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Article

Analysis of the Impact of Corporate Income Tax Incentives on Digital Economy Enterprises

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Abstract: This paper evaluates the effect of income tax preferences for digital economy enterprises based on the data of digital economy enterprises in Beijing, Tianjin and Hebei regions from 2017-2021 (in line with the narrower caliber of the National Bureau of Statistics). The research results show that corporate income tax incentives have a significant impact on R&D investment of digital economy enterprises and provide a better incentive for digital economy enterprises to increase their R&D investment efforts. Tax incentives are heterogeneous in nature of property rights for digital economy enterprises, among which there is a greater promotion for private enterprises. Finally, this paper further expands the study on the factors influencing the innovative capability of enterprises and proposes policy recommendations on the relationship between tax preferences and innovation capability of enterprises based on the empirical results.

Keywords: Digital Economy; Tax Incentives; Enterprise Innovation

1. Introduction

The development level of China's digital economy has made a remarkable leap to a higher stage in the 14th Five-Year Plan period. The value of China's digital economy industry is also steadily increasing, and the value added of the core industries of the digital economy is also increasing as a proportion of GDP, reaching 7.8% by 2020. At the same time, in the context of a unified market, the government has called for accelerated digitization, enabling the integration of online and offline, promoting joint development between regions and using the digital economy to break down regional boundaries.

In September 2020, Beijing introduced the "1+3" policy on digital economy development, which focuses on the creation of a digital trade pilot zone, the construction of a pilot project on the safe management of cross-border data flows and the establishment of the Beijing International Big Data Exchange, in order to accelerate the development of the digital economy. The city of Tianjin pointed out that Tianjin, as a bridge for the collaborative development of the Beijing-Tianjin-Hebei region, will continue to accelerate the integration and docking of data resources in the Beijing-Tianjin-Hebei region, play a bridging role, collaborate to build data parks and strengthen the cooperation of data enterprises among the three regions; Hebei proposed that it will focus on supporting the development of the Xiong'an New Area in the region, put the focus of digital economy development on the digital transformation of the manufacturing industry, and collaborate with the development strategy of Beijing-Tianjin and national events.

In addition, in 2021, the Beijing-Tianjin-Hebei Digital Economy Alliance will be established in Tianjin. The Alliance is a spontaneous collaboration between the Alliance is a spontaneous collaboration of more than 50 organizations from industries, universities, research institutes, financial institutions and associations related to the digital economy. It is a non-profit organization with a wide range of fields and a strong openness. The Alliance focuses on the development of the digital economy, strengthens cooperation and communication between various entities, and contributes to the healthy development of the digital economy in the Beijing-Tianjin-Hebei region.

As technology continues to develop and evolve, most traditional industries are now striving to integrate technological innovations with the digital economy, which has become the trend of development in the world today. The replicability and reusability of data in the digital economy gives companies that enter the digital economy market first a clear development and innovation, the digital economy has become a global trend. Therefore, by increasing tax incentives, the government encourages the transformation and upgrading of enterprises and helps them to accelerate the pace of technological innovation. This is also conducive to China gaining a head start in the development of the digital economy in the world competition and improving our digital competitiveness and international status. In the current situation, the government has introduced various preferential policies, including tax incentives, in order to encourage the development of innovation in enterprises and to enhance the innovation ability of enterprises. Corporate income tax incentives are the most typical of all tax incentives. One is the preferential income tax rate of 15% for high-tech enterprises, and the other is to add deductions for R&D expenses when calculating taxable income, and indirect preferences such as tax exemption for technology transfer. The regulatory role of tax incentives for the development of enterprises in the digital economy has become necessary. This paper focuses on the first situation of corporate income tax incentives.

Through empirical analysis, this paper takes digital economy enterprises from 2017 to 2021 as the research object, and finally includes 142 digital economy enterprises in the study. After the empirical analysis of the tax incentives for these digital economy enterprises, we propose recommendations for the innovative development of digital economy enterprises based on the empirical results.

2. Review of the Literature

The government has a certain incentive for the development and innovation of enterprises through fiscal and taxation instruments. Such incentives are important not only to accelerate the digital transformation of enterprises, but also to contribute to the innovative transformation of society. For this reason, some scholars have studied the theoretical basis and effects of tax incentives. The first is the question of whether tax incentives can, to a certain extent, motivate enterprises to invest more in R&D. Song Qing et al. (2021) conducted a heterogeneity test on GEM listed companies and found that tax incentives can significantly promote R&D investment in different regions. Chen Dong (2020) found that tax incentives have a significant effect on the R&D investment of enterprises. In summary, it can be concluded that the incentive effect of tax incentives is very significant when enterprises increase their investment in R&D to make them innovate faster.

