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Research on International Competitiveness and Influencing Factors of ICT Manufacturing Industry in China

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Abstract

Information and Communication Technology (ICT) industry is an important driving force for the development of the world economy in the 21st century. With the application, progress and popularization of information and communication technology, ICT industry is not only the core component of science and technology in the world today, but also an important force to promote the development of the world economy. As one of the core industries in the information age, ICT industry plays a fundamental, leading and supporting role in promoting the development of productive forces, promoting global economic growth and eliminating the "digital divide". Major developed economies regard it as a strategic pillar industry and have introduced various supporting conditions to promote the rapid development of their ICT industry. Based on the diamond model, this paper explores the influencing factors of the international competitiveness of ICT manufacturing industry through empirical analysis. It is found that the basic and long-term factors such as talent and capital have the strongest positive impact on the international competitiveness of ICT manufacturing industry, the positive impact of excellent industrial development environment is slightly lower, the impact of existing technological capabilities is positive but the weakest, and international capital has a certain negative impact on the international competitiveness of ICT manufacturing industry.

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Keywords

ICT, manufacturing industry, international competitiveness, influencing factors, technologies.

Introduction

Information and Communication Technology (ICT) industry is an important driving force for the development of the world economy in the 21st century. With the application, progress and popularization of information and communication technology, ICT industry is not only the core component of science and technology in the world today, but also an important force to promote the development of the world economy [ZTE Releases 2018 Financial Report, www]. As one of the core industries in the information age, ICT industry plays a fundamental, leading and supporting role in promoting the development of productive forces, promoting global economic growth and eliminating the "digital divide". Major developed economies regard it as a strategic pillar industry and have introduced various supporting conditions to promote the rapid development of their ICT industry. China also attaches great importance to and strongly supports the development of ICT industry, and has achieved good results. However, since 2018, a series of sanctions imposed by the United States on China's ICT industry have seriously restricted the innovation and development of China's ICT industry, and made China deeply aware of the huge gap with the United States in the field of ICT. People from all walks of life have begun to study the gap between China and the United States in the field of ICT, and strive to find a way to break the situation.

In order to solve the above problems, it is necessary to conduct a detailed study on the international competitiveness level and influencing factors of China's ICT manufacturing industry under the new situation, and find out the crux by comparing with advanced countries, so as to suit the remedy to the case, and put forward operable countermeasures and suggestions to improve the international competitiveness of China's ICT manufacturing industry and ensure industrial security.

Overview of ICT Manufacturing Development in China

2.1 Rapid expansion of industrial scale

According to IDC's latest forecast, the scale of China's ICT market (including the third plaorm and innovation accelerator technology) will reach 711.1 billion US dollars in 2021, an increase of 9.3% over 2020, returning to the relatively high-speed growth after the epidemic. From 2021 to 2024, the total expenditure on digital transformation will reach 1.5 trillion US dollars, with an average annual growth rate of 17%, far exceeding the world average growth rate in the same period. In 2021, the market share of China's ICT manufacturing industry reached 27%, ranking first in the world (10).

2.2 Steady growth of investment in industrial fixed assets

According to the statistics of the Ministry of Industry and Information Technology, since 2014, the growth rate of fixed investment in China's ICT manufacturing industry has been stable at more than 10%, the fixed investment in projects with more than 5 million yuan in 2021 has exceeded 270 million yuan, an increase of 16.8% over the same period of last year, and the fixed asset investment in ICT manufacturing industry in 2021 has increased by 12.5% compared with 2020 [CT Industry Development Status…, www]. Faster than the growth of manufacturing investment. In addition, China's ICT industry chain is gradually pushing forward to high value-added areas, and investment in integrated circuit components, special materials and smart consumer equipment is increasing.

2.3 Industrial R & D expenditure continues to increase

Countries around the world have been constantly strengthening and improving the innovation system, and innovation is even an important part of China's national strategy and industrial planning, so as to timely adjust the output benefits brought by R & D innovation and achieve high efficiency of innovation. The development direction of ICT industry in the world is more focused on the frontier areas such as 6G, artificial intelligence, cloud computing, big data computing, block chain, etc., continuously increasing R & D investment, strengthening personnel training, and strengthening supporting infrastructure. The R & D expenditure of China's ICT industry is on the rise. In terms of patent achievements, the number of patents in the ICT industry is increasing year by year. According to the statistics of the Ministry of Industry and Information Technology, the R & D expenditure of China's ICT manufacturing industry increased by 7.5% year-on-year in 2021, maintaining a relatively rapid growth trend, with the largest R & D expenditure on semiconductor materials and integrated circuits, with a growth rate of more than 10% in the past two years. High R & D investment also brings fruiul results. In 2021, the number of patent applications for invention in China's ICT manufacturing industry exceeded 120,000, an increase of 44.8% over the previous year (13), accounting for 30% of the total number of patent applications for invention in China, ranking first in all industries.

