity	0.557***					
Tertiary industry productivity	0.610***	0.989***				
Financial correlation ratio	0.704***	0.410***	0.463***			
Financial financing size	0.663***	0.945***	0.959***	0.634***		
Financial agglomeration	0.715***	0.487***	0.576***	0.570***	0.581***	
Financial efficiency	-0.550***	-0.618***	-0.644***	-0.201***	-0.626***	-0.501***

Note: The results are arranged based on the correlation by the authors. ***, ** and * represent 1%, 5% and 10% significance level, respectively.

short term, but it could slow down industrial structure upgrading. The results are identical with proposition II. In order to determine the detailed impact of financial efficiency on industrial structure upgrading, this paper will empirically discussed.

4.3 Empirical Results Analysis

In this paper, the panel data of Beijing, Tianjin and Hebei region of China from 1985 to 2016 are used to explore the impact of financial development on industrial structure upgrading. The results are presented in Table 6. Based on the financial quantity perspective, financial correlation ratio (*fincr*) and financial financing size (*finsr*) are positive to industrial structure upgrading, and the coefficients are 0.687 and 1.162, respectively. Meanwhile, financial agglomeration (*finar*) and financial efficiency (*finer*) contribute positively to industrial structure from financial quality perspective, and the coefficients are 10.118 and 1.029, respectively. Therefore, the overall impact of the financial development on industrial structure upgrading is positive. This is not completely

Table 6 Estimation about the Impact of Financial Development on Industrial Structure Upgrading

Variable	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
fincr		0.687***			
		(0.093)			
finsr			1.162***		
			(0.112)		
finar				10.118***	
				(1.734)	
finer					1.029***
					(0.279)
invstsr	-0.233*	-0.266***	-0.751***	-0.526***	-0.093
	(0.126)	(0.099)	(0.098)	(0.111)	(0.124)
gexpr	6.917***	4.989***	3.812**	16.318***	5.214**
	(2.108)	(1.677)	(1.441)	(1.388)	(2.022)
finvstr	2.092	2.904**	-2.019*	-0.797	4.569***
	(1.549)	(1.222)	(1.109)	(1.165)	(1.595)
tpr	-1.111***	-0.860***	-0.714***	-0.571***	-1.073***
	(0.127)	(0.105)	(0.093)	(0.088)	(0.119)
edur	6.747	4.101	-23.633***	23.501***	11.027
	(8.393)	(6.605)	(6.330)	(5.317)	(7.923)
str	0.266***	0.272***	0.019	0.044	0.248***
	(0.081)	(0.064)	(0.059)	(0.049)	(0.076)
npgr	-0.079***	-0.064***	0.00003	0.108***	-0.075***
	(0.024)	(0.019)	(0.018)	(0.021)	(0.023)
Constant	5.077***	3.888***	-1.449*	5.038***	2.965***
	(0.773)	(0.629)	(0.815)	(0.578)	(0.921)
Fixed effect	Yes	Yes	Yes	Yes	Yes
Observation	96	96	96	60	96
Within R^2	0.801	0.878	0.912	0.951	0.828

Note: The results are arranged based on the regression by the authors. ***, ** and * represent 1%, 5% and 10% significance level, respectively, and the data in parentheses is standard error.

consistent with the previous analysis. Due to the correlation test, financial efficiency is negatively associated with the upgrading of industrial structure (see Table 6). The reason may be that the effects of financial efficiency on the output of both secondary industry and tertiary industry are negative, but the negative effect on the secondary industry may be stronger than that of tertiary industry. To explore the nonlinear effects, the potential impact mechanism of financial development on industrial productivity is to be presented empirically in the part of further discussion.