The companies studied above are all traditional companies. In the digital context, it is still unknown whether the government's tax incentives can stimulate the R&D investment of digital economy enterprises. The existing literature has mostly explored such issues from a theoretical level.

Ma Hongfan et al. (2021) argue that the development of enterprises should follow the development trend of the digital economy, and with the continuous improvement of the tax governance system and the enhancement of governance capacity, the tax governance approach should be transformed and upgraded in the direction of digitalization; Li Hui et al. (2021) argue that for the issue of digital economy and consumption tax collection and administration, the principle of consumption tax collection should be adhered to create a fair business environment for enterprises, which also makes tax collection and administration regarding the digital economy to be more regulated. Some scholars have also conducted relevant studies on taxation and the development of the digital economy from the empirical level. Based on provincial panel data, Ye Xu et al. (2021) found that the digital economy significantly influenced the employment structure of industries, sectors and skills, and generally contributed to the transformation and upgrading of the employment structure in the direction of high technology; Yu Changlin et al. (2021) argued that government subsidies, tax incentives and other industrial policies could continuously promote technological innovation in the digital economy.

A comprehensive review of literature reveals that the existing studies on digital economy enterprises and tax incentives are more focused on theoretical analysis, while empirical studies are lacking. Most of the studies have been conducted from a macro perspective, with relatively little research on micro enterprises. Therefore, this paper analyzes the impact of tax incentives on digital economy enterprises in the Beijing-Tianjin-Hebei region from an empirical perspective by constructing an econometric model and conducting heterogeneity tests to analyze the impact of tax incentives on digital economy enterprises in the Beijing-Tianjin-Hebei region from different perspectives.

3. Theoretical Analysis and Research Hypothesis

There are two types of tax preferences regarding China's corporate income tax, one is a direct incentive based on a 15% tax rate preference for high-tech enterprises, and the other is an indirect incentive represented by the tax base of R&D expenses plus deductions. By reducing the effective tax rate of enterprises through tax incentives, the government allows digital economy enterprises to have more funds to invest in innovation and R&D, thus promoting innovative transformation of enterprises. Based on the results of previous studies by scholars on tax incentives and corporate innovation, we can know that tax incentives have a certain effect on corporate innovation. For example, Chu Deyin et al. (2017) conducted a research analysis on strategic emerging industries and concluded that tax incentives for corporate income tax would promote the R&D investment costs of the industry. Therefore, this paper takes the digital economy industry as the research object and analyses the impact of corporate income tax incentives on the innovative development of digital economy enterprises. Based on the above analysis, this paper proposes the following hypotheses.

Hypothesis 1: The innovative development of digital economy enterprises can be continuously improved by reducing the corporate income tax rate, considering other relevant variables.

Hypothesis 2: Corporate income tax incentives have different effects on the innovation incentives of different digital economy enterprises.

4. Research Design

4.1. Sample Selection and Variable Description

4.1.1. Sample Selection

This paper takes 142 digital economy enterprises in Beijing-Tianjin-Hebei region as the research object, and the selected data range is the data range is from 2017 to 2021. In order to ensure the reliability of the research results, this paper refers to Gao Peiyong et al. (2013) and Shen Si et al. (2021), and excludes enterprises with missing or negative operating revenues, operating costs, total profits and R&D expenses, as well as enterprises exempted from corporate income tax due to the conversion of operating cultural institutions into enterprises. The final sample of 478 enterprises was obtained. To eliminate the effect of extreme outliers, all continuous variables are winsorized at 1% and 99%.

4.1.2. Description of Variables

Explanatory variable: corporate innovation investment (R&D). This indicator is replaced by R&D expenditure divided by operating revenue, following the example of Shen (2021).

Core explanatory variable: tax-reduction. According to Jia Junxue et al. (2016), the since corporate income tax benefits are the most important part of tax benefits enjoyed by enterprises, this paper adopts the effective tax rate of corporate income tax as a proxy indicator of tax benefits.

Control variables: enterprise age, enterprise size, profitability and cost. The specific calculation methods and data sources are shown in Table 1.

Table 1. Selection of variables and description of indicators.

