

Financial Agglomeration and Transformation of Industrial Innovation Achievements

Yang Guo

School of Economics and Management, Harbin Engineering University, Harbin, China

2849656675@qq.com

Abstract. Finance stands as the lifeblood of the real economy, intricately interwoven with governmental factors (e.g., governance efficacy), levels of urbanization, and the reservoir of human capital. This study leverages panel data encompassing 30 provinces across China spanning from 2005 to 2020, with financial agglomeration (fin) as the focal variable. Employing the measurement framework, financial agglomeration is assessed via the location entropy of the financial sector derived from employee metrics. Subsequently, industrial structural evolution (str) is posited as the dependent variable, while governmental influences (zc), urbanization dynamics (cit1), and educational attainment (ledu) are incorporated as control variables to construct an empirical analysis model. The empirical findings, evaluated through Pool OLS, random effects, and fixed effects methodologies, corroborate a substantively positive correlation between financial agglomeration and industrial structural refinement.

Keywords: Financial Agglomeration; Industrial Structure Upgrading; Location Entropy; Government Policies.

1. Introduction

1.1. Background of Innovation Achievement Transformation and Innovation Background

Innovation has become a pivotal driver of development in the 21st century. Historically, China's economic growth rates achieved double-digit figures, albeit at considerable environmental and social costs, manifesting in pronounced issues such as environmental degradation, social imbalances, and regional disparities. These challenges have become increasingly conspicuous, propelling a deceleration to the current annual growth rate of 6% to 7%. This "structural slowdown" signals a pivotal transition in China's economic development trajectory, as articulated in the 19th National Congress report, which mandates an acceleration in the development of the real economy and a bolstered focus on innovation and technological enhancement.

1.2. Background of Financial Agglomeration

Since the initiation of the reform and opening up policies, China's financial sector has experienced significant growth. However, this rapid development has also highlighted numerous deficiencies, notably the unequal distribution of financial resources across various regions. This disparity has not only widened the economic divide between coastal and inland areas but has also impeded the allocation of innovation capital. As a result, there is diminished motivation for regional technological innovation and a reduction in the efficiency of transforming scientific and technological achievements, ultimately affecting the overall enhancement of China's innovation capabilities. In response, to foster equitable regional development and augment the innovation levels across different areas, China has started to reorganize the spatial distribution of its dispersed financial resources.

1.3. Literature Review

This article aims to explore the impact of financial agglomeration on industrial upgrading, employing financial agglomeration as a focal point. Despite extensive research on the relationship between financial development and industrial upgrading, there is a comparative scarcity of studies analyzing



this from the perspective of financial agglomeration. Thus, this article will examine how financial agglomeration influences industrial upgrading.

1.3.1. Review of International Literature:

The concept of industrial agglomeration, pivotal to this discussion, originates from the economic theories propounded by economist Alfred Marshall in the 19th century. He detailed this theory through numerous case studies, illustrating the link between economic development and regional distribution. When multiple enterprises cluster within a specific area, the concentration of labor and technology not only reduces costs but also enhances the efficiency of production processes, thereby improving the economic benefits for the region and attracting further enterprises. The concept of "agglomeration economies" was formally introduced by Alfred in 1909, describing it as a spontaneous economic phenomenon driven by vested interests and shaped by both intrinsic and extrinsic factors. With the advent of the industrial technology revolution and the burgeoning financial services sector, numerous scholars have begun to assess the economic effects of such agglomeration economies. Pioneering studies by Shaw and Gurley (1955), Patrick (1966), and Goldsmith (1969) revealed that the scale of social finance and the degree of its agglomeration bolster local economic growth. Kindleberger (1974) argued that financial agglomeration not only curtails transaction costs and enhances the efficiency of capital circulation and allocation but also substantially mitigates the financial constraints on upgrading industrial structures. Moreover, Park and Essayyad (1989) noted that financial agglomeration allows financial institutions to achieve economies of scale through cooperative ventures, information dissemination, labor specialization, and shared facilities.