In addition, the coefficient of investment size (*invstsr*) is negative, indicating that if investment size is larger, industrial structure upgrading will be slower. In fact, the development of secondary industry depends more on the increase of investment in fixed assets, while the tertiary industry mainly depends on the promotion of the soft power of human capital. The regression coefficients of both government expenditure (*gexpr*) and foreign investment level (*finvstr*) are positive, indicating that sufficient capital supply positively contributes to upgrade the industry structure. Since the reform and openness at the end of 1970s, China's economy has been greatly developed, and industrial structure has been continuously upgraded. The proportion of tertiary industry has increased from 24 percent in 1978 to 51.6 percent in 2016. This is in line with Chinese government by using fiscal policy to optimally adjust industrial structure. In addition, foreign capital inflows have brought about spillover effects of technology and capital positively contributing to continuous upgrading of the industrial structure. Most of the coefficients with regard to educational level (*edur*) and science and technology level (*str*) are positive, which illustrates the importance of education and science and technology to industrial structure upgrading. The level of social transportation level (*tpr*) is negative for industrial structure upgrading. The transportation sector itself belongs to the tertiary industry, and its main task is to provide service to transport the products, raw materials and intermediate products produced by industrial sectors in secondary industry. The coefficient of natural growth rate (*npgr*) is negative. China's economy in the past long-term development process, has mainly depended on the demographic dividend with lower labor cost. The fast growth of economic output needs to input more production factors. Hence, the production efficiency is hard to be confirmed. With the continuous development of the tertiary industry, a large number of jobs can be provided, and the transition of the economic growth mode will inevitably change the impact mechanism of labor factors on industrial structure upgrading.

4.4 Robustness Check

In order to make sure the robustness, we checked by two ways as follows. First, we completed in the test of model specification. The stationary of variable series we adding into the model were tested in detail. According to the results of unit root test, all of the variables are basically identical with I (1) process. We also tested variable cointegration under panel data context

by Kao residual test and Fisher panel test, and the results strongly suggest that there are significant cointegration relationships. Moreover, we tested the random effects, fixed effects and pooled panel effects, respectively and the results show that fixed effects are accepted. The second way to confirm robustness we used is to replace the variable of industrial structure upgrading by the ratio of tertiary to secondary productivity, and estimated the equations again. The results are presented in Table 7. The coefficients of financial correlation ratio, financial financing size and financial efficiency are positive and significant. Although the coefficient of financial agglomeration is insignificant, its sign is positive as well. The results are nearly unchanged comparing to the previous empirical results. It is indicated that financial development still has significant and positive impact on tertiary industry productivity relative to that of secondary industry. For the control variables, most of their signs and significance are also identical with the prior

Table 7 Estimation about Ratio of Tertiary to Secondary Industry Productivity of Financial Development on the Tertiary Industry Productivity

Variable	Model (6)	Model (7)	Model (8)	Model (9)	Model (10)
fincr		0.023***			
		(0.005)			
finsr			0.030***		
			(0.007)		
finar				0.120	
				(0.133)	
finer					0.040**
					(0.013)
invstsr	-0.015*	-0.016**	-0.029***	0.011	-0.010
	(0.006)	(0.005)	(0.006)	(0.009)	(0.006)
gexpr	-0.021	-0.086	-0.103	-0.007	-0.087
	(0.097)	(0.088)	(0.091)	(0.106)	(0.096)
finvstr	0.094	0.121	-0.014	0.025	0.189*
	(0.071)	(0.064)	(0.070)	(0.089)	(0.075)
tpr	0.004	0.013*	0.015*	0.010	0.006
	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)
edur	-0.809*	-0.897*	-1.605***	-1.574***	-0.644
	(0.387)	(0.347)	(0.398)	(0.407)	(0.374)
str	0.009*	0.010**	0.003	-0.005	0.009*
	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)
npgr	-0.004***	-0.004***	-0.002	-0.003	-0.004***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Constant	1.109***	1.069***	0.938***	0.909***	1.028***
	(0.036)	(0.033)	(0.051)	(0.044)	(0.044)
Fixed effect	Yes	Yes	Yes	Yes	Yes
Observation	96	96	96	60	96
Overall R^2	0.346	0.481	0.463	0.705	0.408

Note: The results are arranged based on the regression by the authors. ***, ** and * represent 1%, 5% and 10% significance level, respectively, and the data in parentheses is standard error.

estimation results in Table 6. Thus, our conclusion is not changed and robust.

4.5 Further Discussion: The Improvement of Financial Development in Industry Productivity

In order to explore the nonlinear effect of financial development on industrial structure upgrading, this paper examines the potential impact of financial development on secondary and tertiary industry productivity. Table 8 presents the results, and the dependent variable is secondary industry productivity. For the secondary industry, the coefficient of financial financing size in quantity perspective is positive and significant, which indicates that it contributes to accelerate industrial productivity (see Model 13). Meanwhile, the coefficients of financial correlation ratio in quantity perspective and financial agglomeration in quality perspective are positive but not significant (see Model 12 and 14). In particular, the coefficient of financial efficiency in quality perspective is negative and significant (see model 15). The results show that financial repression begins to appear in terms of

