

Research on Industrial Relevance Degree and Industrial Financial Situation Risk Matrix Construction

——Based on Chinese Information Technology Industry

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Abstract: Based on Input–Output Table in 2010 issued by National Bureau of Statistics of China, with the help of input–output model and with the calculation of indexes of industrial relevance degree in Chinese information technology industry, the paper reveals the industrial relevance in Chinese information technology industry. The paper also selects the relevant industries which are highly associated with the development of Chinese information technology industry based on industrial relevance degree to analyze the influences of these industries on the financial situation risk fluctuation in information technology industry and to design the matrix of financial situation risk in information technology industry. Then, the paper offers countermeasures and suggestions for the development of our information technology industry.

Keywords: Information Technology Industry; Industrial Association Degree; Financial Situation; Risk Matrix

1. Introduction

As the strategy of "using informatization to drive industrialization" is implemented in China and the strategy of "Internet+" is proposed, information technology industry develops rapidly. Up to June 2015, there were 338 listed enterprises in our information technology industry, which occupied 12.1% of all listed enterprises. Information technology industry is closely associated with high technology. Developing information technology industry is not only an important act to enhance our economic strength but also the necessary requirement to construct innovative country. The development of information technology industry need support from other industries, so it has been an essential problem about how to treat the relationship between information technology industry and other industries comprehensively and relevantly and how to promote the coordinate development between our information technology industry and other industries.

Western scholars make systematic studies on growing motive and internal mechanism of information technology industry and the association between information technology industry and economic growth. While, domestic studies on the relationship between information technology industry and relevant industries are still on the level of qualitative analysis with less quantitative studies. Most of

current studies tend to explore the relationship between information technology industry and other industries on the macroscopic level, which pay less attention to the influence of upstream industries and downstream industries in information technology industry on financial situation risk.

This paper use input–output model to make quantitative analysis on industrial relation situation in Chinese information technology industry; reveals the relation between upstream industries and downstream industries in our information technology industry by calculating the complete consumption coefficient and the complete distribution coefficient of industrial relation in information technology industry; explores the influence mechanism of other industries on the financial situation risk in information technology industry based on industrial association degree to provide decision–making basis for the rapid development of our information technology industry.

2. Analysis on industrial association degree in information technology industry

Leontief analyzed the close relation among different industrial departments in national economy with the help of input–output table in his representative work American Economic Structure from 1919 to 1929, which is the beginning of industrial relevance theory. Hirsechman pro-

posed that different industrial departments in national economy had "industrial association effect" with mutual independence and mutual influence, and industrial output and technical change would have direct or indirect influences on other industrial departments with the help of "forward relevance" and "backward relevance". Industrial supply relevance reflected backward relevance, and industrial sales relevance reflected forward relevance. The sum of forward relevance and backward relevance could reflect the close relation between some industry and other industries.

In order to analyze the relevance effect and influential effect of information technology industry, information technology industry must be defined clearly. However, there are definitions of information technology industry on broad sense and narrow sense. In broad sense, information technology industries include communication and relevant equipment manufacturing industry, computer and relevant equipment manufacturing industry, communication service industry, and computer application service industry.

In narrow sense, information technology industries only include information transmission industry, computer service industry, and software industry. The definition on narrow sense is used in the new revised input-output table and Guideline of Industrial Classification of Listed Corporations, so the paper also adopts the definition on narrow sense to study. The basic data used in this paper comes from Input-Output Table in 2010 issued by National Bureau of statistics of China.

2.1 Industrial supply relevance degree in information technology industry: from the backward relevance perspective

As a high-tech industry, it is necessary for information technology industry to purchase intermediate products from different industries as production means to maintain production. Information technology industry is the demand side of production means, and other industries are supply side. This industrial relation is backward related. For example, production elements such as capital and labor are used in information technology industry and information technology industry should pay the price (interest and salary). Information technology industry also needs to buy machines, equipment, accounting service, and management service, which are the supply of intermediate products in other industries to information technology industry. The bigger the industrial supply relevance coefficient in information technology industry is, the closer the backward relevance between information technology industry

and other industries is.

The formula of industrial supply relevance coefficient is as follows:

$$\text{Industrial supply relevance coefficient in information technology industry} = \frac{X_{i \cdot 28}}{\sum_{i=1}^{41} X_{i \cdot 28}}, \quad i=1, 2, \dots, 41$$

(Formula 1)

In Formula 1, information technology industry is in the 28th row of Input-output Table in 2010. $X_{i \cdot 28}$ represents the input of other industries on sales of information technology industry.

2.2 Industrial sales relevance degree in information technology industry: from the perspective of forward relevance

Apart from backward relevance, there is close forward relevance relation between information technology industry and other industries. Intermediate products and final products in information technology industry will be used in other industries directly or indirectly as input elements. Information technology industry promotes the development of downstream industries by supplying production elements. At present, products and services provided by information technology industry play important roles in all walks of life. Information technology industry can be provider of production factors in almost all industries, so forward relevance between information technology industry and other industries is general. The forward relevance between information technology industry and other industries can be measured with industrial sales relevance degree in information technology industry. The bigger the coefficient is, the more the products that information technology industry will be and the more obvious the promotion influence will be.

The formula of industrial sales relevance coefficient is as follows:

$$\text{Industrial sales relevance coefficient in information technology industry} = \frac{X_{28 \cdot j}}{\sum_{j=1}^{41} X_{28 \cdot j}}, \quad j=1, 2, \dots, 41$$

(Formula 2)

In Formula 2, information technology industry is in the 28th row of Input-output Table in 2010. $X_{28 \cdot j}$ represents the output of sales of information technology industry on other industries.

After calculation, forward relevance and backward relevance table between information technology industry and other industries is as shown in Table 1.