An Empirical Analysis of the Factors Influencing the International Competitiveness of China's ICT Manufacturing Industry

3.1 Variable selection and data sources

3.1.1 Variable selection and description

This paper refers to Porter's diamond model and combines the characteristics of ICT manufacturing industry, which is knowledge-intensive, technology-intensive and capital-intensive, to screen the relevant variables [Yin Weihua, 2016]. In this paper, the human factor, the capital factor and the technology factor are separated from the production factors. In addition, due to the difficulty of obtaining the data of the two elements of enterprise strategy/structure and opportunity, which are not comparable and quantifiable, this chapter does not consider them for the time being. Finally, this chapter constructs the explanatory variable system needed for empirical research from the six dimensions of human factor, capital factor, technology factor, demand condition, related industry and supporting industry, and government. Variables are described in Table 3-1.

3.1.2 Data source and processing

The data set used in this empirical study includes 152 data samples of 18 variables from China, the United States, Japan, South Korea, the United Kingdom, France, Germany and Italy in the 19 years from 2003 to 2021. Data sources are public statistics from authoritative institutions, including the European Union Joint Research Center (JRC), OECD database, ScimagoJournal & CountryRank, World Intellectual Property Organization (WIPO), World Bank DataBank, etc. [Ma Jingmei, Ding Yibing, 2019].

Because there are many sources of data sets, different data publishers have different classifications of ICT manufacturing industry. In order to ensure the uniform comparability of data, this paper refers to the classification and comparison methods of the European Union Joint Research Center in the process of data collection, and screens the selected data. In addition, the dimension difference of this data set is large, in order to avoid too much interference to the empirical study caused by too large data magnitude. In this paper, the number of ICT manufacturing employees, the number of ICT manufacturing researchers, ICT manufacturing labor productivity, ICT patents, SCI literature, SCI literature net citation, ICT manufacturing enterprise R & D expenditure, government allocated ICT industry R & D expenditure, per capita GDP, the ten absolute variables of the added value of ICT service industry are treated logarithmically, while the other variables are relative and are not treated. Due to the large number of variables used in the empirical study in this section, for the readability of the subsequent analysis results, the variable codes are uniformly changed to appropriate abbreviations in English to participate in the regression. The variable codes, variable names and data sources are shown in the following table.

Table 1 - Variable Code and Variable Data Source

Variable code	Variable name	Source of data
LnEMP	ICT manufacturing employment	JRC
LnRERD	Number of ICT manufacturing researchers	JRC
PROD	ICT manufacturing labor productivity	JRC
FDI	Proportion of FDI to GDP	The World Bank
OFDI	OFDI as a percentage of GDP	The World Bank
SAV	Savings rate	The World Bank
CAP	Total capital formation as a percentage of GDP	The World Bank
LnPAT	Number of ICT patents	WIPO
LnSCI	Number of SCI documents	Scimago
LnNCIT	Net citation of SCI literature	Scimago
LnBERD	R & D expenditure of ICT manufacturing enterprises	JRC
PBERD	Proportion of R & D expenditure of ICT manufacturing enterprises	JRC
LnGBARD	R & D expenditure of ICT industry allocated by the government	OECD
RD	Total R & D expenditure intensity	The World Bank
PGDP	GDP per capita	The World Bank
LnVAS	The added value of ICT services	JRC
CRE	Proportion of domestic private sector credit	The World Bank
STO	Share of stock trading volume in GDP	The World Bank

3.2 Model setting and processing

3.2.1 Model setting

According to the previous analysis, RCA index, CA index and TLNETindex were used as explanatory variables to regress the above explanatory variables. Because the data in this paper is panel data, the fixed effect model is used for empirical research, and the econometric model of the factors affecting the international competitiveness of ICT industry is set as follows:

3.1.1 Variable selection and description
3.1.2 Data source and processing
3.2.1 Model setting
3.2.2 Model processing
3.3.1KMO and Bartlett test
3.3.2 Interpretation of Total Variance
3.3.3 Determination of principal component factors
3.3.4 Principal Component Factor Expression
3.3.5 Principal Component Factor Scores
3.4.1 Unit root test
3.4.2 Global Regression
3.4.3 Robustness test

Where I is the ith country, t is the tth period, K is the kth explanatory variable, RCAit, CAit, and TLitare all explained variables, Xkitis an explanatory variable, is an individual fixed effect, and is a partial regression coefficient. is the regression constant and is the residual term [Rong Jinxia, Gu Hao, 2016].