Table 8 Estimation about the Impact of Financial Development on the Secondary Industry Productivity

Variable	Model (11)	Model (12)	Model (13)	Model (14)	Model (15)
fincr		0.031			
		(0.056)			
finsr			0.407***		
			(0.066)		
finar				0.564	
				(1.735)	
finer					-0.412***
					(0.135)
invstsr	0.470***	0.469***	0.289***	0.252**	0.414***
	(0.060)	(0.060)	(0.058)	(0.111)	(0.060)
gexpr	-0.206	-0.292	-1.293	5.030***	0.476
	(0.995)	(1.011)	(0.851)	(1.389)	(0.975)
finvstr	0.791	0.827	-0.648	-3.457***	-0.200
	(0.731)	(0.737)	(0.655)	(1.166)	(0.769)
tpr	-0.405***	-0.394***	-0.266***	-0.302***	-0.420***
	(0.060)	(0.063)	(0.055)	(0.088)	(0.057)
edur	20.915***	20.796***	10.278***	21.382***	19.202***
	(3.961)	(3.983)	(3.741)	(5.322)	(3.822)
str	0.149***	0.149***	0.062*	0.093*	0.156***
	(0.038)	(0.038)	(0.035)	(0.049)	(0.037)
npgr	-0.041***	-0.040***	-0.013	0.035	-0.042***
	(0.011)	(0.012)	(0.011)	(0.021)	(0.011)
Constant	7.008	6.955***	4.723***	8.339***	7.853***
	(0.365)	(0.379)	(0.481)	(0.579)	(0.445)
Fixed effect	Yes	Yes	Yes	Yes	Yes
Observation	96	96	96	60	96
Within R^2	0.987	0.987	0.991	0.978	0.988

Note: The results are arranged based on the regression by the authors. ***, ** and * represent 1%, 5% and 10% significance level, respectively, and the data in parentheses is standard error.

secondary industry productivity improvement.

Table 9 presents the results of financial development impacting on tertiary industry productivity. According to the results, from the financial quantity perspective, the coefficients of financial correlation ratio and financial financing size are significantly positive. Nevertheless, the coefficients of financial agglomeration and financial efficiency, both of which are in financial quality perspective, are positive but not significant. According to the definition of financial correlation ratio and financial financing size, financial institutions have played an important role in accelerating the productivity of tertiary industry, and the financial promotion effect of financial development is obvious. However, for the perspective of financial quality, financial agglomeration and financial efficiency are not significant although the signs are positive. Therefore, financial repression effect of the financial development does not have obvious effect on tertiary industry productivity.

In addition, we compared the effects of financial development on secondary and tertiary

Table 9 Estimation about the Impact of Financial Development on the Tertiary Industry Productivity

Variable	Model (16)	Model (17)	Model (18)	Model (19)	Model (20)
fincr		0.275***			
		(0.064)			
finsr			0.714***		
			(0.062)		
finar				2.108	
				(1.361)	
finer					0.045
					(0.177)
invstsr	0.074***	0.311***	0.006	0.364***	0.330***
	(4.350)	(0.068)	(0.055)	(0.087)	(0.079)
gexpr	-0.051	-0.822	-1.959**	5.043***	-0.125
	(1.243)	(1.147)	(0.802)	(1.090)	(1.284)
finvstr	1.857**	2.182**	-0.669	-3.125***	1.965*
	(0.914)	(0.836)	(0.617)	(0.915)	(1.013)
tpr	-0.378***	-0.278***	-0.134**	-0.192***	-0.376***
	(0.075)	(0.072)	(0.052)	(0.069)	(0.075)
edur	13.195***	12.138***	-5.475	4.765	13.381***
	(4.949)	(4.518)	(3.524)	(4.176)	(5.031)
str	0.223***	0.226***	0.072**	0.032	0.223***
	(0.048)	(0.044)	(0.033)	(0.039)	(0.048)
npgr	-0.082***	-0.075***	-0.033***	0.005	-0.082***
	(0.014)	(0.013)	(0.010)	(0.016)	(0.014)
Constant	8.102***	7.627***	4.092***	7.451***	8.010***
	(0.456)	(0.430)	(0.454)	(0.454)	(0.585)
Fixed effect	Yes	Yes	Yes	Yes	Yes
Observation	96	96	96	60	96
Within R^2	0.979	0.983	0.992	0.981	0.979

