

Economic Ripple Effect Analysis of New Converging Industry: Focusing on Inter-Industrial Analysis of Fintech Industry in South Korea, China and the United States

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The Fintech industry is the convergence of the financial industry and the ICT (Information and Communications Technology) industry. It not only replaces the services provided by traditional financial services such as remittances, settlements, and asset management, but also creates new industries combined with ICT technology such as Cloud funding, P2P, and Internet Professional Bank. Therefore, this research focuses on the economic ripple effect of the Fintech industry on the national economy by inter-industrial analysis. At the same time, in order to learn the different circumstances of Fintech industry worldwide, this study conducted comparative research on Fintech leading countries in the United States and China with South Korea. All the economic ripple effects of South Korea, China, and the United States Fintech industry are relatively low among all industries, and the industrial characteristics are analyzed to be 'intermediate primary production' type industry. This study, as the first attempt, analyzes the current economic impact of Fintech in each country, and inspires future development direction of Fintech industrial policy.

Keywords: Fintech Industry, Economic Ripple Effect, Inter-Industrial Analysis, Future Development

Introduction

National financial competitiveness has become the core supporting force to resist financial risks like 2008 economic crisis.^{1,2} Fintech is a representative converging industry and rapidly expanding all over the world as a strategy to secure financial competitiveness. As the proportion of converging industries has increased year by year, the study on the impact of the converging industry on the national economy is required. However, since technology convergence breaks the boundaries of a single technology and makes the industrial classification difficult. Therefore, a few studies had infer the economic ripple effect of the converging industry indirectly through the analysis of the correlation of a single industry³ or analyze directly through inter-industrial analysis after the reclassification and redefinition of the converging industry.⁴ This study will verify economic ripple effect of Fintech to the upstream and downstream industries.

Methodology

This study will reclassify the Fintech industry, and rearrange the reclassified Fintech industry's

input-output (I-O) tables, and then identify the Fintech industry's production inducement effects, value added Inducement effects and forward and backward linkage effects to other industries. At the same time, in order to learn the global Fintech industry situation, it will compare South Korea with the leading countries of Fintech, the United States and China about the domestic influence on the upstream and downstream industries of Fintech industry. In 2018, seven of the top 10 global Fintech companies were announced as U.S and Chinese companies. Further, it will summarize the characteristics of Fintech industry and inspire the direction of R&D development in the three countries

Reclassification of Fintech industry

Prior to the inter-industrial analysis, we conducted reclassification of the Fintech industry. As for Fintech industrial classification, various institutions have different classification methods. Based on the literature review, Fintech industry can be roughly classified into two categories: financial service and ICT financial technology.⁵ The financial service still retains typical businesses in the traditional financial industry, such as remittances and payments which is still the most important part

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of Fintech industry, and the second part of lending, investment, and personal asset management still has a place in the Fintech industry. The convergence with ICT is the difference between the emerging Fintech industry and the traditional financial industry. The most important part of the Fintech industry is the collection and management of consumer financial data. The use of ICT emerging technologies such as big data and cloud to analyze consumer data and work out personal asset management services are important parts of Fintech industry recently.

Inter-Industry Analysis

The inter-industrial analysis is based on the analysis method of the input-output(I-O) tables and production by a particular sector has the backward linkage effect and the forward linkage effect on the other sectors in the economy.^{6,7} The I-O table can be interpreted in both the row and column directions. The columns describe the composition of inputs required by a particular industry to produce its output. And the rows describe the distribution of a producer's output that used by other industries as intermediate or final demand. The most basic coefficients in the inter-industry analysis are input coefficient, production inducement coefficient, value added inducement coefficient, sensitivity coefficient, influence coefficient and so on. First of all, the input coefficient refers to the proportion of the total amount of intermediate input that each industrial sector needs to purchase from other industrial sectors to produce one unit of production. The inter-industry analysis is based on the analysis of inter-industry dependency relations based on input coefficients. Second, the production inducement coefficient is based on the input coefficient, it means the production changes directly or indirectly caused to the entire industry as the final demand changes by one unit. It is known as the Leontief inverse or the total requirement matrix.

$$B = (I - A)^{-1} \quad \dots (1)$$

Third, the value added inducement effect is similar to the production inducement effect. It refers to the effect that the change in final demand directly or indirectly affects the added value of the entire industry. The value added inducement coefficient refers to the ratio of total added value to total input.