3.2.2 Model processing

Since there are many variables selected in this chapter and the relationship between variables is relatively close, according to the empirical analysis, it is preliminarily judged that the above model has a serious multicollinearity problem. Therefore, the correlation analysis of the above 18 variables is carried out first, and the correlation coefficient matrix is shown in the following table.

Table 2 - Correlation coefficient matrix of each explanatory variable

	LNPAT	LNSCI	LNNCIT	LNPGDP	LNEMP	LNPROD	LNRERD	LNBERD	PBERD
LNPAT	1.000	0.521	0.132	0.106	0.595	0.284	0.863	0.921	0.487
LNSCI	0.521	1.000	0.403	-0.065	0.500	-0.038	0.463	0.490	-0.218
LNNCIT	0.132	0.403	1.000	0.159	0.059	0.148	0.134	0.196	-0.244
LNPGDP	0.106	-0.065	0.159	1.000	-0.657	0.927	-0.309	0.005	-0.203
LNEMP	0.595	0.500	0.059	-0.657	1.000	-0.536	0.841	0.682	0.409
LNPROD	0.284	-0.038	0.148	0.927	-0.536	1.000	-0.089	0.207	0.047
LNRERD	0.863	0.463	0.134	-0.309	0.841	-0.089	1.000	0.932	0.563
LNBERD	0.921	0.490	0.196	0.005	0.682	0.207	0.932	1.000	0.531
PBERD	0.487	-0.218	-0.244	-0.203	0.409	0.047	0.563	0.531	1.000
LNGBARD	0.692	0.678	0.303	0.207	0.351	0.239	0.545	0.607	-0.122
LNVAS	0.592	0.783	0.513	0.342	0.278	0.326	0.436	0.577	-0.300
STO	0.515	0.547	0.438	0.135	0.340	0.254	0.455	0.548	0.206
RD	0.774	0.092	-0.127	0.326	0.220	0.525	0.588	0.704	0.642
CAP	0.325	0.277	-0.146	-0.810	0.814	-0.671	0.594	0.387	0.473
CRE	0.684	0.492	0.318	0.142	0.446	0.190	0.571	0.607	0.212
SAV	0.321	0.204	-0.249	-0.775	0.775	-0.637	0.582	0.381	0.482
PFDI	-0.315	0.073	0.179	-0.213	-0.046	-0.307	-0.210	-0.325	-0.308
POFDI	-0.118	-0.137	0.068	0.289	-0.270	0.214	-0.181	-0.116	-0.195

Table 3 - Correlation coefficient matrix of each explanatory variable (continued)

	LNGBRD	LNVAS	STO	RD	CAP	CRE	SAV	PFDI	POFDI
LNPAT	0.692	0.592	0.515	0.774	0.325	0.684	0.321	-0.315	-0.118
LNSCI	0.678	0.783	0.547	0.092	0.277	0.492	0.204	0.073	-0.137
LNNCIT	0.303	0.513	0.438	-0.127	-0.146	0.318	-0.249	0.179	0.068
LNPGDP	0.207	0.342	0.135	0.326	-0.810	0.142	-0.775	-0.213	0.289
LNEMP	0.351	0.278	0.340	0.220	0.814	0.446	0.775	-0.046	-0.270
LNPROD	0.239	0.326	0.254	0.525	-0.671	0.190	-0.637	-0.307	0.214
LNRERD	0.545	0.436	0.455	0.588	0.594	0.571	0.582	-0.210	-0.181
LNBERD	0.607	0.577	0.548	0.704	0.387	0.607	0.381	-0.325	-0.116
PBERD	-0.122	-0.300	0.206	0.642	0.473	0.212	0.482	-0.308	-0.195
LNGBARD	1.000	0.801	0.362	0.328	0.060	0.560	0.011	-0.226	-0.133
LNVAS	0.801	1.000	0.563	0.178	-0.137	0.659	-0.219	-0.045	0.010
STO	0.362	0.563	1.000	0.266	0.087	0.623	-0.033	-0.049	-0.016
RD	0.328	0.178	0.266	1.000	0.072	0.386	0.183	-0.392	0.043
CAP	0.060	-0.137	0.087	0.072	1.000	0.046	0.943	0.032	-0.264
CRE	0.560	0.659	0.623	0.386	0.046	1.000	-0.084	-0.062	-0.040
SAV	0.011	-0.219	-0.033	0.183	0.943	-0.084	1.000	-0.029	-0.227
PFDI	-0.226	-0.045	-0.049	-0.392	0.032	-0.062	-0.029	1.000	0.463
POFDI	-0.133	0.010	-0.016	0.043	-0.264	-0.040	-0.227	0.463	1.000

