

Empirical analysis of tax incentive policy for intelligent transformation of equipment industry—Take Heilongjiang's a-share listed companies

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Abstract: This paper takes the equipment industry enterprises in Heilongjiang Province as the research object. Firstly, the intelligent transformation index evaluation system of equipment industry enterprises in Heilongjiang Province is constructed to measure the intelligent transformation situation, and it is found that the intelligent transformation situation of equipment industry enterprises presents a trend of first rising and then decreasing with the increase of time. Stata software is used to analyze the annual report data of equipment industry enterprises in Heilongjiang Province and the data of enterprise intelligent transformation. It is found that tax incentives can promote the intelligent transformation of equipment industry enterprises.

1. Introduction

Heilongjiang is the beginning of the Republic's industry, is the country's heavy industry base. Equipment industry is one of the province's four traditional advantages and characteristics of the industry (equipment, petrochemical, energy, food), is the province's development of the key industry, is also a key link to revitalize the old industrial base in Northeast China, is an important starting point to ensure the "five safety" strategy. Heilongjiang Province Industrial Revitalization Action Plan (2022-2026)" proposed to build a high-quality "4567" modern industrial system. Equipment industry is the backbone of industry, and its transformation and upgrading cannot be separated from the support of tax policy.^[1]

2. Empirical Analysis

2.1. Research design

2.1.1. Research hypothesis

Tax incentives can make enterprises have more funds for research and development investment and technological innovation, and then affect the intelligent transformation process of enterprises.^[2]Therefore, hypothesis is proposed: The intelligent transformation of equipment industry

enterprises in Heilongjiang Province is positively correlated with the intensity of enterprise tax incentives.

2.1.2. Source of sample data

In this paper, listed companies in Heilongjiang equipment industry from 2015 to 2022 are selected as samples. In order to improve the quality of research data, missing and ambiguous financial data, major asset restructuring and main business changes during the sample period, and ST* and ST manufacturing enterprises are excluded. Due to the small number of listed enterprises in Heilongjiang equipment industry, and the short listing time of individual enterprises, the relevant data is incomplete, and 8 samples of listed enterprises are finally obtained. There are 64 sample data, and all continuous variables are Winsorize by up or down 1%. The data comes from the data collation of Guotai 'an and the annual reports of listed companies. Due to some data missing, linear interpolation method was used to complete, and data regression was performed by Stata17.0 software.

2.1.3. Variable setting

(1) Explained variables. Intelligent transformation (IL).^[3]The data results obtained by using the entropy weight method above are shown in Table 1:

Table 1: Measurement results of intelligent transformation of equipment industry in Heilongjiang Province from 2015 to 2022

Year	2015	2016	2017	2018	2019	2020	2021	2022
000901	0.4024	0.4846	0.5089	0.5256	0.6628	0.6361	0.3592	0.1695
000922	0.0914	0.1036	0.0938	0.0819	0.1186	0.2644	0.1067	0.1244
002698	0.2251	0.2770	0.3290	0.2540	0.3963	0.3845	0.3145	0.1992
300040	0.2029	0.1634	0.1521	0.1528	0.1355	0.0973	0.2435	0.0630
600038	0.2067	0.3670	0.4117	0.4288	0.2932	0.5175	0.4208	0.1150
600178	0.1565	0.1134	0.1771	0.1656	0.1645	0.1355	0.4321	0.4749
600202	0.1177	0.2236	0.1703	0.1111	0.1281	0.2803	0.1219	0.1816
601106	0.2134	0.2662	0.0641	0.0919	0.0855	0.0767	0.1132	0.1265

Data source: Annual reports of listed companies

(2) Explanatory variables. TAX benefits (TAX), which represent the return of taxes received by the enterprise; Total Tax Burden (OTB) represents the total tax burden on each unit of total profit earned by a business.

(3) Control variables. With reference to previous studies, financial leverage (FL), liquidity constraint (LC), total assets turnover (TTC), net profit rate on total assets (ROA), operating profit rate (OPA) and main business Growth rate (Growth) are taken as control variables. See Table 2:

Table 2: Definitions of variables

variable	symbol	Variable definition
Intelligent transformation	IL	Entropy weight method
Tax incentives	TAX	Total tax refunds received by In
Overall tax burden	OTB	(Taxes - tax rebate)/Total profit
Financial leverage	FL	Total liabilities/total assets
Liquidity constraint	LC	Net cash flow/total assets
Turnover of total assets	TTC	Operating income/Average total assets
Net profit rate on total assets	ROA	Net profit/total assets
Operating profit margin	OPA	Operating profit/revenue
Growth rate of main business	Growth	(Main business revenue in the previous year)/Main business revenue in the previous year)

2.1.4. Model construction

Based on the above analysis, in order to study the impact of tax incentives and overall tax burden on the intelligent transformation of listed equipment industry enterprises in Heilongjiang Province, Model is constructed.

$$IL_{it} = \theta_0 + \alpha_1 TAX_{it} + \alpha_2 FL_{it} + \alpha_3 LC_{it} + \alpha_4 TTC_{it} + \alpha_5 ROA_{it} + \alpha_6 OPA_{it} + \alpha_7 Growth_{it} + \varepsilon$$

In the formula, i represents the i enterprise, t represents the t year, α is the regression coefficient of variables in model 1, θ_0 represents the constant term, ε is the random interference term.