Fourth, the sensitive coefficient and influence coefficient explain each of the forward and backward linkage effect. If sector j increased its output, this means there will be increased demands from sector j

(as a purchaser) on the sectors whose goods are used as inputs to production in j . This is the direction of causation in the usual demand-side model, which is called backward linkage effect and it is measured by influence coefficient. Conversely, increase output in sector i also means that additional amounts of product i are available to be used as inputs to other sectors for their own production. This is the direction of causation in the supply-side model, which is called forward linkage effect, and it is measured by sensitive coefficient.⁸ The sensitive coefficient is the ratio of the production inducement coefficient of the i industry to the average production inducement coefficient of the industry. In general, the more influential materials used, the higher the infection coefficient is:

$$\text{Sensitive coefficient of } i \text{ industry} = \frac{\sum_{j=1}^n b_{ij}}{\frac{1}{n} \sum_{j=1}^n \sum_{i=1}^n b_{ij}} \quad \dots (2)$$

The influence coefficient is the ratio of the production inducement coefficient of the sector j to the production inducement coefficient of the entire industry. Generally, the more the raw material or final material used, the greater the industry influence coefficient is:

$$\text{Influence coefficient of } j \text{ industry} = \frac{\sum_{i=1}^n b_{ij}}{\frac{1}{n} \sum_{j=1}^n \sum_{i=1}^n b_{ij}} \quad \dots (3)$$

This study will focus on South Korea, China, and the United States Fintech industry through inter-industrial analysis. Korean data comes from the "2014 Input-Output Statistics(Bank of Korea, 2016)". Chinese data comes from the "2012 National Input-Output Statistics(National Bureau of Statistics of China, 2014)". United States data from the "IO Use Before Redefinitions PRO 1997-2016 Summary (BEA, 2017)". The industry impact on national economy is analyzed based on the production inducement effects, value added inducement effect, forward and backward linkage effect of the Fintech industry in three countries. In order to unify the different classification in the three countries, this study matched the small-sized classification with the OECD input-output classification. OECD⁸ released the input-output table classification classifying the entire industry into 34 large sized categories. Based on the industry definition, the input-output tables of South Korea, China, and the United States are mapped in units of small sized categories.

Comparative analysis of Fintech industry between country

For understand the universal development of the Fintech industry, South Korea, China, and the United States will be compared. As for the classification, South Korea Fintech Industry is based on the Korean Standard Industrial Classification (KSIC-10) released by Statistics Korea in 2017; China Fintech Industry is classified based on the Industrial Classification for National Economic Activities released by the National Bureau of Statistics in 2017; while the United States Fintech Industry is based on the North American Industry Classification System (NAICS) published by Census Bureau at the same year, in order to redefine the elements of the Fintech industry in the three countries.

Results and Discussion

Industrial reclassification

According to the redefined characteristics of Fintech industry in the three countries, the classification of the input-output table is reclassified, the results are shown as Table 1.

Economic ripple effect analysis by inter-industry analysis

In order to obtain a development plan for the Fintech industry in South Korea, China, and the

United States, we separately analyzed the Fintech industry in the three countries. Based on the input-output tables issued by various agencies, the Fintech industry's production inducement effect, value added inducement effect, and the forward and backward linkage effects are analyzed. Based on the above analysis results, it is simply organized as follows <Figure 1-3>. According to Figure 1 and 2, the Fintech industry of three countries has not grown into a major industry. Because production inducement effect of them is ranked 20th out of 32 industries in total (South Korea 23rd, China 26rd, U.S 22rd). And the Fintech industry of three countries has a high correlation with the R&D and other business activities industry. According to figure 3, the Fintech industry has higher forward linkage effect than backward.