It can be seen from the above table that the correlation coefficient between some variables is greater than 0.8, and there is a strong correlation. If the above variables are directly regressed, the parameter estimates will be unstable and not significant, and the above variables need to be further processed.

The main methods to deal with multicollinearity are principal component analysis, ridge regression estimation, stepwise regression and so on. In this paper, the principal component analysis is used to process the data and the model. In this paper, we choose to use principal component analysis to deal with the variable data set and find out the common factors, which is prepared for the subsequent empirical research.

3.3 Principal component analysis

The first step of principal component analysis is correlation analysis of relevant variables, which has been achieved in the above validation process and will not be repeated here. The next step is KMO and Bartlett test.

3.3.1 KMO and Bartlett test

KMO and Bartlett sphericity tests are used to verify whether the initial variables are suitable for principal component analysis. The results in the table below show that the original variables selected in this chapter are suitable for principal component analysis.

Table 4 - KMO and Bartlett test

KMO sampling appropriateness measure		**0.748**
Bartlett sphericity test	Approximate chi-square	4459340
	Degrees of freedom	153
	Significance	0.000

3.3.2 Interpretation of Total Variance

The total variance interpretation shows the information of the original variables covered by the extracted principal components, and the table below embodies the original

Information about the original variables covered after extracting the principal components from the 18 variables.

Table 5 - Interpretation of Total Variance

Ingre-dient	**Initial eigenvalue**			**Extract the sum of the load squares**			**The sum of the squares of the rotating loads**		
	Total	**Variance, %**	**Cumulative, %**	**Total**	**Variance, %**	**Cumulative, %**	**Total**	**Variance, %**	**Cumulative, %**
1	6.666	37.035	37.035	6.666	37.035	37.035	4.873	27.070	27.070
2	4.462	24.791	61.825	4.462	24.791	61.825	4.574	25.412	52.482
3	2.577	14.316	76.142	2.577	14.316	76.142	4.021	22.339	74.821
4	1.333	7.406	83.548	1.333	7.406	83.548	1.571	8.727	83.548
5	0.903	5.015	88.562						
6	0.561	3.115	91.678						
7	0.470	2.610	94.288						
8	0.353	1.964	96.252						
9	0.195	1.083	97.334						
10	0.180	0.999	98.334						
11	0.112	0.620	98.953						
12	0.066	0.367	99.321						
13	0.045	0.251	99.572						
14	0.028	0.157	99.728						
15	0.020	0.109	99.837						
16	0.016	0.089	99.926						
17	0.008	0.046	99.972						
18	0.005	0.028	100.00						

The second column in the table reflects the initial characteristic value of each component. If the initial characteristic value is greater than 1, it indicates that the component is better described than the original single variable. If it is less than 1, it indicates that it is better to use the original single variable to explain. Generally, the component with characteristic value greater than 1 is extracted as the principal component. The third column is the variance contribution rate of each component, the greater the contribution rate, the stronger the ability of this factor to explain the total variance, and the greater the degree of importance. It can be seen from the table that the variance of the extracted four principal components accounts for 83.548% of the total variance, basically retaining the information of most of the original indicators, and the extracted four principal components cover most of the original indicators.

3.3.3 Determination of principal component factors

The rotated component matrix table gives the load distribution of the original variables on each principal component factor, that is, it shows the original variables that each principal component mainly represents. Accord to that distribution of the original variable in each principal component factor, the principal component factor can be given an economic meaning [Li Feng, 2015].