Table 1 Industrial Relevance Table between Information Technology Industry and Other Industries

Industry	Industrial Supply Relevance Degree in Information Technology Industry	Rank	Industrial Sales Relevance Degree in Information Technology Industry	Rank
Electric, machine, and equipment manufacturing industry	0.145 77	1	0.016 05	14
Communication equipment, computer, and other electronic equipment manufacturing industry	0.126 51	2	0.060 06	5
Rent and commercial service industry	0.106 14	3	0.009 83	21
Information transmission, computer service, and software industry	0.091 74	4	0.089 36	3
Wholesale and retail trade industry	0.066 51	5	0.040 37	8
Paper-making, printing, and cultural, educational, and sports products manufacturing industry	0.066 00	6	0.006 10	29
Transportation and storage industry	0.064 92	7	0.042 06	7
Real estate industry	0.055 36	8	0.014 43	17
Electric power and heating power production and supply industry	0.052 79	9	0.031 30	10
Financial industry	0.043 83	10	0.112 12	2
Lodging and catering industry	0.041 59	11	0.008 09	23
Instrument and cultural and office machine manufacturing industry	0.018 98	12	0.003 33	34
General and specialized equipment manufacturing industry	0.017 13	13	0.025 34	12
Transportation equipment manufacturing industry	0.014 93	14	0.014 13	18
Resident service and other services industry	0.013 56	15	0.004 94	31
Culture, sports, and entertainment industry	0.011 85	16	0.004 85	33
Chemical industry	0.011 22	17	0.036 50	9
Comprehensive technology service industry	0.010 35	18	0.005 42	30
Food production and tobacco processing industry	0.005 16	19	0.014 64	16
Metal product industry	0.004 26	20	0.008 06	24
Petroleum processing, coking, and nuclear fuel processing industry	0.004 08	21	0.011 27	20
Textile, clothing, shoes, hats, leather, eiderdown, and products industry	0.004 01	22	0.012 90	19
Architecture industry	0.003 59	23	0.180 57	1
Research and experiment development industries	0.003 54	24	0.002 20	37
Post industry	0.002 77	25	0.003 15	35
Water production and supply industry	0.002 59	26	0.000 78	40
Education	0.002 48	27	0.014 77	15
Craft and manufacturing industries (including waste products and waste materials)	0.002 24	28	0.007 76	25
Wood processing and furniture manufacturing industry	0.002 03	29	0.006 60	26
Gas production and supply industry	0.001 20	30	0.000 39	41
Public management and social organization	0.000 81	31	0.054 65	6
Hygiene, social security, and social welfare industry	0.000 63	32	0.017 94	13
Water conservancy, environment, and public facility management industries	0.000 59	33	0.004 88	32
Non-metal mineral product industry	0.000 57	34	0.009 73	22
Textile industry	0.000 26	35	0.006 37	27
Metal smelting and calendaring processing industry	0.000 02	36	0.079 96	4
Agriculture, forestry, animal husbandry, and fishing industry	0	37	0.027 31	11
Coal mining and washing industry	0	38	0.006 24	28
Petroleum and gas mining industry	0	39	0.002 25	36
Metal mine mining and selection industry	0	40	0.001 96	38
Non-metal mine and other mines mining and selection industry	0	41	0.001 37	39

Data source: Input-output Table in 2010 issued by National Bureau of statistics of China.

3. Analysis on picture of industries with strong relevance based on industrial relevance degree in information technology industry

3.1 Construction of picture of industries with strong relevance with information technology industry

The industrial chain of information technology industry is long, and is almost associated with all industries, but relevance degree is obviously different. Coefficients of backward relevance and forward relevance in information technology industry top 10 industries can be got in Table 1. These industries are closely associated with information technology industry, which is shown in Figure 1.

3.2 Analysis on industries with strong relevance with information technology industry based on industrial supply relevance coefficient

On backward relevance, our information technology industry is closely associated with manufacturing industry, retail industry, and transportation industry with low added value, and some resource consumption industries such as chemical industry, metal smelting industry, and calendar-

ing processing industry, but is not associated with some industries with high added value such as comprehensive service industry, research and experiment development industry, and education. It shows that although our information technology industry develops fast, its development is extensive with large space for improvement.

There are industries in backward relevance which not only provide production factors for information technology industry but also make use of information technology industry—circumferential relevance industries. Financial industry, communication equipment, computer and other electronic equipment manufacturing industry, electric power and heating power production and supply industry are closely associated with supply in information technology industry and sales in information technology industry and have obvious circumferential relevance with information technology industry.

3.3 Analysis on industries with strong relevance with information technology industry based on industrial sales relevance coefficient

On forward relevance, the influence of forward relevance in information technology industry covers all levels