1.3.2. Review of Domestic Literature:

Domestic scholars, drawing upon the insights of international experts and contextualizing them within the domestic economic milieu, have consistently affirmed the significant role of financial agglomeration in propelling economic growth (Li et al., 2011; Zhao, 2014; Zhang and Sun, 2018). Importantly, industrial structure upgrading is recognized as a crucial mechanism through which this role is manifested (Yang and Fang, 2013). Empirical analyses indicate that financial agglomeration fosters regional economic development and enhances the optimization of local industrial structures through knowledge and spatial spillover effects (Wang and Ye, 2015; Yu, 2017; Liu and Li, 2014). Specific studies, such as those by Li and Wang (2009), have demonstrated how financial agglomeration facilitates the upgrading of industrial structures in Guangdong Province by expanding financing channels and optimizing the efficiency of fund allocation. However, the promotion effect varies across different sectors and regions, with notable discrepancies in the effectiveness across the eastern, central, and western regions of China (Sun and Li, 2012; Yu, 2017).

1.3.3. Synthesis of Literature Review:

The scholarly consensus, drawn from both theoretical analysis and empirical evidence, posits that financial agglomeration indeed plays a catalytic role in upgrading industrial structures. Nevertheless, this effect is influenced by temporal and geographical factors. The literature reviewed provides a robust theoretical foundation for this study. Given the accelerated pace of economic development and the evolving demands for financial agglomeration and industrial upgrading, this article utilizes the latest data to delve into the contemporary impact of financial agglomeration on industrial upgrading under new economic conditions.

1.4. Contribution

1.4.1. Optimizing Resource Utilization within Economic Frameworks through Financial Agglomeration

Within the framework of financial agglomeration, the presence of a multitude of financial institutions diversifies financing methodologies, thereby addressing the varied capital requirements of different scenarios more adeptly. This dynamic ensures that financial resources are continually reallocated towards sectors exhibiting higher efficiency and potential, while less productive industries are phased

out. Consequently, enterprises leverage optimized resource allocation models to maximize the utilization of economic resources, enhance market competitiveness, and progressively achieve industrial modernization.

1.4.2. Facilitating Industrial Integration via Financial Agglomeration

As financial clustering evolves, capital allocation becomes increasingly efficient and varied, satisfying the extensive capital demands of various industries. This abundance of financial capital allows sectors demonstrating efficiency and competitive edge to rapidly consolidate their market positions. Concurrently, the accumulation of financial capital fosters industrial integration, enabling a symbiotic enhancement of sectoral interdependencies and innovation. This integration not only bolsters individual industries but also fortifies the economic structure as a whole, paving the way for sustained growth and development.

This refined text aims to meet the standards required for publication in an academic journal, presenting a coherent and sophisticated exploration of the impacts of financial agglomeration.

2. Overview of Financial Agglomeration and Industrial Upgrading Theory

2.1. The Connotation of Financial Agglomeration and Industrial Upgrading

In academic discourse, the phenomenon of financial agglomeration is primarily explored through the lens of financial centers, with extensive theoretical contributions from international scholars. Compared to the global academic community, China's engagement with this field is relatively recent. Building upon the extensive analytical frameworks established by prior researchers, several definitions of financial agglomeration have been proposed. Despite variations in terminology, these definitions converge on a core concept: financial agglomeration represents a dynamic clustering of diverse elements including firms, financial instruments, markets, personnel, and regulatory bodies. This convergence facilitates the concentration of industry by leveraging financial and economic synergies.

2.1.1. The connotation of financial agglomeration

Financial agglomeration is characterized by the strategic concentration of various financial entities, markets, expertise, tools, institutions, legal frameworks, and systems within a specified locality, thereby achieving a significant level of scale and density. This aggregation not only facilitates interactions and collaborations among financial actors but also integrates the regional resources effectively. Consequently, this spatial and organizational configuration engenders a dynamic process that fosters a comparative competitive advantage.

2.1.2. The connotation of industrial upgrading

Industrial upgrading can be comprehensively analyzed from micro, meso, and macro perspectives. At the micro level, firms serve as the fundamental units, with their product outputs acting as primary economic benefit generators and focal points for corporate evolution. Small and medium-sized enterprises are advised to enhance their management strategies and elevate operational standards, thereby increasing the production efficiency of their products. Innovating and developing new products and technologies, augmenting the market value of products, and strengthening brand influence are also critical. Underpinning this, the economic growth theory posits that robust production capabilities are essential for economic expansion. Consequently, enterprises should intensify research and development efforts in new technologies, optimize product impacts, reform inefficient production methodologies, and concentrate on securing long-term gains.

