

# *Empirical Analysis of Tax Incentive Policies for Digital Transformation of Traditional Advantageous Industries—Taking A-Share Listed Companies in Traditional Advantageous Industries in Heilongjiang Province as an Example*

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**Abstract:** Industrial digital transformation is an important engine to cultivate and develop new driving forces for countries around the world. This paper selects 2011-2022 Heilongjiang province a-share traditional advantage industry data of listed companies, the tax support policy and the relationship between the enterprise digital, it is concluded that the enterprise tax burden and digital transformation, and put forward to reduce the digital transformation, take the lead in the encouraged manufacturing implementation lower value-added tax rates and enterprise income tax transfer policy advice.

## 1. Introduction

We will accelerate the establishment of "4567" modern industrial new system, promote industrial digital transformation, through the application of big data, artificial intelligence, Internet of Things and other digital technologies in traditional advantageous industries, promote industrial digital upgrading and high-quality development, improve innovation efficiency and core competitiveness. <sup>[1]</sup>Tax support policies mainly support enterprise research and development and innovation by means of tax expenditure to promote digital technology research and development, <sup>[2]</sup>which is an important starting point to realize industrial digitalization.

## 2. Model Construction and Analysis

### 2.1. Model Construction

The data mainly came from the CSMAR database. According to the 2012 industry classification of CSRC, traditional advantageous enterprises in Heilongjiang Province were screened out, missing important data samples were eliminated, and the data were processed at the interval of 1%-99%.

### 2.1.1. Selection of Variables

Variables include explained variables, such as enterprise digitization degree (DL) : total amount of intangible assets containing digital keywords such as "software", "system" and "platform"; Explanatory variables, such as Tax, refer to Chen Mingyi et al. (2018) and use the ratio of "(income tax expense + taxes and surcharges)/business income" to represent the tax burden degree of traditional advantageous industries; The Income tax is set by referring to the business tax and additional/business income in the database; Turnover tax is expressed as income tax expense/total profit by referring to Guotai Junan database; Intermediate variables, such as R&D input; And control variables, such as asset-liability ratio, enterprise size, profitability, fixed asset density, enterprise growth, ownership type, etc.

### 2.1.2. Research Hypothesis

The tax burden of traditional advantageous enterprises truly reflects the capital status and economic burden of traditional advantageous enterprises, which is directly related to the economic interests of traditional advantageous enterprises. For example, excessive tax burden will lead to the reduction of profitability and capital of enterprises, and then lead to the reduction of R&D investment of enterprises, which will affect the degree of digital transformation. <sup>[3]</sup>Based on this, this paper puts forward the hypothesis that the reduction of corporate tax burden can promote the digital transformation of enterprises.

### 2.1.3. Model Setting

In order to verify the above hypothesis, the following model is established in this paper for verification:

$$Dt_{i,t} = \beta_0 + \beta_1 * Tax_{i,t} + \mu_{i,t} \quad (1)$$

$$Dt_{i,t} = \beta_0 + \beta_1 * Tax_{i,t} + \beta_2 * control_{i,t} + \mu_{i,t} \quad (2)$$

Verify the coefficient in (1) and add the coefficient verified by the control variable. If the coefficient is negative, it proves that tax burden has an inhibiting effect on the digital transformation of enterprises, and it is necessary to promote the digital transformation and upgrading of enterprises by reducing the tax burden of enterprises.

## 2.2. Empirical Analysis

### 2.2.1. Descriptive Statistics

Descriptive statistics in this paper (control variables: omitted. The same below) is shown in Table 1:

Table 1: Descriptive statistical results

|          | count | mean  | min   | max   | sd    |
|----------|-------|-------|-------|-------|-------|
| Dt       | 285   | 1.083 | 0.000 | 4.454 | 1.222 |
| Tax      | 285   | 0.023 | 0.015 | 0.140 | 0.030 |
| Income   | 285   | 0.022 | 0.011 | 0.125 | 0.028 |
| Turnover | 285   | 0.001 | 0.000 | 0.032 | 0.005 |

Table 1 results show that the maximum value of digital transformation degree Dt of the explained variable is 4.454, while the minimum value is only 0. This result shows that there is a

significant gap in the degree of digital transformation among the sample enterprises. The mean value of this variable is 1.083, and the standard deviation is 1.222, indicating that the degree of digital transformation among the sample enterprises is generally high.