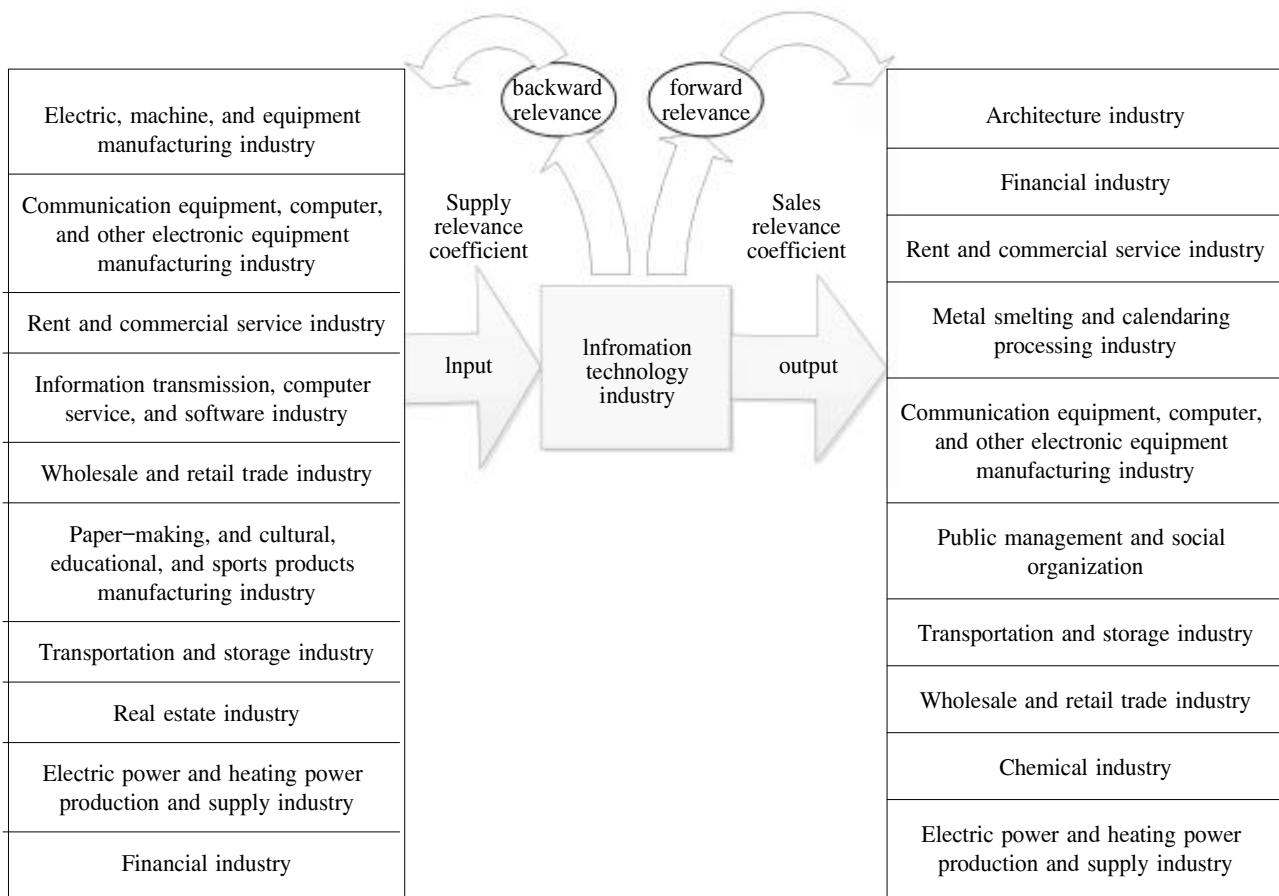


Figure 1 Picture of Industries with Strong Relevance with Information Technology Industry

of industries. Among the industries with strong forward relevance with information technology industry, there are agriculture, forestry, animal husbandry, and fishing industries which belong to the first industries, manufacturing industry, architecture industry, and processing industry which belong to the second industries, and finance industry which belongs to the third industries. But information technology industry has closer forward relevance with the second industries. Compared with developed countries, our information technology industry has the features of having close forward relevance with the second industries but having not close forward relevance with the third industries. It shows that the informatization degree of our third industries is not high, which fail to drive the development of information technology industry.

Information technology industry is not closely associated with research and experiment development industry and education, which shows that the added value of our information technology industry is low and there are obstacles in transformation of scientific achievement.

4. Construction of matrix of financial situation risk in information technology industry

Financial situation risk fluctuation refers to the process that after some industry changes on industrial chain, other relevant industries will also change and some industries which are directly or indirectly associated with the latter will change, which will influence the whole industrial chain.

4.1 Analysis on the influence power of financial situation risk in information technology industry

As a link in industrial chain, the change of demand of information technology industry will influence upstream industries; while the change of supply will influence downstream industries. That is to say, the financial situation of information technology industry will influence relevant industries. The influence degree of information technology industry on its relevant industries could be measured with influence power coefficient. The formula of influence power coefficient is as follows:

$$F_j = \frac{\sum_{i=1}^n b_{ij}}{\frac{1}{n} \sum_{j=1}^n \sum_{i=1}^n b_{ij}} \tag{Formula 3}$$

In Formula 3, F_j is the influence power coefficient of industry j ; The numerator is the sum of row j in Leontief inverse matrix; the denominator is the average number of the sum of Leontief inverse matrix; $F_j = 1$ represents the

influence of industry j on other industries is equal to social average level. The bigger the influence power coefficient is, the more obvious the driving influence of industry j on other industries will be.

4.2 Analysis on the sensitivity of financial situation risk in information technology industry

The change of any industries has direct or indirect influences on other industries. Any industries are influenced by the change of other industries. In other words, the change of financial situation of other industries will influence the financial situation risk in information technology industry. Such financial situation risk fluctuation degree can be shown with sensitivity coefficient. The formula of sensitivity coefficient is as follows:

$$E_i = \frac{\sum_{j=1}^n b_{ij}}{\frac{1}{n} \sum_{i=1}^n \sum_{j=1}^n b_{ij}} \tag{Formula 4}$$

In Formula 4, E_i represents the sensitivity coefficient in industry i ; The numerator is the sum of line i in Leontief inverse matrix; the denominator is the average number of the sum of Leontief inverse matrix; $E_i=1$ represents that the sensitivity of industry i on the change of other industries is lower than social average level. The bigger the sensitivity coefficient is, the more sensible the industry i on the change of other industries will be.

We select top 10 industries in Figure 1 on "complete consumption coefficient" which have backward relevance with information technology industry and "complete distribution coefficient" which have forward relevance with information technology industry. Due to the influence of circumferential relevance, there are only 14 industries left, including Electric, machine, and equipment manufacturing industry, Communication equipment, computer, and other electronic equipment manufacturing industry, Rent and commercial service industry, Information transmission, computer service, and software industry, Wholesale and retail trade industry, Paper-making, printing, and cultural, educational, and sports products manufacturing industry, Transportation and storage industry, Real estate industry, Electric power and heating power production and supply industry, Financial industry, Chemical industry, Architecture industry, Public management and social organization as well as Metal smelting and calendaring processing industry. According to the formula above, the influence power coefficient and sensitivity coefficient of these industries are shown in table 2.

