Analysis of the Impact of Tax Incentive Policies on the Equipment Industry in Heilongjiang Province

Defa Cai, Baozhu ZHao, Jiaxin SHi*
School of Public Finance and Administration, Harbin University of Commerce, Harbin, China
**Corresponding author*

Abstract: This paper calculates the total factor productivity of the equipment industry in Heilongjiang Province from 2007 to 2023 through the LP method, and uses stata software to analyze the annual report data of enterprises and the data of total factor productivity. According to the results of the model analysis, it concluded that tax preferences can promote the high-quality development of enterprises, while the overall tax burden has a certain inhibitory effect.

Keywords: Equipment Industry; High-Quality; Development Tax Incentive Policy

1. Introduction

Heilongjiang Province is the northernmost province in China, with the important mission of maintaining the "five major security" of the country and building and the "three bases, one barrier, and one high ground". The equipment industry is one of the four traditional leading characteristic industries in Heilongjiang Province, especially the equipment industry with obvious advantages. How to lead the development of new qualitative productive forces through scientific and technological innovation, accelerate the quality improvement and upgrading of key fields, and create advanced manufacturing clusters urgently needs to study the positive impact and effectiveness of the current tax incentive policy.

2.Research Design And Variable Selection

2.1 Research design

(1)Research hypothesis.This paper puts forward 2 assumptions: the high-quality development of the equipment manufacturing industry is positively correlated with the strength of corporate tax preferences, and it is correlated with the overall level of corporate tax burden.

(2)Data Sources and Sample Selection.The sample selected in this article is listed companies in the equipment manufacturing industry in Heilongjiang Province from 2007 to 2023. In order to improve the quality of the research data, the missing and blurred financial data, the occurrence of major asset restructuring and changes in the main business during the sample period, the manufacturing enterprises of ST * and ST type are eliminated. Since there are few listed companies in the equipment manufacturing industry in Heilongjiang Province, and some equipment manufacturing enterprises have listed for a short time, the relevant data is incomplete. Therefore, the final sample data of 8 listed companies and 109 samples are obtained, and all continuous variables subject to a 5% tail trim.The data is from Guotai An data collation and the annual report of listed companies, which is summarized and collated, and the data regression is performed byata18.0 software.

2.2 Variable Selection

(1)Dependent Variable.In this paper, the total factor productivity (TFP) of the enterprise is selected as the explained variable, and the LP method is used to calculate the factor productivity of the enterprise. Following the practice of Lu Xiaodong, Lian Yujuan, etc., the total output, capital, labor and intermediate input are measured the operating income, net fixed assets, number of employees and cash paid for purchasing goods and receiving services of the enterprise in the listed company database. The LP method can better solve theogeneity and sample selection problems in the traditional quantitative method.

(2)Explanatory variables.This paper selects the "tax refund received by enterprises" as the tax preference (Tax) index, and takes its logarithm; it is expressed by the proportion of difference between various taxes and fees and tax refund to the total profit as the overall tax burden (OTB).

(3) Control variables.Referring to existing, the control variables in this paper are shown in Table 1.

3. Empirical Analysis

3.1 Model Construction

According to the analysis in the above section, in order to study the positive effects of tax preferential

and overall burden on the development of equipment industry in Heilongjiang Province, Model 1 and Model 2 are constructed respectively.

Model1: $TFP_{it} = \theta_0 + \alpha_1 TAX_{it} + \alpha_2 SIZE_{it} + \alpha_3 LEV_{it} + \alpha_4 ROA_{it} + \alpha_5 ATO_{it} + \alpha_6 Cashflow_{it} + \alpha_7 Growth_{it} + \alpha_8 FirmAge_{it} + \varepsilon$

Model2 : $TFP_{it} = \theta_0 + \beta_1 OTB_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 ROA_{it} + \beta_5 ATO_{it} + \beta_6 Cashflow_{it} + \beta_7 Growth_{it} + \beta_8 FirmAge_{it} + \varepsilon$

In the above multiple regression model, i represents the i-th enterprise, t represents the t-th year, $\alpha$is the regression coefficient of each variable in model 1;β is the regression coefficient of each variable in model 2, θ_0 represents the constant term, ε is the random disturbance term.

3.2 Descriptive Statistics

This paper makes a descriptive statistics of the annual sample data of the selected listed companies in Heilongjiang's equipment industry, and analyzes the mean, median, standard deviation, minimum and maximum values of each variable. See Table 2.