From a macroeconomic standpoint, the core of industrial chain transformation lies in transitioning from a labor-centric development model to one predicated on technology and innovation, particularly during the overhaul of economic and industrial frameworks. Achieving industrial upgrading, whether viewed through the lens of macroeconomic progression or micro market dynamics, necessitates an

emphasis on enhancing the added value of products to foster corporate transformation and bolster the economic prowess of enterprises.

2.2. The Impact Mechanism of Financial Agglomeration on Industrial Upgrading

2.2.1. Financial Agglomeration Helps Enterprises Quickly Financing

Financial hubs, central to the phenomenon of financial agglomeration, play a pivotal role in the allocation of capital and resource flows, significantly enhancing financing efficiency and boosting economic returns. The convergence of diverse resources—human capital, information, and physical assets—within these centers substantially diminishes the costs associated with capital financing. Consequently, financial agglomerations are instrumental in enabling rapid capital acquisition for corporations, thereby supporting their multifaceted developmental aspirations. Ample financial backing afforded by these centers provides vital opportunities for industrial realignment and enhancement. Moreover, the conducive environment fostered by financial agglomerations facilitates more effective industrial upgrading.

2.2.2. Financial Agglomeration Improves the Efficiency of Economic Resource Utilization

In the context of financial agglomeration, a diverse array of financial institutions enhances the variety of funding mechanisms available, thereby catering more adeptly to the multifarious financing requirements across various scenarios. Concurrently, financial capital tends to gravitate towards sectors that demonstrate higher efficiency and promise, while continuously phasing out industries marked by lower productivity. Ultimately, this dynamic facilitates the optimization of economic resource utilization through efficient allocation models. Such strategic resource deployment augments market competitiveness and propels the gradual advancement of industrial upgrading, thereby refining the overall economic landscape.

2.2.3. Financial Agglomeration can Promote Industrial Integration

As the level of financial agglomeration intensifies, capital allocation becomes increasingly efficient and diversified, effectively accommodating the extensive capital financing demands of various industries. With ample funding, efficient sectors rapidly accentuate their competitive edges under these conditions, leading to an accumulation of financial capital. This, in turn, facilitates and accelerates the process of industrial integration.

3. Analysis of the Current Situation of Financial Agglomeration and Industrial Upgrading in China

3.1. Analysis of the Current Situation of Financial Agglomeration in China

As time progresses, all elements related to finance become increasingly interconnected and mutually influential, ultimately coalescing within specific geographical locales, thereby creating a significant concentration of financial activities. This phenomenon, termed financial agglomeration, naturally emerges as the economic scale reaches a certain level of maturity. Financial agglomeration is influenced not only by an array of financial factors but also by geographical, cultural, and local industrial characteristics. Consequently, the regional evolution of financial centers represents a novel manifestation of the gradual formation and development of financial agglomeration. This emergence undoubtedly enhances market liquidity and trading activities, while providing a robust framework for the integration and investment of funds. This paper presents a detailed analysis of the current state of financial agglomeration in China, supported by relevant indicators and empirical data.

3.1.1. Measurement of Financial Agglomeration

By referring to similar literature, scholars generally use indices such as spatial Nikki coefficient and location entropy to measure financial agglomeration. Given the availability and convenience of the data in this article, location entropy is used to measure the degree of financial agglomeration. Location

entropy refers to indicators that reflect the degree of specialization of the corresponding industrial sector and the role of a region in higher-level areas by measuring the distribution of factors in a certain region. Among them, if the location entropy of a certain industry in the region is less than 1, it indicates that the agglomeration degree of that industry in the region is poor, while if it is greater than 1, it indicates that the agglomeration degree is good.