It can be seen from Table 2 that:

Table 2 Influence Power Coefficient and Sensitivity Coefficient of Different Industries

Industry	Influence Power Coefficient	Rank	Sensitivity Coefficient	Rank
Chemical industry	3.52	1	1.21	4
Metal smelting and calendaring processing industry	2.59	2	1.23	3
Electric power and heating power production and supply industry	2.28	3	1.10	7
Transportation and storage industry	1.60	4	0.92	9
Communication equipment, computer, and other electronic equipment manufacturing industry	1.49	5	1.40	1
Financial industry	1.12	6	0.63	12
Electricity, machine, and facility manufacturing industry	1.10	7	1.34	2
Paper-making, printing, and culture, sports, and education products manufacturing industry	1.09	8	1.20	5
Wholesale and retail trade industry	1.05	9	0.60	13
Rent and commercial service industry	0.85	10	1	8
Information transition, computer serviced, and software industry	0.57	11	0.82	10
Real estate industry	0.54	12	0.56	14
Architecture industry	0.42	13	1.15	6
Public management and social organization	0.34	14	0.68	11

(a) There are 9 industries that the influence power coefficient of information technology industry on other industries is larger than 1. Except from financial industry and wholesale and retail trade industry, the other 7 industries belong to the second industries. Most of departments in the top belong to machine and equipment manufacturing department, whose technical content is high and added value is high. They belong to the senior industries in national economic system. Therefore, our information technology industry drives the development of these industries and has important influence on the industrial structure optimization and industrial structure updating. Industries

whose influence power coefficient are smaller than 1 concentrate on the third industries and architecture industry.

(b) Many industries promote the development of information technology industry. In the above 14 industries, there are 6 whose influence power coefficient and sensitivity coefficient are both larger than 1. All of these industries belong to the second industries, and 3 of them belong to manufacturing industry, which indicates that the above mentioned industries can provide the information technology industry with immense supports. Meanwhile, it is notable that the fast growing economy can largely spurs the demands of each industry. For satisfying the needs of social production, the 6 industries are facing increasing pressure, thus rendering the development of the information technology industry restrained by these industries. Furthermore, in the third industries, only the sensitivity coefficient of rent and commercial service industries is larger than 1, which reflects that the driving force of the industries on information technology industry is stronger.

(c) It can be seen in Table 2 that the influence power coefficient and sensitivity coefficient of most of the third industries are lower, which is decided by the features of service industry. Service industry is the supporting industry, most of its products can't enter into social reproduction. Thus, it is normal that its influence power coefficient and sensitivity coefficient are lower than that of the second industries.

5. Matrix of financial situation risk in information technology industry

Social average value (1.0, 1.0) is the original point on the coordinate; influence power coefficient is the horizontal axis on the coordinate; sensitivity coefficient is the vertical axis on the coordinate. The matrix of financial situation risk in information technology industry is shaped as shown in Figure 2.

(a) The influence power coefficient and sensitivity coefficient in I (on the first quadrant) are large than social average value 1.0. These industries have features of strong radiation and strong restriction. The industries on the first quadrant include chemical industry, metal smelting and calendaring processing industry, electric power and heating power production and supply industry, communication equipment, computer, and other electronic equipment manufacturing industry, electronic machine and facility manufacturing industry, paper-making, printing, and culture, education, and sports products manufacturing industry.

The industries on the first quadrant are not only sensitive to other industries but also have strong driving force

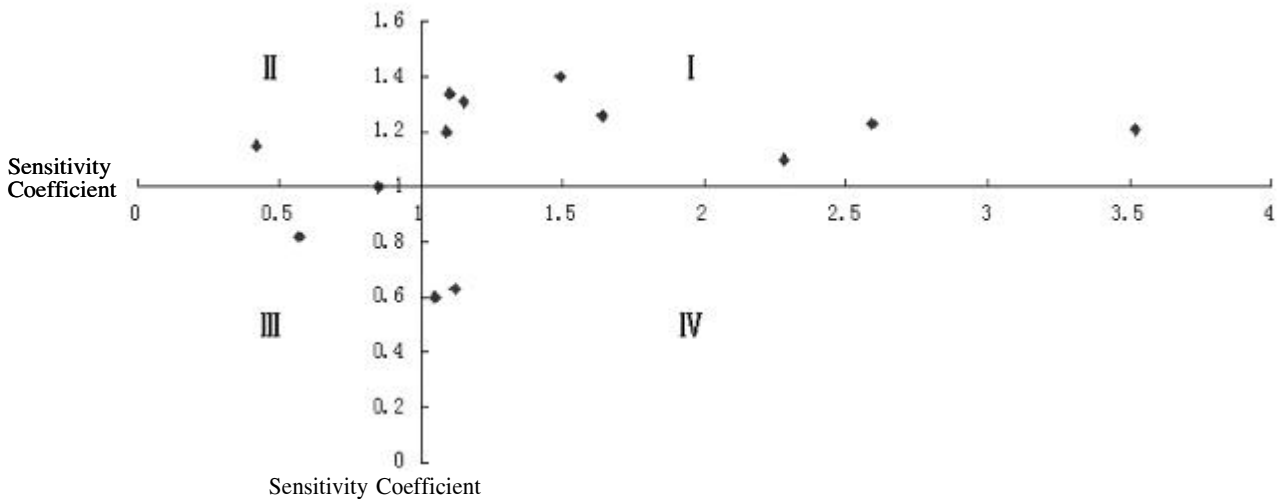


Figure 2 Matrix of Financial Situation Risk in Information Technology Industry

on other industries. In economic development, these 6 industries are main suppliers of intermediate consumption materials in other industries, which drive economic growth by supply. They consume products in other industries in production and drive the development of national economy by demand. These industries have been the pillar industries in national economic system, which play the vital role in the development of national economy. Their development will directly decide the whole quality of national economy, which are key industries that the government supports.

(b) The influence power coefficient of industries in II (on the second quadrant) is smaller than 1 and the sensitivity coefficient is larger than 1. These industries belong to the departments with weak radiation and strong restriction. The industries on the second quadrant include rent and commercial service industry and architecture industry. The industries on the second quadrant restrict the development of economy powerfully. The industries on this quadrant have features of weak radiation and strong restriction, so we should make special industrial policies to strengthen the reform and development of these industries due to the demand of healthy development of economy in the future.

(c) The influence power coefficient and sensitivity coefficient in III (on the third quadrant) are smaller than social average value 1. These industries have features of weak radiation and weak restriction. The industries on the third quadrant include information transmission, computer service, and software industry, real estate industry as well as public management and social organization. As the intensive field of high technology, information technology

industry has the high-tech strength of exposing and influencing other industries. Generally, considering the demand of rapid and healthy development of our economy in the future, we should speed up the transformation and updating of information technology industry from manufacturing industry with low added value to service industry with high added value to produce more powerful investment multiplier effect in the whole national economy.