Variable type	Variable name	Variable symbols	Explanation of indicators	Data sources
Explained variables	Corporate innovation investment	R&D	R&D costs /Operating income	Annual Reports by Company
Explanatory variables	Tax benefits	Tax-reduction	In terms of the effective corporate income tax to express the tax rate	
Control variables	Age of business	Age	Ln (Current year - Company establishment Year + 1)	
	Size of business	Size	Logarithm of operating income	
	Profitability	Profit	Profits / Operating income	
	Operating cost ratio	Cost	Operating costs / Operating income	

4.2. Econometric Model

This paper uses the least square (OLS) method to test the impact of tax incentives for digital economy firms on firms' innovation investment. The specific model is constructed as follows:

$$R\&D_{it}=\beta_0+\beta_{1tax}\text{-}reduction_{it}+\beta_2 age_{it}+\beta_3 size_{it}+\beta_4 profit_{it}+\beta_5 cost+ind_k+year_t+\mu_{it} \quad (1)$$

Where the subscript i represents the firm and t represents the year; the firm's innovation input (R&D) is the explanatory variable and tax-reduction is the explanatory variable; the remaining

variables are control variables; and μ is a random disturbance term. In this paper, we choose a two-way fixed effects model controlling for industry and year.

4.3. Descriptive Statistics

The table below shows the descriptive statistics for each variable. The standard deviation of R&D is 0.072, with the maximum and minimum values of 0.379 and 0.009 respectively, which indicates that there is some variation in the level of innovation investment among different enterprises. The standard deviation of tax-reduction is 0.020, with a maximum and minimum value of 0.15 and 0.1 respectively, indicating that there is some variation in the effective tax rate between firms. The average age of digital economy enterprises is only three years, which indicates that the development of digital economy enterprises is on the rise, and therefore the tax incentives can be used to stimulate the innovation ability of digital economy enterprises to a certain extent. There are also significant differences in size, profitability and cost across digital economy firms.

Table 2. Descriptive statistics of the variables.

Variables	Sample size	Average value	Standard deviation	Median	Max	Min
R&D	478	0.101	0.072	0.083	0.009	0.379
Tax-reduction	478	0.140	0.020	0.15	0.1	0.15
Age	478	3.025	0.229	3.091	2.485	3.434
Size	478	21.109	1.271	20.989	18.324	25.264
Profit	478	0.145	0.102	0.122	0.012	0.494
Cost	478	0.594	0.187	0.607	0.069	0.937

Note: Continuous variables are winsorized at the 1% and 99% levels.

5. Empirical Analysis

5.1. Full Sample Basis Regression

Before conducting the regression, the model needs to be tested for multicollinearity. According to the results in Table 3, the VIF value of the core explanatory variable, i.e., tax incentives, is 1.09, while the values of the other control variables are all below 10, so it can be concluded that there is no multicollinearity in the regression model of this paper.

Table 3. Multicollinearity test.

Variables	VIF	1/VIF
Tax-reduction	1.09	0.916
Age	1.11	0.902
Size	1.23	0.810
Profit	1.68	0.597
Cost	1.80	0.555

Then, a full-sample regression of the data was conducted to observe the impact of corporate income tax incentives on firms' innovation investment. Table 4 shows the regression results. The first column shows the results without controlling for other influencing factors, while the second column

shows the results after controlling for related influencing factors. The coefficients of tax incentives are significantly negative in both columns. In column (1), the estimated coefficient of tax incentives is -0.798, which indicates that the reduction of corporate income tax rate of digital economy enterprises can promote the R&D investment of enterprises and thus improve the innovative development of enterprises, thus hypothesis 1 is confirmed. According to the results in column (2), the estimated coefficient of the tax benefit is -0.236, which indicates that the reduction of the corporate income tax rate of digital economy enterprises can promote the R&D investment of enterprises when other influencing factors are considered, which is basically consistent with the results without considering the influence of other control variables.

Table 4. Corporate income tax incentives and corporate innovation investment.

Variables	R&D	
	(1)	(2)
Tax-reduction	-0.798***	-0.236**
	(-4.78)	(-2.12)
Age	--	-0.051***
		(-5.25)
Size	--	-0.003*
		(-1.66)
Profit	--	-0.234***
		(-8.80)
Cost	--	-0.330***
		(-21.67)
Industry Effect	Control	Control
_cons	0.203***	0.585***
	(8.41)	(11.86)
R^2	0.0614	0.6032
N	478	478

Note: *, **, *** denote significant at the 10%, 5% and 1% levels, respectively. The parentheses represent the t-value, the same below.