2.2. The analytical process

2.2.1. Descriptive statistics

In this paper, descriptive statistical analysis is carried out on the annual sample data of listed enterprises in Heilongjiang equipment industry. The mean, median, standard deviation, minimum and maximum values of the main variables are shown in Table 3:

Table 3: Descriptive statistics

Variable	sample	mean	median	standard	deviation	minimum range	maximum range
IL	64	0.328	0.316	0.104	0.161	0.568	0.407
TAX	59	15.383	16.625	4.63	0	19.151	19.151
OTB	64	1.047	0.433	1.656	0	8.591	8.591
FL	64	0.526	0.543	0.144	0.138	0.712	0.575
LC	64	0.087	0.078	0.055	0.005	0.233	0.228
TTC	64	0.505	0.485	0.22	0.094	0.991	0.898
ROA	64	0.018	0.02	0.051	-0.169	0.11	0.279
OPA	64	0.004	0.041	0.279	-1.754	0.305	2.059
Growth	64	0.25	0.093	0.618	-0.65	3.004	3.654

2.2.2. Correlation analysis

This paper conducts correlation statistical analysis on the annual sample data of listed enterprises in Heilongjiang equipment industry respectively. Specific data are shown in Table 4:

Table 4: Statistical analysis of correlation

	IL	TAX	OTB	FL	LC	TTC	ROA	OPA	Growth
IL	1								
TAX	0.2163*	1							
OTB	-0.3913*	-0.0055	1						
FL	-0.3618*	0.1156	0.0492	1					
LC	0.2939*	-0.1735	-0.1798	-0.0241	1				
TTC	0.3991*	-0.0439	0.0965	-0.1786	0.5339*	1			
ROA	0.1268	-0.0653	-0.1723	-0.3436*	0.0306	0.2304*	1		
OPA	0.0493	0.0572	-0.0341	-0.2955*	-0.0504	0.2906*	0.8281*	1	
Growth	-0.1016	0.1296	0.0916	-0.1117	-0.0765	0.1753	0.1684	0.2087*	1

Note: * significant correlation at 10% level, ** significant correlation at 5% level, and *** significant correlation at 1% level.

Model: Through correlation test, the size of the correlation coefficient between each variable can be obtained. The correlation coefficient between intelligent transformation (IL) and TAX incentive (TAX) is 0.2163, and the two are positively correlated at the significance level of 10%. The

correlation coefficient between intelligent transformation (IL) and financial leverage (FL) is -0.3618, and the two are significantly negatively correlated at the 10% level, indicating that the higher the asset-liability ratio of equipment industry enterprises, the more unfavorable the intelligent transformation of enterprises. The correlation coefficients between enterprise intelligent transformation and net profit rate of total assets, operating profit rate and main business growth rate are 0.1268, 0.0493 and -0.1016, respectively, and are not significant to be further tested.

2.2.3. Multicollinearity test

In order to accurately reveal the internal relationship between the explanatory variable and the explained variable, it is ensured that the setting of the explanatory variable is not strongly linear influenced by other variables. Specific test results are shown in Table 5:

Table 5: Multicollinearity test

Variable	VIF	1/VIF
TAX	1.2	0.83646
OTB	1.2	0.83571
FL	1.25	0.798846
LC	1.78	0.561544
TTC	1.92	0.519486
ROA	3.69	0.271224
OPA	3.77	0.265231
Growth	1.17	0.855409
Mean VIF	2	

The variance inflation factor (VIF) of each variable in the model is less than 4, which means that there is no serious multicollinearity problem among explanatory variables in the model, and there is no strong linear relationship between variables. The explanatory variables are relatively independent, and their respective influences on the explained variables can be estimated more accurately. The model is well constructed, and there is no need to replace the variables in the model.

2.2.4. Regression analysis

Regression based on sample data and established models, R^2 was 37.6%, F value was 4.39, which showed that the model passed the significance test and the independent variables could explain the dependent variables well. The empirical results of Model 1 show that the regression coefficient between the two variables is 0.006, and they are significant at the level of 5%. This is in line with expectations.

2.3. Basic Conclusions

The research shows that the intelligent transformation of equipment industry enterprises in Heilongjiang Province shows a trend of first increasing and then decreasing with the increase of years. Stata software is used to analyze the annual report data of equipment industry enterprises in Heilongjiang Province and the estimated data of enterprise intelligent transformation according to the model. It is concluded that tax incentives can promote the intelligent transformation of equipment industry enterprises in Heilongjiang Province, and the overall tax burden has a certain inhibitory effect on the intelligent transformation of equipment industry enterprises in Heilongjiang Province.

3. Countermeasures and Suggestions

The empirical analysis results show that the regression coefficient between the two variables of tax incentives for equipment industry enterprises and the intelligent transformation of enterprises is 0.006, and the two are significant at the level of 5%, indicating that tax rebates in tax incentives will promote the intelligent transformation of equipment industry enterprises. Therefore, the tax return policy can reduce the economic burden of equipment industry enterprises, increase the cash flow of enterprises, and better optimize and upgrade.^[4]So, Based on the characteristics of Heilongjiang Province, tax incentive policies are formulated based on regions, industries and types of enterprises, so as to improve the pertinency of tax incentives. From the three dimensions of development stage, experiment stage and industrialization stage, improve the implementation effect of tax policy to promote the transformation of scientific research achievements; Implement talent-centered tax incentive policies to attract more talents to gather in Longjiang.

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