(d) The influence power coefficient of industries in IV (on the fourth quadrant) is larger than social average value 1, but the sensitivity coefficient is smaller than social average value 1. These industries belong to the industries with strong radiation and weak restriction.

The industries on the fourth quadrant include financial industry, wholesale and retail trade industry and transportation and storage industry. It can be seen in the figure that the industries on the fourth quadrant are mature industries. Their development drives the development of other industries powerfully, but other industries tend to have little demand on them. The typical example is wholesale and retail trade industry (the influence power coefficient is 1.05; the sensitivity coefficient is 0.6). Its development can drive the development of other relevant industries. Its influence power coefficient is larger than social average level and sensitivity coefficient is small, so its driving force on the development of other industries is limited.

6. Conclusion

Information technology industry is a high-tech service industry, whose development has important meaning on the development of whole national economy. With its activities, information delivery is accurate, timely, and

comprehensive, which is helpful to raise the productivity in all walks of life. Thus, our country should strengthen the industrial support and increase investment on information technology industry to play the leading role of information technology industry on national economy.

Firstly, our country should follow the development trend of information technology industry, promote information technology industry to transform from extensive industry to intensive industry, and change the current situation that raising productivity by buying more machines and equipment. Our country should strengthen the training of workers, pay attention to the accumulation of human resource, and improve the quality of workers.

Secondly, our country should grasp the functional fixation of information technology industry reasonably and continue to keep the interactive relation between information technology industry and other industries. Today, with the rapid economic development and high integration of resources, all walks of life have more services requirement with high quality on information technology industry. Thus, information technology industry should seize the precious development opportunity to speed up industrial updating, to improve service level gradually, and to follow the demands of other industries.

Thirdly, with higher income of our residents, rise of e-commerce, and coming of "Internet+" age, information technology industry must play an increasingly vital role in personal consumption field, so it requires information technology industry to subdivide market according to different consumption groups, to capture the change of consumers' demands, and to provide personal service for different consumers. The service for individual consumer must be the new growing point of the development of information technology industry.

The development of information technology industry is influencing other industries deeply. Meanwhile, we should see that the situation of different industries also influences the development of information technology industry. Especially, some industries have influence on the fluctuation of financial situation risk in information technolo-

gy industry. As high-tech industry, information technology industry has features of fast updating on technology and short period on products. Its financial situation risk can't be ignored. Therefore, our country should pay more attention to monitor the situation of relevant industries at the same time of developing information technology industry; strengthen the real-time monitoring of the financial risks of industrial operation, investment, and financing situation and establish risk emergency mechanism to assure that the financial situation risk of this industry is reasonable.

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行业关联度与行业财务环境风险矩阵建构

——基于中国信息技术业

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【摘要】 本文以我国国家统计局发布的《2010年投入产出表》为基础,运用投入产出模型,对我国信息技术业行业关联度指标进行计算,揭示了我国信息技术业发展的产业关联状况;并基于行业关联度筛选出与我国信息技术业发展高度关联的行业,分析这些行业对信息技术业财务环境风险波动的影响;然后设计信息技术业财务环境风险矩阵,在此基础上提出进一步发展我国信息技术业的对策建议。

【关键词】 信息技术业; 行业关联度; 财务环境; 风险矩阵

一、引言

随着我国“以信息化带动工业化”战略的 implementation 和“互联网+”战略的提出,信息技术业得到空前发展。截至2015年6月,我国信息技术业主板上市公司达338家,占全部上市公司的12.1%。信息技术业与高科技紧密相连,进一步发展信息技术业,既是增强我国经济实力的重要举措,又是我国建设创新型国家的必然要求。信息技术业的发展离不开其他产业的支持,因此,如何以全面的、联系的眼光看待信息技术业和其他产业的关系,促进我国信息技术业与其他产业的协调发展,就成为亟需解决的重要问题。

西方学者对信息技术业的增长动力和内在机制、信息技术业与经济成长的关联性等方面都进行了较系统的研究,而国内对信息技术业与相关产业关系的研究尚处在定性分析的层面,定量研究较少。现有研究更多从宏观层面探究信息技术业与其他产业的关系,而很少关注信息技术业上下游产业对其财务环境风险的影响。本文利用投入产出模型对我国信息技术业的产业关联情况进行定量分析,通过对信息技术业与相关行业的行业供应关联系数和行业销售关联系数的计算,揭示信息技术业与上下游产业的关联关系,基于行业关联度探究其他行业对信息技术业财务环境风险波动的影响机理,为加快我国信息技术业发展提供决策依据。

二、信息技术业行业关联度分析

列昂惕夫在其代表作《美国经济结构1919~1929》中引入了投入产出表,开创了著名的产业关联理论。Hirschman进一步指出国民经济各部门是普遍联系、相互依存、相互影响的。某产业环境或技术的变化会通过“前向关联”和“后向关联”直接或间接影响其他产业。“后向

关联”反映某行业对其上游产业的需求关系,“前向关联”反映某行业对其下游产业的供给关系。换言之,“后向关联”通过原材料的供应实现,“前向关联”通过产品的销售实现。“前向关联”和“后向关联”的总和,可以反映某一行业与其他行业联系的紧密程度。

要分析信息技术业的关联效应,就必须对信息技术业加以明确的界定,然而信息技术业的定义却有广义和狭义之分。广义的信息技术业包括通信及相关设备制造业、计算机及相关设备制造业、通信服务业、计算机应用服务业等四个行业。而狭义的信息技术业仅仅包括信息传输、计算机服务和软件业。由于最新修订的投入产出表和《上市公司行业分类指引》都采用狭义的定义,本文也采用狭义定义加以研究。本文所采用的基础数据来源于我国国家统计局发布的《2010年投入产出表》。