5.2. Sub-sample Regressions

5.2.1. Heterogeneity of Property Rights

The property right attributes of enterprises may affect the effect of the effective tax rate of corporate income tax on the innovation investment of enterprises. Therefore, this paper examines the heterogeneity of the research sample based on property rights. First, 142 digital economy enterprises are classified into three categories according to their property rights: private enterprises, state-owned enterprises, and other enterprises.

The results in column (1) of Table 5 show that there is a negative and significant relationship between corporate income tax incentives and innovation investment of digital economy enterprises, which indicates that reducing the effective corporate income tax rate can stimulate innovation investment of private enterprises, and Hypothesis 2 is confirmed. After controlling for relevant

influencing factors, comparing (2), (4) and (6), for private firms, reducing the effective corporate income tax rate can significantly stimulate private firms' innovation investment through tax incentives, while the incentive effect for SOEs and other firms is not significant, which may be due to the low innovation efficiency of other firms and the small sample size of SOEs.

Table 5. Tax incentives and firms' investment in innovation: private, state, and other.

Variables	Private		State-owned		Other	
	(1)	(2)	(3)	(4)	(5)	(6)
Tax-reduction	-1.108***	-0.415***	-2.059	-0.542	-0.409	0.083
	(-4.67)	(-2.64)	(-0.36)	(-0.41)	(-1.63)	(0.50)
Age	--	-0.009	--	-0.091**	--	-0.150***
		(-0.82)		(-3.66)		(-7.58)
Size	--	-0.009***	--	-0.045**	--	0.007**
		(-3.05)		(-4.33)		(2.16)
Profit	--	-0.220**	--	-0.068	--	-0.275***
		(-7.04)		(-0.70)		(-5.25)
Cost	--	-0.310***	--	0.117	--	-0.379***
		(-16.99)		(1.04)		(-13.44)
Industry Effect	Control	Control	Control	Control	Control	Control
_cons	0.268***	0.600***	0.373	1.261**	0.130***	0.664***
	(7.57)	(9.10)	(0.43)	(5.88)	(3.56)	(7.81)
R^2	0.0777	0.6477	0.4847	0.9931	0.0985	0.6264
N	268	268	10	10	200	200

Note: *, **, *** indicate significant at the 10%, 5%, and 1% levels, respectively.

5.2.2. Regional Heterogeneity

Since the economic development in Beijing, Tianjin and Hebei are different, and the digital economy enterprises are unevenly distributed, and there is less data on digital economy enterprises in Hebei, this paper divides the digital economy enterprises in Beijing, Tianjin and Hebei into Beijing, Tianjin and Hebei regions for regression analysis.

According to the table below, comparing columns (1) and (3), the estimated coefficient of tax incentives for digital economy enterprises in Beijing is significantly negative, while the estimated coefficient of tax incentives for digital economy enterprises in Tianjin and Hebei is not significant. It can be concluded that, without considering other influencing factors, the tax incentives of corporate income tax can significantly promote the innovation investment of digital economy enterprises in Beijing, while there is no significant effect on the other two regions. Then, comparing columns (2) and (4), the estimated coefficients of tax incentives for digital economy enterprises in Beijing, Tianjin and Hebei are all significantly negative, controlling for the relevant influencing factors, indicating that under certain conditions, the tax incentives given by the government can effectively motivate

enterprises to increase the level of innovation investment and thus enhance the innovative development of digital economy enterprises. In addition, the absolute values of the estimated coefficients of tax incentives in Tianjin and Hebei are larger than those in Beijing, which indicates that the incentive effect of corporate income tax incentives on enterprises' innovation investment is more significant for digital economy enterprises in Tianjin and Hebei.

Table 6. Tax incentives and enterprise innovation investment: Beijing, Tianjin, and Hebei regions.

Variables	Beijing		Tianjin and Hebei	
	(1)	(2)	(3)	(4)
Tax-reduction	-0.802***	-0.262**	-87.604	-59.912*
	(-4.83)	(-2.35)	(-1.46)	(-1.72)
Age	--	-0.049***	--	-0.053**
		(-4.88)		(-2.04)
Size	--	-0.003	--	-0.012**
		(-1.47)		(-2.10)
Profit	--	-0.246***	--	-0.120
		(-8.88)		(-1.52)
Cost	--	-0.334	--	-0.449***
		(-21.39)		(-6.41)
Industry Effect	Control	Control	Control	Control
_cons	0.204***	0.579***	13.225	9.843*
	(8.34)	(11.42)	(1.47)	(1.88)
R^2	0.0621	0.6142	0.0690	0.7266
N	439	439	39	39

Note: *, **, *** indicate significant at the 10%, 5% and 1% levels, respectively.