Table 6 - Rotated Composition Matrix

	Principal Component			
	Fl	**F2**	**F3**	**F4**
LNVAS	0.949	-0.190	0.035	-0.053
LNSCI	0.865	0.234	-0.048	-0.063
LNGBARD	0.802	-0.056	0.175	-0.283
CRE	0.707	-0.026	0.383	0.050
STO	0.659	-0.023	0.307	0.132
LNNCIT	0.631	-0.122	-0.203	0.220
LNPGDP	0.149	-0.955	0.137	0.008
CAP	0.034	0.923	0.258	-0.056
SAV	-0.078	0.887	0.323	-0.084
LNPROD	0.155	-0.880	0.374	-0.032
LNEMP	0.417	0.802	0.351	-0.083
RD	0.119	-0.180	0.917	-0.083
PBERD	-0.245	0.277	0.845	-0.076
LNPAT	0.594	0.103	0.747	-0.152
LNBERD	0.578	0.194	0.740	-0.126
LNRERD	0.506	0.470	0.670	-0.099
POFDI	-0.049	-0.278	0.067	0.835
PFDI	0.044	0.198	-0.370	0.800

Extraction method: principal component analysis. Rotation method: Kaiser normalized maximum variance method. a. The rotation has converged after 5 iterations.

As shown in the above table, the six variables in F1, namely, the added value of ICT service industry, the amount of SCI literature and net citation of computer science, the R & D investment of ICT manufacturing industry allocated by the government, the credit level of domestic private sector, and the proportion of stock market trading volume to GDP, have high loads. The common feature of these six variables is that they all belong to the influencing factors of the external environment of the industry, so F1 can be named as the environmental incentive factor.

The five variables of per capita GDP, the proportion of total capital formation to GDP, the savings rate, the number of ICT manufacturing employees and the labor productivity of ICT manufacturing industry in F2 have higher loads. These five variables are all elements related to human and capital, and are also the key supporting elements to support technological innovation, so F2 can be named as the technological supporting factor.

F3 in the intensity of R & D expenditure, the proportion of R & D expenditure of ICT manufacturing enterprises, the number of patents in ICT industry,

ICT manufacturing enterprises' R & D expenditure and the number of ICT manufacturing researchers have a higher load on these five variables. These five variables are closely related to the level of technological innovation, so F3 can be named as the core factor of technology.

F4 has a high load on the two variables of the proportion of net FDI inflow to GDP and the proportion of net OFDI outflow to GDP, which directly measure the level of international investment, so F4 can be named as the international investment factor.

3.3.4 Principal Component Factor Expression

After determining the principal component factors and their meanings, the expression of each principal component factor can be written according to the principal component score coefficient matrix.

Table 7 - Component Score Coefficient Matrix

	Fl	F2	F3	F4
LNPAT	0.064	-0.010	0.158	-0.009
LNSCI	0.219	0.060	-0.131	-0.046
LNNCIT	0.175	-0.007	-0.103	0.123
LNPGDP	0.014	-0.224	0.073	-0.007
LNEMP	0.070	0.168	0.023	0.011
LNPROD	-0.010	-0.218	0.143	-0.003
LNRERD	0.054	0.078	0.132	0.030
LNBERD	0.062	0.012	0.157	0.011
PBERD	-0.151	0.021	0.285	0.066
LNGBARD	0.178	-0.024	-0.065	-0.181
LNVAS	0.227	-0.039	-0.092	-0.042
STO	0.127	-0.010	0.047	0.131
RD	-0.073	-0.085	0.289	0.054
CAP	-0.013	0.198	0.033	0.023
CRE	0.130	-0.016	0.056	0.082
SAV	-0.048	0.185	0.065	0.011
PFDI	0.050	0.088	0.033	0.523
POFDI	-0.024	-0.041	0.148	0.590

From the above table, the expression can be written as follows:

Fl=0.064*LNPAT+0.219*LNSCI+0.175*LNNCIT+0.014*LNPGDP+0.070*LNEMP-0.010*LNPROD+0.054*LNRERD+0.062*LNBERD-0.151*PBERD+0.178*LNGBARD+0.227*LNVAS+0.127*STO-0.073*RD-0.013*CAP+0.130*CRE-0.048*SAV+0.050*PFDI-0.024*POFDI

In the same way, the other three factors will not be listed in this article due to the limitation of space.