The maximum value of enterprise Tax burden of explanatory variable is 0.140, and the minimum value is -0.015, indicating a large gap in the degree of enterprise tax burden among sample enterprises. The mean value and standard deviation of this variable are 0.023 and 0.030, indicating that the overall level of corporate tax burden is not high. However, there was no significant difference between the Turnover variables of Income and turnover.

### 2.2.2. Correlation Analysis

The correlation coefficient between variables is mainly to determine the relationship between variables, but it has obvious limitations. Therefore, the correlation test does not fully represent the true relationship between the variable data. The results of correlation test of variables between samples are shown in Table 2:

Table 2: Correlation test

|          | Dt    | Tax                  | Income               | Turnover |
|----------|-------|----------------------|----------------------|----------|
| Dt       | 1.000 |                      |                      |          |
| Tax      | 0.141 | 1.000                |                      |          |
| Income   | 0.136 | 0.988 <sup>***</sup> | 1.000                |          |
| Turnover | 0.076 | 0.306 <sup>***</sup> | 0.164 <sup>***</sup> | 1.000    |

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

It can be seen from the positive and negative signs of the coefficients that the correlation coefficients between the degree of digital transformation of explained variables Dt and explanatory variables Tax, Income and Turnover are all negative. This result is consistent with the previous hypothesis, that is, there is a negative correlation between the corporate tax burden and the degree of digital transformation. It can be seen from the comparison of coefficient sizes that the absolute value of the correlation coefficient between the explained variable and the explanatory variable is greater than 0.1. This result shows that there is a linear relationship between the explained variable and the explained variable. At the same time, the absolute value of the correlation coefficient between the explained variables and most other control variables is less than 0.5, indicating that the correlation between the control variables and the explained variables is significantly lower than that of the explanatory variables. That is, the control variables do not produce multicollinearity problems to affect the empirical results.

### 2.2.3. Analysis of Benchmark Regression Results

In this paper, the bidirectional fixed-effect regression model with the degree of digital transformation as the explained variable and the corporate tax burden as the explanatory variable is constructed to verify the above hypothesis, as shown in Table 3:

Among them, result (1) is the benchmark regression result to verify the impact of enterprise tax burden on the degree of digital transformation under no control variables, and result (2) is the empirical result to verify the impact of enterprise tax burden on the degree of digital transformation under the addition of enterprise characteristic control variables.

As can be seen from Table 3, the adjusted R-squared in result (1) is 0.087, indicating that the model results have a linear relationship. In order to avoid problems such as heteroscedasticity in the model results, clustering robustness was chosen to be added in this paper. As can be seen from the results, the regression coefficients of corporate tax burden and the degree of digital transformation

are both negative, and are significant at the 1% statistical significance level, indicating that the decrease of corporate tax burden is conducive to improving the degree of digital transformation. It can be seen from result (2) that the regression coefficient between corporate Tax burden and the degree of digital transformation is -5.1991, which is also significant at the level of 10% statistical significance, indicating that the corporate tax burden has a negative relationship with the degree of digital transformation.

Table 3: Baseline regression results

|            | (1)       | (2)      |
|------------|-----------|----------|
|            | Dt        | Dt       |
| Tax        | 8.9243    | 5.1991   |
|            | (3.6264)  | (1.9379) |
| _cons      | 1.2896*** | 5.6240   |
|            | (18.1334) | (4.1176) |
| Year       | No        | Yes      |
| Industry   | No        | Yes      |
| N          | 285       | 285      |
| adj. $R^2$ | 0.087     | 0.460    |

$t$  statistics in parentheses

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

In summary, the baseline regression results verify the hypothesis that there is a significant negative relationship between corporate tax burden and the degree of digital transformation.