Core variable: Financial agglomeration (fin). This article adopts the measurement method of Yu et al. (2013), Xiao and Hong (2017), and measures financial agglomeration based on the location entropy of the financial industry obtained from the number of employees. The calculation formula is:

$$fin_{it} = (emp_fin_{it} / emp_{it}) / (emp_fin_t / emp_t) \quad (1)$$

Among them, *i* represents each region, *t* represents time, *emp_fin* represents the number of employed individuals in the financial industry, *emp* represents the number of employed individuals nationwide, and *fin* represents the level of financial agglomeration measured by financial location entropy. The larger the value, the higher the level of financial agglomeration.

3.1.2. Current Situation of Financial Agglomeration in China

With the development of the economy, China is paying more and more attention to the positive effects caused by financial agglomeration. Therefore, provinces and cities in various regions are gradually establishing local unique financial centers, and the degree of financial agglomeration is increasing year by year. This article briefly explores the development trend of agglomeration in China, using Shanghai (representative cities in the eastern region), Jilin (representative cities in the central region), and Inner Mongolia (representative cities in the western region). From Figure 1, it can be seen that the location entropy of financial agglomeration in cities in China, regardless of their eastern, central, and western regions, is generally above one, especially in Inner Mongolia, which is relatively backward as a western region. However, the location entropy still remains around one, indicating that the overall level of financial agglomeration in China is good. From the trend, although these three cities cannot represent the eastern, central, and western regions separately, it can be briefly seen that the level of financial agglomeration in the western and central regions is constantly increasing.

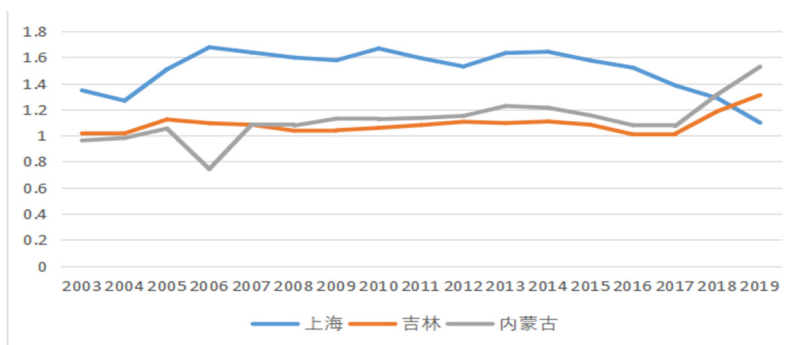


Figure 1. Trends of Financial Agglomeration in Representative Regions of China from 2003 to 2019

3.2. Analysis of the Current Situation of Industrial Upgrading in China

3.2.1. Measurement of Industrial Upgrading in China

Industrial structure upgrading (str). Industrial structure refers to the proportion of a single industry in the economy to GDP. The upgrading of industrial structure refers to the dynamic transformation of the current economic structure from an old (underdeveloped) industrial structure to a higher level industrial structure (Yang and Liu ,2016). To effectively depict the dynamic process of economic adjustment between different industrial structures. This article refers to the methods of Gan et al. (2011) and Fang (2020) to represent the upgrading process of industrial structure from traditional to new industries by the proportion of the output value of the tertiary industry to the secondary industry.

3.2.2. Current Situation of Industrial Upgrading in China

In recent years, with the continuous development of China's economy, various industries have made certain progress, among which the tertiary industry, which is a key national support, has developed rapidly. This is closely related to the country's strong implementation of the industrial transformation plan. The tertiary industry has gradually increased and surpassed the secondary industry in 2013. Starting from 2015, the gap between the total GDP of the secondary industry and the tertiary industry has become increasingly large. Although the development of the secondary industry is still on the rise, the magnitude is relatively small, which further exacerbates its difference from the tertiary industry. The proportion of the secondary industry has significantly decreased since 2003. The spread of SARS in China has caused great trauma to the secondary and tertiary industries. Since 2003, although the secondary industry has rebounded, it has shown an overall downward trend. The primary industry has continued to decline, while the tertiary industry has gradually increased and surpassed the secondary industry in 2013, proving that China's industrial transformation policies implemented in recent years have achieved significant results.