3.3.5 Principal Component Factor Scores

According to the above data, the score of each principal component factor can be calculated, and the specific results are shown in the following table.

Table 8 - Principal Component Factor Scores of Countries

		2003	2005	2007	2009	2011	2013	2015	2017	2019	2021
China	Fl	-1.23	-0.86	-0.31	0.46	0.80	0.89	1.02	1.74	1.41	1.32
	F2	2.74	2.85	2.94	2.83	2.58	2.53	2.29	2.00	1.91	1.79
	F3	-1.09	-0.93	-0.92	-0.76	-0.63	-0.57	-0.41	-0.02	-0.11	0.11
	F4	0.07	0.07	0.23	0.44	-0.02	0.04	-0.18	0.39	-0.54	-1.08
America	F1	1.66	1.74	1.96	2.24	2.10	2.14	2.02	2.13	2.02	1.52
	F2	-0.17	-0.42	-0.40	-0.52	-0.77	-0.70	-0.59	-0.54	-0.68	-0.65
	F3	0.25	-0.02	0.05	0.43	0.27	0.37	0.37	0.38	0.51	0.63
	F4	-0.07	-0.34	-0.56	1.05	0.05	0.43	0.17	0.30	0.08	-0.86
Japan	F1	0.00	0.17	0.24	0.41	0.49	0.47	0.49	0.38	0.37	0.10
	F2	0.08	-0.10	-0.18	-0.12	-0.32	-0.45	-0.36	-0.27	-0.27	-0.05
	F3	1.04	0.90	1.07	1.11	0.84	0.98	1.02	0.99	1.01	1.31
	F4	-0.98	-0.99	-0.89	-0.53	-0.85	-0.80	-0.34	-0.33	-0.20	0.05
Korea	F1	-1.65	-1.43	-1.27	-0.87	-0.95	-0.94	-1.12	-1.00	-1.07	-1.37
	F2	0.74	0.61	0.55	0.33	0.34	0.24	0.10	0.15	0.13	0.01
	F3	0.86	1.03	1.38	1.62	1.62	2.00	2.21	2.16	2.46	2.74
	F4	-0.51	-0.51	0.01	0.11	0.32	0.35	0.20	-0.09	0.30	-0.06
The UK	F1	-0.52	-0.44	-0.15	0.15	0.20	0.05	0.14	0.15	0.06	-0.27
	F2	-0.28	-0.40	-0.29	-0.68	-0.87	-0.93	-0.89	-0.79	-0.80	-0.90
	F3	-0.70	-0.90	-0.79	-0.36	-1.43	-1.04	-1.30	-1.62	-0.95	-1.22
	F4	1.34	0.50	3.68	4.49	-1.40	0.14	-0.37	-1.63	1.77	-2.18
France	F1	-1.15	-0.98	-0.79	-0.48	-0.08	-0.05	-0.08	-0.20	-0.24	-0.57
	F2	-0.21	-0.42	-0.46	-0.49	-0.74	-0.68	-0.68	-0.56	-0.53	-0.44
	F3	0.14	-0.09	-0.01	-0.08	-0.53	-0.56	-0.61	-0.45	-0.37	-0.07
	F4	1.81	0.36	1.55	1.34	-0.51	-0.51	-1.14	-0.48	-0.69	-0.72
Germany	F1	-0.61	-0.46	-0.37	-0.14	-0.10	-0.11	-0.13	-0.20	-0.24	-0.61
	F2	-0.05	-0.31	-0.44	-0.50	-0.52	-0.41	-0.47	-0.45	-0.43	-0.40
	F3	-0.04	-0.19	-0.07	0.03	-0.28	-0.21	-0.24	-0.08	-0.05	0.10
	F4	0.71	-0.07	0.20	0.39	-0.03	0.21	-0.23	0.19	0.61	-0.35
Italy	F1	-1.64	-1.31	-1.09	-0.70	-0.65	-0.68	-0.77	-0.70	-0.82	-1.09
	F2	-0.06	-0.18	-0.29	-0.39	-0.50	-0.52	-0.57	-0.52	-0.46	-0.45
	F3	-1.01	-1.17	-1.07	-0.97	-1.36	-1.14	-1.24	-1.30	-1.22	-0.99
	F4	-0.39	-0.82	0.08	1.15	-1.04	-0.34	-0.84	-0.81	-0.99	-0.69

After calculating the score of each component, the RCA index, CA index and TLNETindex can be regressed with the four principal component factors as independent variables.