Note: The results are arranged based on the regression by the authors. ***, ** and * represent 1%, 5% and 10% significance level, respectively, and the data in parentheses is standard error.

industry productivity as well. The results show that financial correlation ratio and financial financing size are more influential in enhancing tertiary industry productivity rather than that of secondary industry. In detail, the coefficient of financial correlation ratio is not significant for the productivity of the secondary industry, while the regression coefficient in the model (17) is positive. The coefficients of the financial financing size to secondary and tertiary industry productivity are significantly positive, but the former one is obviously smaller than that of the latter, which are 0.407 and 0.714 respectively. Financial agglomeration and financial efficiency show significant different effects on secondary and tertiary industry productivity. In Table 8, the coefficients of financial agglomeration and financial efficiency are positively insignificant and negatively significant, respectively. In Table 9, both of them are positively insignificant. Hence, in Beijing, Tianjin and Hebei region of China, financial promotion effect on secondary and tertiary industry productivity is significant and financial repression effect on secondary and tertiary industry productivity are positively significant and insignificant, respectively. The results imply that the impact of financial development on industrial structure upgrading is nonlinear, since there is financial promotion and repression effect simultaneously. The impact mechanism is identical with proposition I and II.

5. Conclusions and Implications

Since 1980s, the coordinative development in Beijing, Tianjin and Hebei region of China has been put on the agenda. The Fifth Plenary Session of the 18th National Congress of Communist Party of China put forward new development philosophy, and the importance of coordinative development is increasingly highlighted. The integration process of Beijing, Tianjin and Hebei region needs to be constantly optimized, upgraded and adjusted by regional industries, while financial capital can lay a solid foundation for industrial structure upgrading. Therefore, it is particularly important to explore the impact of the financial development on industrial structure upgrading in Beijing, Tianjin and Hebei region of China.

In this paper, we constructed theoretical model of financial development on industrial structure upgrading, which included financial promotion and repression effect as well. By using panel data of Beijing, Tianjin and Hebei region in China from 1985 to 2016, the impact of financial development on industrial structure upgrading was empirically explored from the perspective of financial quantity and financial quality. The results show that the overall effect of financial development on industrial structure upgrading in Beijing, Tianjin and Hebei region of China is positive. However, financial development also shows promotion and repression effect on industrial structure upgrading, which is identical with the developed theoretical model and proposition I and II. Compared with secondary industry, financial correlation ratio and financial financing size significantly improve the productivity of tertiary industry in Beijing, Tianjin and Hebei region of China. Financial efficiency is

negative to secondary industry productivity in Beijing, Tianjin and Hebei region, and its impact on tertiary industry productivity is insignificant. Nevertheless, the overall effect of financial development on industrial productivity is nonlinear, since financial promotion and financial repression begin to take effect on industrial structure upgrading.

Combined with the conclusions of this study, with respect to speeding up the pace of industrial upgrading and accelerating the integration process of Beijing, Tianjin and Hebei region, strategic considerations for policy makers can be given as following aspects. Firstly, more attention should be paid to the usage of repression and promoting effect from financial development. This paper indicates that the overall impact of financial development on industrial structure upgrading in Beijing, Tianjin and Hebei region is positive. However, the effects of financial development from the perspective of financial quantity and financial quality are differential. Therefore, measures should be implemented to strengthen prudent management of financial policies, and to relieve the negative effects of the financial repression on the industrial structure upgrading in Beijing, Tianjin and Hebei region of China. Secondly, the externality of regional financial policies also should be taken into consideration when planning and implementing specific policy measures. In particular, the level and task for Beijing, Tianjin and Hebei to develop economy are different. Therefore, during the arrangement of financial policy portfolio, local government should take into account negative externality of financial policy. Thirdly, urge the reform of market economic system and improve the interregional mobility of key production factors, and then to optimize resource allocation. When constructing theoretical model in this paper, the hypothesis of free flowing of production factors is added. To fulfill this assumption, the price guiding mechanism of market economy has to be improved, which is positive to provide strong vitality and impetus for industrial structure upgrading and economic coordinative development in Beijing, Tianjin and Hebei region of China.

Acknowledgements

The authors acknowledge funding support from the Nation Natural Science Foundation of China (71603049), Social Science Foundation of Ministry of Education of China (16YJC790006) and General Research Project Foundation of Beijing Finance Society.

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