(一) 信息技术业行业供应关联度:基于“后向关联”视角

信息技术业作为高科技产业,必然需要从各产业购入中间产品作为生产资料以维持生产。信息技术业为生产资料的需求方,而其他产业为供给方,这种产业间的关系即为“后向关联”。例如,信息技术业需要使用资本、劳务等生产要素,并为此付出使用成本(利息和工资),也需要购买机器设备,以及会计和管理等服务,这是其他产业中间产品对信息技术业的供应。信息技术业行业供应关联系数越大,表示信息技术业与其他行业的“后向关联”越紧密。行业供应关联系数的计算公式为:

$$\text{信息技术业行业供应关联系数} = \frac{X_{i,28}}{\sum_{i=1}^{41} X_{i,28}} \quad (i=1, 2, \dots, 41) \quad (\text{公式1})$$

式中： $X_{i,28}$ 表示其他行业对信息技术业销售的投入，信息技术业位于《2010年投入产出表》的第28列。

(二)信息技术业行业销售关联度：基于“前向关联”视角

除了“后向关联”，信息技术业还与其他行业存在着紧密的“前向关联”关系。信息技术业的中间产品和最终产品，会作为投入要素直接或间接地被其他产业耗用，信息技术业通过供给生产要素推动下游产业的发展。目前，信息技术业提供的产品和服务在各行各业都发挥了重要作用，信息技术业可以作为几乎所有行业的生产资料提供者，因此，信息技术业与其他产业的“前向关联”普遍存在。信息技术业对其他产业的“前向关联”程度可以用信息技术业行业销售关联系数来度量。系数越大，表明信息技术业为该产业提供的产品越多，对其发展的推动作用就越明显。行业销售关联系数的计算公式为：

$$\text{信息技术业行业销售关联系数} = \frac{X_{28,j}}{\sum_{j=1}^{41} X_{28,j}} \quad (j=1,2,\dots,41) \quad (\text{公式2})$$

式中： $X_{28,j}$ 表示信息技术业销售对其他行业的产出，信息技术业位于《2010年投入产出表》的第28行。

经计算，信息技术业对各行业的前向和后向关联关系如表1所示。

三、基于信息技术业行业关联度的强关联行业解析

(一)信息技术业强关联行业图建构

信息技术业的产业链条较长，与几乎所有的行业都有关联，但关联程度具有显著的差异，由表1可得到信息技术业行业供应关联系数和行业销售关联系数各排名前10的行业，这些行业与信息技术业具有高度紧密的关联关系，如图1所示。



图1 信息技术业的强关联行业

表1 信息技术业与各行业的行业关联

行业	信息技术业行业供应关联系数	排名	信息技术业行业销售关联系数	排名
电气、机械及器材制造业	0.14577	1	0.01605	14
通信设备、计算机及其他电子设备制造业	0.12651	2	0.06006	5
租赁和商务服务业	0.10614	3	0.00983	21
信息传输、计算机服务和软件业	0.09174	4	0.08936	3
批发和零售贸易业	0.06651	5	0.04037	8
造纸印刷及文教体育用品制造业	0.06600	6	0.00610	29
交通运输及仓储业	0.06492	7	0.04206	7
房地产业	0.05536	8	0.01443	17
电力、热力的生产和供应业	0.05279	9	0.03130	10
金融业	0.04383	10	0.11212	2
住宿和餐饮业	0.04159	11	0.00809	23
仪器仪表及文化办公用机械制造业	0.01898	12	0.00333	34
通用、专用设备制造业	0.01713	13	0.02534	12
交通运输设备制造业	0.01493	14	0.01413	18
居民服务和其他服务业	0.01356	15	0.00494	31
文化、体育和娱乐业	0.01185	16	0.00485	33
化学工业	0.01122	17	0.03650	9
综合技术服务业	0.01035	18	0.00542	30
食品制造及烟草加工业	0.00516	19	0.01464	16
金属制品业	0.00426	20	0.00806	24
石油加工、炼焦及核燃料加工业	0.00408	21	0.01127	20
纺织服装鞋帽皮革羽绒及其制品业	0.00401	22	0.01290	19
建筑业	0.00359	23	0.18057	1
研究与实验发展业	0.00354	24	0.00220	37
邮政业	0.00277	25	0.00315	35
水的生产和供应业	0.00259	26	0.00078	40
教育	0.00248	27	0.01477	15
工艺品及其他制造业(含废品废料)	0.00224	28	0.00776	25
木材加工及家具制造业	0.00203	29	0.00660	26
燃气生产和供应业	0.00120	30	0.00039	41
公共管理和社会组织	0.00081	31	0.05465	6
卫生、社会保障和社会福利业	0.00063	32	0.01794	13
水利、环境和公共设施管理业	0.00059	33	0.00488	32
非金属矿物制品业	0.00057	34	0.00973	22
纺织业	0.00026	35	0.00637	27
金属冶炼及压延加工业	0.00002	36	0.07996	4
农林牧渔业	0	37	0.02731	11
煤炭开采和洗选业	0	38	0.00624	28
石油和天然气开采业	0	39	0.00225	36
金属矿采选业	0	40	0.00196	38
非金属矿及其他矿采选业	0	41	0.00137	39

注：资料来源于中国国家统计局发布的《2010年投入产出表》。

(二)基于行业供应关联系数的信息技术业强关联行业解析

1. 我国信息技术业与低附加值的制造业、零售业和交通运输业以及一些资源消耗类行业,如金属冶炼及压延加工业的行业供应关联十分紧密,而与一些高附加值行业,如综合技术服务业、研究与实验发展业、教育等行业的行业供应关联不足。这说明我国信息技术业虽然发展速度较快,但发展方式较为粗放,仍有较大的提升空间。

2. 存在既为信息技术业提供生产要素,又利用信息技术业产品的产业,即环向关联产业。金融业,通信设备、计算机及其他电子设备制造业,电力、热力生产和供应业与信息技术业的行业供应关联度和行业销售关联度都比较大,说明以上行业与信息技术业的环向关联关系明显。

(三)基于行业销售关联系数的信息技术业强关联行业解析

1. 信息技术业行业销售关联的影响覆盖到所有层次的产业。在与信息技术业行业销售关联紧密的行业中,既包括属于第一产业的农林牧渔业,属于第二产业的制造业、建筑业、加工业,也包括属于第三产业的金融业,但信息技术业与第二产业的行业销售关联更加紧密。与发达国家相比,我国信息技术业呈现出与第二产业的行业销售关联度偏大、与第三产业的行业销售关联度偏小的特点,说明我国第三产业的信息化程度不足,对信息技术业的拉动作用不明显。