3.4 Regression analysis

Using the model processed in 3.2 and the relevant data calculated in 3.3, and taking the four principal component factors obtained in 3.3 as independent variables, we can make an empirical analysis of the factors affecting the international competitiveness of ICT manufacturing industry.

3.4.1 Unit root test

In order to avoid the problem of false regression, when dealing with panel data, it is generally necessary to conduct a unit root test to see if the data is stable. Table 3-9 shows the unit root test results of all variables. It can be seen that all data pass the unit root test at the significance level of 5%. Therefore, the panel data used in the empirical regression is stable and can be used for regression.

Table 9 - Unit Root Test Results

Variables	Statistics		P-value
Rea	-1.6565	0.0488	Smooth

Variables	Statistics		P-value
Ca	-3.2459	0.0006	Smooth
T1	-3.8426	0.0001	Smooth
Fl	-1.8088	0.0352	Smooth
F2	-3.7071	0.0001	Smooth
F3	-1.8125	0.0342	Smooth
F4	-3.0973	0.0010	Smooth

3.4.2 Global Regression

In the regression model of panel data, the individual fixed effect fully considers the impact of heterogeneity of countries on the international competitiveness of ICT manufacturing industry, while the random effect model considers that the heterogeneity of countries is random and unrelated to the explained variables, so it is necessary to determine which model should be used before the overall regression [Sun Lingxi, Cao Linlin, 2016]. In this paper, Hausmann test is used to judge whether to choose fixed effect model or random effect model. After testing the three explanatory variables, the P value of Hausmann test is 0, and the null hypothesis is rejected at the significance level of 1%, indicating that the use of fixed effects is better. The overall regression results are shown in the table below.

Table 10 - Overall Regression Results

VARIABLES	(1) rca	(2) ca	(3) tl
fl	0.425***	0.357***	-0.033***
	(7.52)	(7.43)	(-2.76)
f2	1.152***	0.952***	-0.110***
	(8.90)	(8.64)	(-3.97)
f3	0.399***	0.304***	0.024
	(5.63)	(5.04)	(1.59)
f4	0.079***	0.090***	0.006
	(-3.36)	(-4.49)	(1.10)
Constant	1.096***	0.092***	0.002
	(7430)	(7.32)	(0.73)
Observations	152	152	152
CompanyFE	YES	YES	YES
YearFE	YES	YES	YES
t-statisticsinparentheses		***p<0.01,	**p<0.05, *p<0.1

The above table lists the overall regression results with three different explanatory variables. Among them, the regression results with RCA index and CA index as the explanatory variables are similar, while the regression results with TL index as the explanatory variable are quite different from the former two. Therefore, the regression results of the former two are analyzed first, and the analysis results of the il index are analyzed separately.

(1) Analysis of regression results of RCA index and CA index

The regression results of RCA and CA index are similar, the four factor variables have significant effects, and the direction is the same, only a slight difference in the size of the regression coefficient. The coefficient corresponding to the CA index is smaller, reflecting that the four independent variables have a relatively smaller impact on the CA index, which may be due to the fact that the CA index excludes the impact of import trade, thus the impact of related factors has declined relative to the RCA index. Generally speaking, there is little difference between the two.

From the perspective of the influence of independent variables on RCA and CA index, Fl, F2 and F3 all have a positive impact on the international competitiveness of the industry, among which the technical support factor F2 has the greatest impact, followed by the environmental incentive factor F1, and the technological core factor F3 has a relatively small impact. The international capital factor F4 has a negative impact on the international competitiveness of the industry. By analyzing the specific influencing factors represented by each factor, the following conclusions can be drawn.

Human factor and capital factor are the most basic factors affecting the industrial international competitiveness. From the empirical results, they have the greatest impact on the industrial international competitiveness. The improvement of the scale and quality of human resources and the improvement of capital support have the strongest effect on enhancing the international competitiveness of ICT manufacturing industry.

The support of related industries and supporting industries, scientific research departments and government departments mainly reflects the external business development environment of a country's industry, which is quite different from the role of human and capital factors, but the improvement of the overall industrial environment can also provide a strong boost to the enhancement of the international competitiveness of ICT manufacturing industry.