### 2.3. Heterogeneity Analysis

In order to further study the impact of corporate tax burden and the degree of digital transformation, this paper further reduces corporate tax burden to two heterogeneity aspects: income tax burden and turnover tax burden. The heterogeneity analysis results are shown in Table 4:

Table 4: Heterogeneity results of corporate tax burden and degree of digital transformation

|            | (3)      | (4)      |
|------------|----------|----------|
|            | Dt       | Dt       |
| Income     | 5.2222   |          |
|            | (1.7716) |          |
| Turnover   |          | 12.8952  |
|            |          | (1.9362) |
| _cons      | 5.6650   | 2.9462   |
|            | (4.1484) | (1.0440) |
| Year       | Yes      | Yes      |
| Industry   | Yes      | Yes      |
| N          | 285      | 285      |
| adj. $R^2$ | 0.459    | 0.467    |

$t$  statistics in parentheses

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

As can be seen from Table 4, it shows that there is a negative correlation between tax burden and the degree of digital transformation.

## 2.4. Robustness Test

This paper chooses to replace the bidirectional fixed-effect regression model with the Tobit model, and replaces the baseline regression results (1) and (2) to obtain results (5) and (6). See Table 5:

Table 5: Robustness test

|               | (5)                    | (6)                    |
|---------------|------------------------|------------------------|
|               | Dt                     | Dt                     |
| Tax           | 5.8370<br>(2.4108)     | 5.1991<br>(1.8442)     |
| _cons         | 1.2182***<br>(13.4106) | 5.6240<br>(3.4740)     |
| var(e.D<br>t) | 1.4581***<br>(11.9373) | 0.7134***<br>(11.9373) |
| Year          | Yes                    | Yes                    |
| Industr<br>y  | Yes                    | Yes                    |
| N             | 285                    | 285                    |

*t* statistics in parentheses

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

As can be seen from the results in Table 5(5), the coefficient of the explanatory variable enterprise tax burden is still negative, and the result passes the 5% statistical significance test; It can be seen from the results of (6) that the coefficient of the explanatory variable enterprise tax burden is still negative, and the result passes the 10% statistical significance test. This result shows that after the Tobit model is replaced, the explanatory degree of enterprise tax burden and the degree of digital transformation changes. However, the hypothesis of negative correlation between corporate tax burden and the degree of digital transformation is still valid, that is, the negative correlation between corporate tax burden and the degree of digital transformation is robust.

Select L. Ax to defer taxes for a period of time, and replace the baseline regression results (1) and (2) to get the results, it shows that the degree of interpretation of the change in corporate tax burden and the degree of interpretation of the digital conversion changed after L. Ax delayed for some time. However, the hypothesis of negative correlation between corporate tax burden and the degree of digital transformation is still valid, that is, the negative correlation between corporate tax burden and the degree of digital transformation is robust.

## 3. Countermeasures and Suggestions

It is suggested that the state implement a pilot tax support policy for specific industries or regional encouraged manufacturing industries in Heilongjiang's old industrial base, such as China Heavy, AVIC shares, Dong 'an power and other leading enterprises, equipment manufacturing industry trial VAT cut first-rate tax policy; The enterprise income tax system takes the lead in realizing the transformation from the classical system to the ownership system or the double-rate system. <sup>[4]</sup>If dividends are distributed to a joint stock company, the share of the shareholders will be taxed or exempted at the rate of 10%.

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## References

- [1] Jin Weidong, Ren Xizhen, He Li. (2022) *Innovation incentive effect of R&D expense plus deduction policy [J]. Journal of Shanghai University of Finance and Economics*, 2, 108-121.
- [2] Gan Xingqiong, Yu Qian. (2023)*Multiple incentive effects of tax incentives on enterprise innovation [J]. Journal of Guizhou University of Finance and Economics*, 3, 71-80.
- [3] Hao Xiuqin, Yang Bojian. (2023)*The impact of tax burden on innovation input of manufacturing enterprises [J]. Economic Jingwei*, 5, 150-160.
- [4] Cao Yue, Lin Jiang. (2023)*A study on the impact of international tax competition on the effectiveness of tax incentive policies for Chinese enterprises' innovation [J]. Fiscal Research*, 10, 100-114.