4. Empirical Analysis on the Impact of Financial Agglomeration and Industrial Upgrading Development

4.1. Sample Selection and Establishment of Indicator System

The variables in this article are mainly divided into three parts

The dependent variable is industrial structure upgrading (str). Due to the specific explanation provided in Chapter 3, it will not be elaborated here

Core variable: Financial agglomeration (fin). As Chapter 3 has already provided specific explanations, we will not go into detail here

Control variables. To control for other factors that affect the upgrading of industrial structure, this article further controlled for government factors (zc), urbanization level (cit1), and human capital (ledu) in each region. Among them, the degree of policy freedom is measured by the ratio of government fiscal expenditure to fiscal revenue in each region, in order to control the local government's intervention ability in the economy; The level of urbanization is expressed as the proportion of urban population to the total population; Human capital is characterized by the size of the number of students in ordinary universities, and logarithmic processing is performed to prevent excessive fluctuations in variables.

In summary, the definition of indicators in this article is shown in Table 1:

Table 1. Variable Definition

Variable Name	Variable symbols	computing method
industrial structure	Str	Third/Second industry
Financial agglomeration	Fin	Location entropy in the financial industry
Fiscal Freedom	Zc	Fiscal expenditure/fiscal revenue
Urbanization	Cit1	The proportion of urban population
human capital	LED U	The logarithm of the number of students in regular universities

The data selected in this article mainly comes from various provinces such as the National Bureau of Statistics website, Population and Employment Statistical Yearbook, and Education Statistical Yearbook.

4.2. Model Construction

To verify the impact of financial agglomeration in various provinces and regions on industrial structure upgrading from 2003 to 2019, an empirical model design is constructed as follows:

$$str_{it} = \alpha \times fin_{it} + \beta_1 \times zc_{it} + \beta_2 \times ledu_{it} + \beta_3 \times cit1_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

Among them, α , β The coefficients represent the impact of various factors on the upgrading of industrial structure. If this value is positive, it indicates a positive impact, and if it is negative, it indicates a negative impact.

4.3. Empirical Process

The previous chapter provided the indicator data and basic characteristics required for empirical analysis in this section. This chapter mainly uses the above data and combines appropriate estimation methods to empirically test the impact of financial industry agglomeration on the upgrading of industrial structure in various regions. Firstly, build an empirical analysis model and select estimation methods; Finally, estimate the model and analyze it.

4.3.1. Selection of Estimation Methods

After constructing the model, it is also necessary to choose the estimation methods required for the above model. There are three main methods for analyzing empirical results: Pool OLS, random effects, and fixed effects. Table 2 presents the results of selecting three estimation methods. The first column shows the test results for selecting Pool OLS or fixed effects for the model. As can be seen from the F-statistic, this value has a probability of 0.00, which is less than 0.01, indicating that the null hypothesis should be rejected at a significance level of 1%, indicating that fixed effects should be chosen for estimation. The second column shows the test results for selecting random or fixed effects for the model. According to the chi square statistic of the Hausman test, the accompanying probability is 0.28, which is greater than 0.1, indicating that the null hypothesis of using random effects to estimate the original model should be accepted. Overall, random effects should be used to estimate Model 6-1.

Table 2. Selection of estimation methods

	Step 1: Wald F statistic	Step 2: Chi square statistic
statistic	71	5.0
Adjoint probability	0	0.28

4.3.2. Empirical Results and Analysis

Based on the above test results, this article uses random effects to estimate equations 2, and the final estimation results can be seen in Table 3.

The first column shows the results obtained using the random effects estimation method. Among them, the estimated coefficient of financial agglomeration fin is 0.767, which is greater than 0, and this value is significant at the 1% level, indicating a positive relationship between financial agglomeration fin and industrial structure upgrading, indicating that the improvement of financial agglomeration level helps to promote the upgrading of regional industrial structure. The possible reason for its existence is that the higher the level of regional financial industry agglomeration, the more conducive it is to promoting the integration of local financial resources, improving the efficiency of local financial institutions in allocating financial resources, accelerating the flow of funds in different industrial structures, and improving the efficiency of industrial structure adjustment. In addition, the higher the level of financial agglomeration, the more it helps to achieve economies of scale in the financial market, reduce transaction costs of capital flow, reduce losses of funds in intermediate links, and provide richer financial support for local industrial structure upgrading.