Table 1. Definition of Variables

Variable	Symbol	Variable definition
Total factor productivity	TFP	Total output, capital, labor and intermediate inputs are measured by operating revenue, net fixed assets, number of employees and cash paid for purchasing goods and receiving services of listed companies in the database.
Tax preference	TAX	Ln Total tax refund received
Overall tax	OTB	(various taxes and fees - tax refund) / total profit
Burden Company size	SIZE	Natural logarithm of total assets at the end of the year
Debt-to-assets ratio	LEV	Total liabilities at the of the year / total assets at the end of the year
Net interest rate on total assets	ROA	Net profit/average total assets
Net turnover rate of total assets	ATO	Operating income/average total assets
Cash flow ratio	Cashflow	Net cash flow from operating activities/total assets
Revenue growth rate	Growth	Current year operating income / Previous year operating income - 1
Company age	FirmAge	ln(Current year - Company establishment year +1)

Table 2. Descriptive

Variable	Sample size	Minimum	Median	Arithmetic mean	Maximum	Standard deviation
TFP_LP	109	6.129	8.173	8.156	9.833	0.981
TAX	109	0.000	15.944	15.225	19.026	3.964
OTB	109	-0.358	2.535	2.304	3.288	0.911
Size	109	19.898	21.960	22.260	24.312	1.229
Lev	109	0.183	0.510	0.496	0.712	0.169
ROA	109	-0.102	0.022	0.022	0.110	0.050
ATO	109	0.137	0.432	0.496	0.967	0.239
Cashflow	109	-0.073	0.016	0.018	0.135	0.054
Growth	109	-0.316	0.048	0.215	2.199	0.607
FirmAge	109	1.946	2.890	2.826	3.367	0.386

It can be seen from Table 2 that the mean value of tax preference (TAX) is 15.225 and the standard deviation 3.964, which means that most enterprises fluctuate within 3.964 units above and below the mean value, and there is a certain degree of dispersion of data points relative to the mean value, although not very large, this value indicates that there is a certain fluctuation in tax preferences for enterprises. The range is 19.26, indicating a large difference in tax refunds between enterprises in the equipment manufacturing industry in Heilongjiang Province, indicating that the effectiveness of tax policies affects different enterprises to degrees.

3.3 Correlation Analysis

The correlation analysis of the selected annual sample data of listed enterprises in the equipment manufacturing industry of Heilongjiang Province is carried out respectively, and the specific data shown in Table 3.

Table 3. Correlation Statistical Analysis

Variables	TFP_LP	TAX	OTB	Size	Lev	ROA	ATO	Cashflow	Growth	FirmAge
TFP_LP	1.000									
TAX	0.310***	1.000								
OTB	-0.315***	-0.139	1.000							

Size	0.774***	0.314***	-0.344***	1.000						
Lev	0.288***	0.124	-0.152	0.446***	1.000					
ROA	0.226**	-0.084	0.009	-0.010	-0.374***	1.000				
ATO	0.557***	-0.004	-0.026	0.021	-0.054	0.238**	1.000			
Cashflow	-0.130	-0.037	0.128	-0.089	0.050	0.202**	-0.058	1.000		
Growth	0.068	0.123	-0.042	-0.031	-0.035	0.256***	0.212**	0.052	1.000	
FirmAge	0.022	-0.003	0.183*	-0.124	0.216**	0.081	0.151	0.374***	-0.046	1.000

Appendix: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Model one: The correlation coefficient between TFP-LP and TAX is 0.310, and the two are positively correlated at the 1 significance level. Model two: The correlation coefficient between TFP-LP and OTB is -0.315, and the two are negatively correlated at the 1% level.

3.4 Multicollinearity Test

In order to accurately reveal the intrinsic correlation between explanatory variables and explained variables, and ensure that the setting of explan variables will not be strongly linearly affected by other variables. See Table 4:

Table 4. Multicollinearity Test

Variable	VIF	1/VIF
Lev	1.82	0.54921
Size	1.71	0.583149
ROA	1.53	0.653424
FirmAge	1.44	0.696783
Cashflow	1.26	0.793916
Growth	1.18	0.849358
OTB	1.17	0.852126
TAX	1.17	0.854155
ATO	1.16	0.863656
Mean VIF	1.38	

The variance inflation factors (VIF) of all variables in the model are all less than 2, indicating that there is no serious problem of multicollinear among the explanatory variables in the model, and there is no strong linear relationship between the variables. The explanatory variables are relatively independent, and the effect of each of them on explained variable can be estimated with relative accuracy. The model is well constructed, and there is no need to replace the variables in the model.