2. 信息技术业和研究与试验发展业、教育等产业关联度低,从一个侧面说明我国信息技术业附加值较低,科技成果转化存在障碍。

四、信息技术业财务环境风险矩阵构建

财务环境风险波动是指产业链上的某个行业发生变化后,引起与其相关的其他行业发生变化,并导致与后者直接或间接相关的行业发生变化,依次传递,从而影响整个产业链的过程。

(一)信息技术业财务环境风险影响力分析

信息技术业作为产业链中的一环,其需求的改变会影响上游产业,而供给的改变会影响下游产业,即信息技术业企业的财务状况将影响与其相关的周边行业。信息技术业对其相关行业的影响程度可以用影响力系数来衡量。影响力系数的计算公式为:

$$F_j = \frac{\sum_{i=1}^n b_{ij}}{\frac{1}{n} \sum_{j=1}^n \sum_{i=1}^n b_{ij}} \quad (\text{公式3})$$

式中: F_j 表示j行业的影响力系数;分子为列昂惕夫逆矩阵的第j列之和;分母为列昂惕夫逆矩阵列和的平均数。 $F_j=1$ 表示j行业对其他行业的影响程度等于社会平均

水平,影响力系数越大,j行业对其他行业的拉动作用就越明显。

(二)信息技术业财务环境风险感应度分析

任何行业的变化都会直接或者间接地影响其他行业,也不可避免地受到其他行业变动的的影响,即其他行业的财务状况变动将影响到信息技术业财务环境风险波动。这种财务环境风险波动程度可以用感应度系数来表示。感应度系数的计算公式为:

$$E_i = \frac{\sum_{j=1}^n b_{ij}}{\frac{1}{n} \sum_{i=1}^n \sum_{j=1}^n b_{ij}} \quad (\text{公式4})$$

式中: E_i 表示i行业的感应度系数;分子为列昂惕夫逆矩阵的第i行之和;分母为列昂惕夫逆矩阵列和的平均数。 $E_i=1$ 表示i行业对其他行业变化的感应程度等于社会平均水平,感应度系数越大,i行业对其他行业的变化就越敏感。

选取图1中与信息技术业行业供应关联系数和行业销售关联系数排名前10的行业,由于环向关联的影响,最终得到14个行业。包括电气、机械及器材制造业,通信设备、计算机及其他电子设备制造业,租赁和商务服务业,信息传输、计算机服务和软件业,批发和零售贸易业,造纸印刷及文教体育用品制造业,交通运输及仓储业,房地产业,电力、热力的生产和供应业,金融业,化学工业,建筑业,公共管理和社会组织以及金属冶炼及压延加工业。根据以上公式,经计算得到这些行业的影响力系数和感应度系数,如表2所示:

表2 各行业的影响力系数和感应度系数

行业	影响力系数	排序	感应度系数	排序
化学工业	3.52	1	1.21	4
金属冶炼及压延加工业	2.59	2	1.23	3
电力、热力的生产和供应业	2.28	3	1.10	7
交通运输及仓储业	1.60	4	0.92	9
通信设备、计算机及其他电子设备制造业	1.49	5	1.40	1
金融业	1.12	6	0.63	12
电气、机械及器材制造业	1.10	7	1.34	2
造纸印刷及文教体育用品制造业	1.09	8	1.20	5
批发和零售贸易业	1.05	9	0.60	13
租赁和商务服务业	0.85	10	1	8
信息传输、计算机服务和软件业	0.57	11	0.82	10
房地产业	0.54	12	0.56	14
建筑业	0.42	13	1.15	6
公共管理和社会组织	0.34	14	0.68	11

从表2可以看出:

1. 影响力系数大于1的产业共有9个,除金融业与批

发和零售贸易业之外,其余7个都属于第二产业。

位于前列的产业部门大多属于机械设备制造部门,这些产业都具有技术含量高、产业附加值大的特点,属于国民经济系统中的高级产业,说明这些产业的发展将对我国经济产生巨大的推动作用。信息技术业与这些行业关联度高,因此,信息技术业应该进一步服务于这些产业的发展。

2. 在信息技术业的发展过程中,许多产业发挥了强大的推动作用。在以上14个行业中,感应度系数与影响力系数均大于1的产业共有6个,这6个产业全部属于第二产业,其中有3个属于制造业。这说明以上产业能为信息技术业的发展提供巨大支持,但同时应该注意到,当经济出现快速增长时,各个产业的需求都在增加,为满足社会生产的需求,这6个产业的需求压力也会不断加大,所以这些产业往往容易成为制约信息技术业发展的“瓶颈”。

此外,在第三产业中,只有租赁和商务服务业的感应度系数大于1,这说明该部门对信息技术业的推动作用在增强。

3. 从表2中可以看出,与信息技术业关联度较高的产业中,大部分的第三产业影响力系数和感应度系数都偏低,这是由服务业的产业特点决定的。服务业作为支持性行业,大多数产品都不能进入社会再生产过程,因此其影响力系数和感应度系数低于第二产业是正常现象。

五、信息技术业财务环境风险矩阵

以社会平均值(1.0, 1.0)为坐标原点、影响力系数为坐标轴横轴、感应度系数为坐标轴纵轴,形成信息技术业财务环境风险矩阵,如图2所示。

1. 处于区域 I (第一象限)的行的影响力系数和感应度系数均大于社会平均值 1.0,这些行业具有强辐射和

强制约的双重性质。

第一象限的行业包括:化学工业,金属冶炼及压延加工业,电力、热力的生产和供应业,通信设备、计算机及其他电子设备制造业,电气、机械及器材制造业,造纸印刷及文教体育用品制造业共6个行业。

第一象限中的行业不仅对其他行业的感应程度大,还对其他行业具有很强的拉动能力。在经济发展过程中,这6个行业既是其他行业原材料的主要供应者,又是其他行业产品的重要消费者。这类行业一方面通过提供原材料对下游产业的发展产生推动作用,一方面又通过消耗中间产品对上游产业的发展产生拉动作用。它们已经成为国民经济体系中的支柱产业,对国民经济发展具有举足轻重的作用。这类行业的发展将直接决定国民经济整体质量,是政府予以重点支持的关键性行业。