Observing the coefficient of the control variable, the coefficient of fiscal freedom zc is 0.095, which is also significant at the 1% level, and the sign is positive, indicating a positive relationship between fiscal freedom and industrial structure upgrading. That is, the higher the level of fiscal freedom of regional governments, the more it helps to promote local industrial structure upgrading. This result indicates that local government financial intervention plays an important role in achieving industrial structure upgrading. The estimated coefficient of urbanization rate $cit1$ is 0.793, which is significantly positive at the 1% level, indicating that the improvement of urbanization level can also significantly promote the advancement of local industrial structure towards higher level. The estimated coefficient of human capital led is 0.117, which is significantly positive at the level of two stars of 5%, indicating a positive correlation between human capital and the upgrading of local industrial structure. Contrary to the results of the aforementioned correlation coefficients, this result reveals a significant positive impact relationship between the two after considering inter group differences among provinces. That is, the higher the accumulation of human capital, the more conducive it is to promoting the rapid upgrading of local industrial structure.

Furthermore, the second column of this article also presents the estimation results obtained using the fixed effects method. The results show that the coefficient of financial agglomeration is 0.753, which is significantly positive at the 1% level. Compared with the estimated coefficients under random effects, there is no significant difference between the two. This result also reveals a significant positive relationship between financial agglomeration and industrial structure upgrading, that is, the improvement of the level of financial agglomeration in the region helps to promote the transformation and upgrading of industrial structure towards higher level. Meanwhile, from the coefficients of other control variables, it can be seen that the coefficient of fiscal freedom factor is still significantly positive, that is, the larger the government's fiscal discretionary space, the more conducive it is to providing assistance from the government for industrial structure upgrading, thereby promoting the transformation of industrial structure towards higher levels. The coefficient of urbanization level is significantly positive, and even with fixed effects estimation, the improvement of urbanization level $cit1$ still helps to promote the transformation and upgrading of industrial structure. The coefficient of human capital is 0.162, which is significantly positive at the 1% level, higher than the coefficient obtained using random effects estimation, indicating that human capital has a positive impact on industrial structure upgrading.

Table 3. Regression Results

Dependent variable: str	(1)	(2)
Fin	0.767***	0.753***
	(10.23)	(9.93)
Zc	0.095***	0.093***
	(5.17)	(4.72)
Cit1	0.793***	0.669***
	(4.96)	(3.93)
LED U	0.117**	0.162***
	(2.52)	(3.13)
_Cons	-0.657***	-0.749***
	(-3.44)	(-4.33)
<i>Within R2</i>	0.331	0.332
<i>N</i>	527	527

Note: The values in parentheses represent t values, and ***, **, and * represent significance levels of 1%, 5%, and 10%, respectively.

5. Countermeasures and Suggestions

To effectively address the ongoing challenges and opportunities presented by domestic financial agglomeration and industrial development, this report puts forward the following recommendations, refined for academic dissemination:

(1) Escalation of Investments in Financial Agglomeration to Facilitate Industrial Modernization in China:

Empirical analyses indicate that industrial modernization exhibits positive spatial dependence within the context of high-level planning and rationalization. This suggests potential for leveraging inter-provincial dependencies and spillover effects to standardize and enhance industrial structures across regions uniformly. Increased investment in financial agglomeration could thus play a pivotal role in achieving comprehensive regional and national industrial modernization.

(2) Scientific Assessment of the Correlation Between Foreign Direct Investment (FDI) and Industrial Modernization:

A nuanced, scientific approach is required to understand the impact of foreign investment on industrial upgrading. It is imperative that the government implements policies that enable foreign capital to enter the local markets judiciously, mitigating adverse impacts on domestic enterprises while harnessing foreign investment to stimulate local industrial innovation and modernization.

(3) Governmental Policy Formulation with an Emphasis on Regional Coordinated Development:

Given China's extensive territorial expanse, significant regional disparities, and diversity, lessons from earlier phases of reform and opening-up that overlooked regional coordinated development must be heeded. It is essential to devise judicious industrial development policies that unify provincial strengths, fostering a collaborative force that propels nationwide industrial modernization.

These strategic recommendations aim to align with global academic standards in their formulation and presentation, ensuring they contribute robustly to scholarly discussions on economic development strategies.

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