3.5 Regression Analysis

Regression was performed based on the sample data and the established model, and the results are shown in Table 5:

Table5. Analysis of Regression Coefficients of the Model

	(1)	(2)
	TFP_LP	TFP_LP
TAX	0.0205**	
	(2.4144)	
Size	0.5523***	0.5774***
	(10.1101)	(10.5098)
Lev	-0.2212	-0.2092
	(-0.7557)	(-0.7206)
ROA	3.1433***	2.3532***
	(3.9514)	(2.8914)
ATO	1.8126***	1.8359***
	(8.5117)	(8.6227)
Cashflow	-1.4688***	-1.3579***
	(-2.8630)	(-2.6393)
Growth	-0.0186	0.0114
	(-0.3927)	(0.2527)
FirmAge	0.0972	0.0397
	(0.5688)	(0.2295)
OTB		-0.0888**
		(-2.5387)
_cons	-5.5531***	-5.4419***
	(-6.0958)	(-5.9920)
id	Yes	Yes
year	Yes	Yes
r2	0.943	0.943
N	109	109

Notes: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Model 1: The coefficient in the regression results is 0.0205 and significant at the 5% level, indicating that the model passed the significance test, and the independent variable can well explain the dependent variable, and its regression results are statistically significant. Empirical results show that tax preferences are positively correlated with high-quality development level of equipment manufacturing enterprises, and hypothesis 1 is established.

Model 2: The coefficient in the regression results is -0.0888 negatively correlated at the 5% level, and the model also passed the significance test, and the independent variable can well explain the dependent variable, and its regression results are also statistically. Empirical results show that the overall tax burden level is negatively correlated with the high-quality development of equipment manufacturing enterprises, and hypothesis 2 is established.

3.6 Hausman Test

The model in this article is constructed based on the panel data obtained by the sample enterprises. In the previous analysis, the model was constructed based on the method of fixed effects. In order to ensure that the choice of fixed effects model is appropriate, in empirical analysis, the model and data are properly before the empirical analysis, and the Hausman test is carried out by using the stata18.0 software. According to the test results, and the p-value obtained is 0.0003 (Prob＞chi2 = 0.0003), the original hypothesis is rejected, that is, the random effects model is not best choice. Therefore, it is appropriate to use the fixed effects model to analyze the data in this article. The test results are shown in Table 6:

Table 6. Hausman Test Results

chi2(7) = 27.47
Prob > chi2 = 0.0003 (V_b-V_B is not positive definite)

4. Conclusions

The above analysis shows that tax preferences can significantly improve the total factor productivity of equipment manufacturing enterprises in Heilongjiang Province, and when tax preference increases by 1%, its total factor productivity will increase accordingly by 0.0205%. However, the rise in the overall tax burden has anory effect, that is, when the overall tax burden level increases by 1%, the total factor productivity of the enterprise also decreases accordingly by 0.888% It can be seen that high-quality development of enterprises can be promoted through the design of tax incentive policies.

Acknowledgments

This paper is supported by Special Research on the Spirit of the Important Speech and Instructions of General Secretary Xi Jinping (Project number：23XZT033)

References

[1] Cai Defa, Liu Tingting, Wang Fanshuo. Research on Tax Incentive Policies for theAdding Core and Enhancing Intelligence" of the Equipment Manufacturing Industry [J]. Economic Research Guide, 2020(32): 127-18.

[2] Feng Feng, Xiong Zhao. International Experience of Equipment Manufacturing Industry Development and Its Enlightenment to China [J]. Econom, 2023(04): 56-66.

[3] Liu Xiaohui, Wang Xiaoling, Wu Hong, et al.lections on Tax Policies and Services to Promote the Development of Equipment Manufacturing Industry Chain - Based on the Research of Harbin Equipment Manufacturing Industry [J]. Tax Research,2023(09): 32-36.

[4] Li Jiachang, Cai Defa. The Impact of Tax Preferences on the of Advanced Manufacturing Industry Clusters [J]. Science and Industry, 2023(17): 41-49.