2. 处于区域 II (第二象限)的行的影响力系数小于1、感应度系数大于1,属于弱辐射强制约性的行业。第二象限的行业包括:租赁和商务服务业及建筑业2个行业。第二象限中的行业对经济发展有着较强的制约作用。由于处于第二象限内的行业容易受到其他行业的影响,为保证今后一定时期内国民经济健康发展,应该制定相关政策防范这些行业可能存在的系统性风险。

3. 处于区域 III (第三象限)的行的影响力系数和感应度系数均小于社会平均值1,这些行业具有弱辐射和弱制约性的特性。位于第三象限的行业有:信息传输、计算机服务和软件业,房地产业,公共管理和社会组织等3个行业。

信息技术业位于第三象限,说明目前其影响力系数与感应度系数均较低,这是由服务业的行业特点决定的。应该看到,信息技术业作为高新技术较为集中的领域,具有辐射和影响其他产业的高技术势能。考虑到今后一段

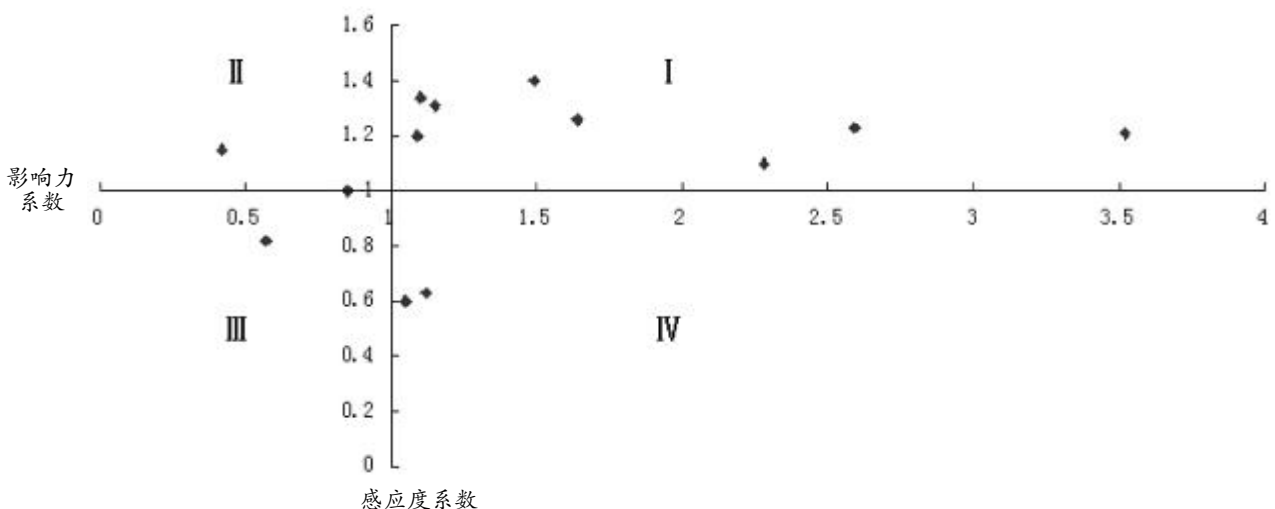


图2 信息技术业财务环境风险矩阵

时期我国经济快速健康发展的需要,应该进一步加快信息技术业由低附加值的制造业向高附加值的服务业转型升级的步伐,从而使信息技术业投资在国民经济发展中产生更大的投资乘数效应。

4. 处于区域Ⅳ(第四象限)的行的影响力系数大于社会平均值1,而感应度系数小于社会平均值1。属于强辐射弱制约力的行业。第四象限的行业包括:交通运输及仓储业、金融业、批发和零售贸易业等3个行业。

从图2可以看出,位于第四象限的行业大都处于成熟期。它们的发展对其他行业有很强的拉动作用,而且受其他行业的影响较小。最典型的是批发和零售贸易业(影响力系数为1.05,感应度系数为0.60)。它的发展能够缩短其他行业的生产周期。虽然它的影响力系数大于社会平均水平,但是由于感应度系数较小,所以它对其他行业的推动作用是有限的。

六、结论

信息技术业是一门带有高科技性质的服务性产业,其发展对整个国民经济的发展意义重大,信息技术业通过它的活动使经济信息的传递更加及时、准确、全面,有利于各行业提高劳动生产率。因此,应该进一步加大对信息技术业的产业扶持和资金投入,发挥信息技术业对国民经济的引领作用。具体措施包括:

首先,要顺应信息技术业的行业发展趋势,推动信息技术业由粗放型向集约型转化,改变过多依赖购买机器设备提高生产率的现状。应加大对从业者的培训力度,提高从业者素质,同时重视高素质人才的积累,防止人才流失。

其次,应该合理把握信息技术业的行业功能定位,继续保持信息技术业与其他行业良性的互助关系。在经济高速发展和资源高度整合的今天,各行业对信息技术业提出了数量更大,也更个性化的服务要求。因此,信息技术业本身应该抓住难得的发展机遇,加快产业升级的步

伐,逐步提升服务水平,顺应其他行业的需求。

最后,随着我国居民收入水平迅速上升,电子商务的兴起和“互联网+”时代的到来,信息技术业必将在个人消费领域发挥越来越重要的作用。这就要求信息技术业企业根据不同消费群体建立细分市场,敏锐捕捉消费者需求的变化,为不同消费者提供个性化的服务。针对个人消费者的服务必将成为信息技术业发展的新增长点。

信息技术业的发展正深刻地影响着其他行业,同时应该看到,各行业的景气状况也反向影响着信息技术业的发展,尤其是部分行业(主要指第二产业)对信息技术业财务环境风险的波动造成一定影响。信息技术业作为高新技术产业,具有技术更新快、产品生命周期短的特点,其行业财务环境风险不容小觑。因此,在大力发展信息技术业的同时,应重视该行业关联行业的景气程度监测,加强对该行业经营、投资、筹资财务环境风险的实时监控,并建立风险应急机制,确保该行业财务环境风险处于合理水平。

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