Comparative analysis

In this study, we analyzed the impact of the Fintech industry on the national economy in the three countries, the similarities and differences between the three countries' Fintech industries can be summarized as follows: For the similarities between the three countries, firstly, the impact of Fintech industry on the

Table 1 — Unified table of industrial reclassification

Sector	No.	Industry Code	ISIC Corresponding Divisions	Description	Small Sized Categories in Input-Output Tables		
					South Korea	China	The U.S.
Primary Industry	1	C01T05	01, 02, 05	Agriculture, hunting, forestry and fishing	001-008	01001-05005	111CA-113FF
	2	C10T14	10, 11, 12, 13, 14	Mining and quarrying	009-012	06006-11011	211-213
	3	C15T16	15, 16	Food products, beverages and tobacco	013-023	13012-16025	311FT
Manufacturing	4	C17T19	17, 18, 19	Textiles, textile products, leather and footwear	024-029	17026-19033	311TT-315AL
	5	C20	20	Wood and products of wood and cork	030-031	20034-21035	321,377
	6	C21T22	21, 22	Pulp, paper, paper products, printing and publishing	032-035, 134-135	22036-24038	322-323, 512
	7	C23	23	Coke, refined petroleum products and nuclear fuel	036-037	25039-25040	324
	8	C24	24	Chemicals and chemical products	038-046	26041-28049	325
	9	C25	25	Rubber and plastics products	047-050	29050-29051	326
	10	C26	26	Other non-metallic mineral products	051-055	30052-30058	327
	11	C27	27	Basic metals	056-062	31059-32063	331
	12	C28	28	Fabricated metal products	063-066	33064-34068	332
	13	C29	29	Machinery and equipment, nec	067-077	34069-35074	333
	14	C30T33X	30, 32, 33	Computer, Electronic and optical equipment	082-085, 087-088	39086-40092	334
	15	C31	31	Electrical machinery and apparatus, nec	078-081, 089-091	38080-38085	335
	16	C34	34	Motor vehicles, trailers and semi-trailers	092-097	36075-37079	3361MV
	17	C35	35	Other transport equipment	098	41093	3364OT
	18	C36T37	36, 37	Manufacturing nec; recycling	099-100	42094-43095	339

SOC							
Service Industry	19	C40T41	40, 41	Electricity, gas and water supply	101-107	44096-46098, 76125-78127	22
	20	C45	45	Construction	108-114	47099-50102	23
	21	C50T52	50, 51, 52	Wholesale and retail trade; repairs	115	51103	42-4A0
	22	C55	55	Hotels and restaurants	125-126	61112-62113	721-722
	23	C60T63	60, 61, 62, 63	Transport and storage	116-124	53104-59110	481-493
	24	C64	64	Post and telecommunications	127, 129-130	60111	-
	25	C70	70	Real estate activities	140-142	70119	HS-ORE
	26	C71	71	Renting of machinery and equipment	143	71120	532RL
	27	C73T74	73, 74	R&D and other business activities	144-151	72121-75124	5412OP, 5411, 55
	28	C74	75	Public admin. and defence; compulsory social security	152	90139, 93138	GFGD-GSLE
	29	C80	80	Education	153	82130	61
	30	C85	85	Health and social work	154-156	83131-84132	621-624
	31	C90T93	90, 91, 92, 93	Other community, social and personal services	157-161	79128-80129, 85133-89137	561-562, 711AS-713, 81
	32	-	-	Fintech	086, 128, 131-133, 136-139	63114, 65115, 66116, 67117, 68118	511, 513, 514, 5415, 521CI-525