The number of patents, R & D investment and other factors mainly reflect the existing technological level of ICT manufacturing industry in a country. The impact of this part of the factors is slightly weaker than the environmental incentive factors, indicating that the accumulation of existing technology has a certain effect on the competitiveness of ICT manufacturing industry, but compared with the environmental factors and more basic human capital factors, the impact is smaller.

International investment has a negative impact on the international competitiveness of a country's ICT industry.

(2) Analysis of TL index regression results

The regression result of TL index is not ideal. The results of only two of the four variables were significant, and the coefficients of the two variables with higher significance were too small, and the sign direction was contrary to common sense [Yu Jingkai, Jiang Xueying, 2016]. The independent variables selected in this paper have been verified for a long time and are generally recognized to have a significant impact on industrial competitiveness, which shows that there are big problems in using TL index to represent industrial international competitiveness for empirical analysis. This paper argues that the reason is that the technical measurement indicators used in the TL index do not conform to the actual technical situation of ICT manufacturing industry in various countries.

3.4.3 Robustness test

In the overall regression, this paper uses RCA index, CA index and TL index respectively for empirical analysis, in which the regression results of RCA index and CA index are similar, and the relevant explanatory variables have significant results, which is equivalent to a robustness test using the method of replacing variables, and the model results are relatively stable. In this section, the RCA index and CA index will be regressed again using the lagged variables of the four factors to ensure that there is no endogeneity problem in the model [Wu Jiadong, Zeng Haiying, 2019]. The regression results are shown in the table below.

Table 11 - Endogenous Test

VARIABLES	**(1) ca**	**(2) rca**
L.fl	0.299***	0.302***
	(6.36)	(5.58)

VARIABLES	(1) ca	(2) rca
L.f2	0.916***	1.065***
	(8.58)	(8.68)
L.f3	0.236***	0.350***
	(3.76)	(4.85)
L.f4	.0.073***	.0.094***
	(-3.54)	(-3.94)
Constant	0.089***	1.093***
	(7.25)	(77.15)
Observations	144	144
CountryFE	YES	YES
YearFE	YES	YES

Through the above endogenous test, it can be proved that the environmental incentive factor, technical support factor and technical core factor have a positive impact on the international competitiveness of ICT manufacturing industry, while the international investment factor has a negative impact on the international competitiveness of ICT manufacturing industry, and the regression results are significant.

Conclusion

Through factor analysis and regression analysis, the main conclusions are as follows:

Firstly, human and capital factors are the most basic factors that affect the international competitiveness of the industry. From the empirical results, they have the greatest impact on the international competitiveness of the industry. The improvement of the scale and quality of human resources and the improvement of capital support have the strongest effect on enhancing the international competence of ICT manufacturing industry.

Secondly, the support of relevant industries and supporting industries, scientific research departments and government departments mainly reflects the external business development environment of a country's industry, which is quite different from the role of human and capital factors, but the improvement of the overall industrial environment can also provide a strong boost to the promotion of the international competitiveness of ICT manufacturing industry.

Thirdly, the number of patents, R & D investment and other factors mainly reflect the existing technological level of ICT manufacturing industry in a country. The impact of this part of the factors is slightly weaker than the environmental incentive factors, indicating that the accumulation of existing technology has a certain effect on the competitiveness of ICT manufacturing industry, but compared with the environmental factors and more basic human capital factors, the impact is smaller.

Fourth, international investment has a negative impact on the international competitiveness of a country's ICT industry.

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Исследование международной конкурентоспособности и влияния на факторы производства ИКТ в Китае

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Аннотация

Индустрия информационных и коммуникационных технологий (ИКТ) является важной движущей силой развития мировой экономики в 21 веке. Целью анализа, описанного в данной статье, стало изучение факторов, влияющих на международную конкурентоспособность обрабатывающей промышленности ИКТ, путем эмпирического анализа на основе алмазной модели. Проведенное исследование показало, что основные и долгосрочные факторы, такие как таланты и капитал, оказывают самое сильное положительное влияние на международную конкурентоспособность обрабатывающей промышленности в области ИКТ, положительное влияние благоприятной среды для развития промышленности несколько ниже, влияние существующего технологического потенциала

является положительным, но самым слабым, международный капитал оказывает определенное отрицательное влияние на международную конкурентоспособность обрабатывающей промышленности в области информационных и коммуникационных технологий.

Для цитирования в научных исследованиях

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Ключевые слова

Производство, ИКТ, международная конкурентоспособность, факторы влияния, технологии.

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