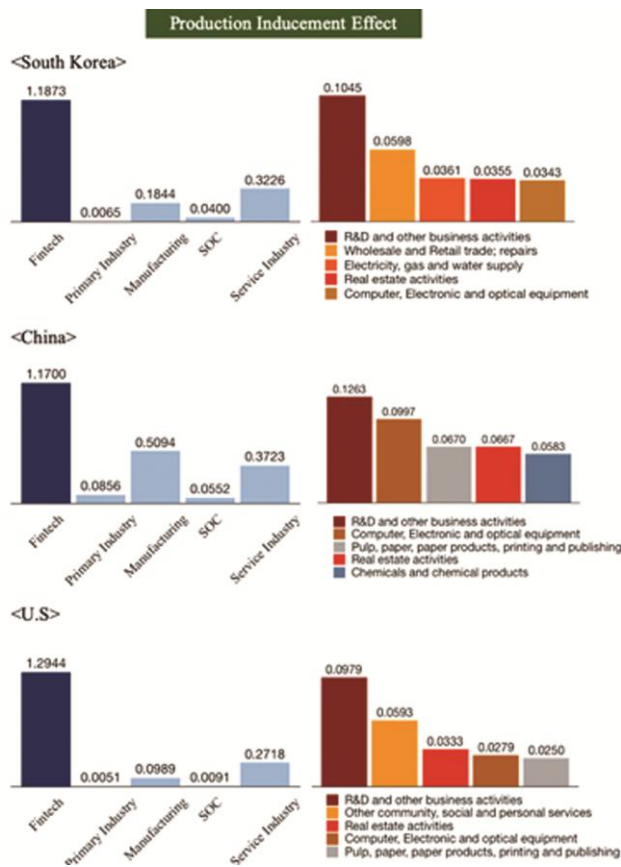


Fig. 1 — Production Inducement Effect

National economy downstream of the entire industry, it has not grown into a major industry on a world scale. Secondly, the Fintech industry has a high correlation with the R&D and other business activities industry (figure1,2). The Fintech industry itself is an emerging industry centered on ICT technology.

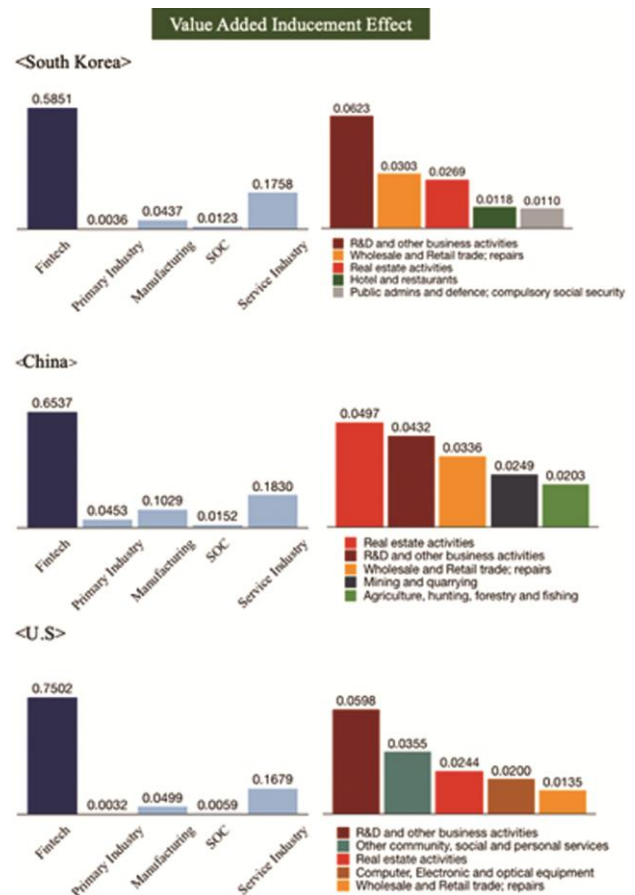


Fig. 2 — Value Added Inducement Effect

Therefore, the R&D investment and the dependence on the business support industry will increase correspondingly. Thirdly, the Fintech industry in the three countries has demonstrated as the 'intermediate primary production' industry (figure3). The output of

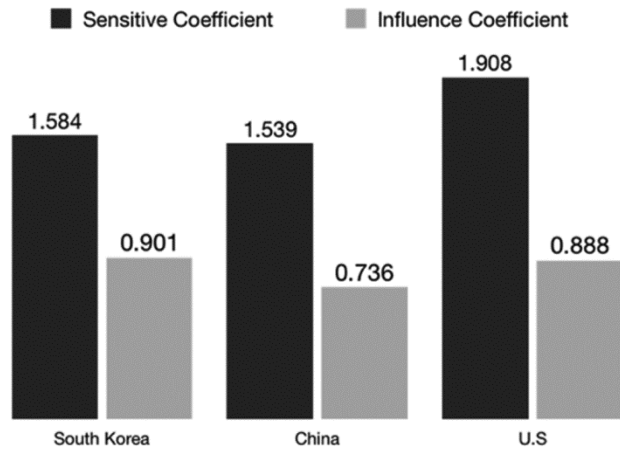


Fig. 3 — Fintech Linkage Effect

the industry is often used as an intermediate material for other industries, that is, to provide a service-type industry for other industries. Thus, the Fintech industry still maintains the characteristics of the service industry, and in addition to Fintech itself, it is also needed to consider the development of other industries directly or indirectly affected by Fintech, in order to maximize the effect of Fintech's economy for the future policy establishment. For the differences between the three countries, South Korea and the United States are affected by Fintech industrial production, which has the greatest impact on the service industry, while in China, it is the manufacturing industry most affected by it, followed by the service industry (figure1,2). With the expansion scope of Chinese Fintech industry, not only the service industry, but also the demand for Fintech industry in Chinese manufacturing industry is expanding. Therefore, in the future policy establishment of the Fintech industry, the development of the Fintech-related manufacturing industry should also be actively promoted. The Fintech industry in South Korea and the United States has a high degree of dependency on the service industry. Thus, when setting up Fintech related policies, it is necessary to focus on promoting the simultaneous development of related service industries.

Conclusion

The converging industry has broken the boundaries of a single industry and developed new products or services in convergent ways. With the high-tech ICT technology brought about by the Fourth Industrial Revolution has become the central role of integration of various industries, the Fintech industry as a typical

industry of ICT convergence with the traditional financial industry has grown at an alarming rate worldwide. This study analyzes the effects of the Fintech industry on the national economy and analyzes the countries in the three countries of South Korea, China, and the United States. The significances of this study after the above analysis are as follows:

Firstly, with the gradual deepening of industrial integration, there are many deficiencies in the literature research on the economic ripple analysis of the converging industry. This research focuses on the Fintech industry rapidly growing in recent years. As an important part of the converging industry, it has made a systematic study of the impact of Fintech industry on the national economy and economic ripple effects on other industries. Secondly, this study reclassifies the small-sized categories of input-output tables based on the characteristics of the Fintech industry, treated as a new converging industry instead of being analyzed as an independent industry. This study is also based on the national input-output table of each country to analyze the industrial relations within each country through inter-industrial analysis. According to the Fintech production inducement effect and value added inducement effect on the national economy, the Fintech industry impact on the national economy is analyzed. Thirdly, in addition of Korea, this study compared with Fintech leading countries like the United States, China. Fintech industry in these three countries is compared horizontally to study the characteristics of the Fintech industry under different national conditions. Based on the research results of this study, the future development direction of Fintech industry has also been an inspiration. Through the current economic circumstances of the three countries in Fintech industry, it can be found that there are many similar aspects in the Fintech market in the three countries. The impact of Fintech industry on the national economy downstream of the entire industry while it has a tight correlation with the R&D and other business activities industry. Also, the Fintech industry has demonstrated as a 'intermediate primary production' industry. However, in China, it is the manufacturing industry most affected by it, while the service industry most affected in South Korea and the United States. In the future policy establishment, it is more necessary to pay attention to the Fintech-related industries to expend the impact on national economic. In the process of this study, there are some limitations as follows.

First, with the expanding scope of the industries, there are many incomplete parts of the current economic structure compared to the 2014 Korean Input-Output Table and Chinese 2012 National Input-Output Table used in this study. There are many errors in the input-output data that leads to an inevitable error in the data and actual economic conditions. Second, the study compares the input-output tables of the three countries with different classifications. Although the definition of Fintech industry is based on the same standard, the differences in industry classification will still result in analysis error. Third, this study focused on comparative analysis the economic ripple effect of Fintech Industry in the three countries through the coefficients of inter-industrial analysis, which has limitations on the future Fintech industry development judgments. In the future, it is expected that the future development trend of Fintech industry will be more specifically studied and analyzed through the scenario analysis. Although there are many deficiencies in this research, the results of the Fintech industry's research on the economic ripple effects of South Korea, China, and the United States are still significant. In the future, Fintech's industry will be further studied in detail for updated data from various countries and reclassified industry definitions.

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