5.3. Robustness Test

5.3.1. Two-way Causality Test

If the tax incentives of corporate income tax and enterprises' innovation investment are causal, i.e., while the tax incentives of corporate income tax affect the level of enterprises' innovation investment, enterprises may enjoy more tax incentives by increasing the level of innovation investment. Then, the model is endogenous. In this regard, we lagged the core explanatory variable, i.e., corporate income tax incentives, by one period for robustness testing. The results are shown in the table below. This indicates that reducing the effective corporate income tax rate and increasing the tax incentives can promote the innovation investment of enterprises and enhance their innovation capability. This is consistent with the results of the full sample regression (Table 4), indicating that the regression results are robust.

Table 7. Robustness test of tax incentives with one lag.

Variables	R&D	
	（1）	（2）
Tax-reduction$_{t-1}$	-0.788***	-0.223*
	（0.71）	（2.20）
Age	--	-0.048***
		（-4.17）
Size	--	-0.002
		（-0.90）
Profit	--	-0.206***
		（-6.11）
Cost	--	-0.334***
		（-18.37）
Industry Effect	Control	Control
_cons	0.202***	0.555***
	（6.92）	（9.58）
R^2	0.0641	0.6209
N	322	322

Note: *, **, *** indicate significant at the 10%, 5% and 1% levels, respectively.

5.3.2. Causality Identification Test of Propensity Score Matching

Table 8. Causal identification of corporate income tax incentives and firm innovation: estimation based on PSM.

Variables	R&D		
	K=1	**Nuclear matching**	**Radius Matching**
	（1）	**（2）**	**（3）**
ATT average processing effect	0.101*	0.101**	0.101**
（Dummy variable：Tax-reduction）	（0.015）	（0.010）	（0.010）
Control variables	YES	YES	YES
Constant term	8.737***	8.737***	8.737***
	（4.23）	（4.23）	（4.23）
Log-likelihood value	-188.624	-188.624	-188.624
Pseudo R	0.0310	0.0310	0.0310
Observations	541	541	541

Note: *, **, *** indicate significant at the 10%, 5% and 1% levels, respectively.

In this paper, the propensity score matching method (PSM) is used to investigate the causal relationship between corporate income tax incentives and corporate innovation investment by using

enterprises that enjoy corporate income tax incentives as the experimental group and enterprises that do not enjoy corporate income tax incentives as the control group. In this paper, the sample data is expanded to 541 items, and the digital economy enterprises that do not enjoy the EITC are set as the control group 0 and the digital economy enterprises that enjoy the EITC are set as the treatment group 1.

In this paper, we use "one-to-one with put-back nearest neighbor matching (k=1)" for empirical analysis, followed by "kernel matching" and "radius matching" for robustness analysis of the results of the above method. The results of the above methods are then analyzed using "kernel matching" and "radius matching". As shown in the following table, columns (1), (2) and (3) are significantly positive, indicating that corporate income tax incentives promote innovation investment, while the opposite is not true. This is consistent with the findings obtained from the above regressions and proves that the results are robust.

6. Conclusions and Implications

6.1. Research Conclusions

The development of digital economy plays an increasingly important role in the development process of the world today, and the future is still oriented towards the development of digital economy. As an important force to promote the modernization of China, digital economy occupies an important position in the development process of China. However, how we should promote the innovative development of digital economy enterprises and enhance our economic development through digital economy is still a problem to be solved today. Based on the data of digital economy enterprises in Beijing-Tianjin-Hebei region from 2017 to 2021 (in line with the narrow caliber of the National Bureau of Statistics), this paper examines the effect of tax incentives for 142 digital economy enterprises. Finally, the following conclusions are drawn: firstly, with the control of other influencing factors, by reducing the tax rate, the enterprises are motivated to increase their innovation investment and enhance their innovation capability; secondly, through the heterogeneity test, it is concluded that increasing the tax incentives for enterprises has a more significant incentive effect for private enterprises, which makes the innovation investment of private enterprises significantly improved; thirdly, for the Beijing-Tianjin-Hebei region. The thirdly, there is a significant difference between the digital economy enterprises in Beijing, Tianjin and Hebei, and the tax incentives for digital economy enterprises in Beijing can significantly promote the innovative development of digital economy enterprises in the region, while the impact of Tianjin and Hebei is relatively small.

6.2. Research Implications

First, tax incentives should be increased. Tax incentives can, to a certain extent, promote the R&D investment of digital enterprises and stimulate their ability to innovate and develop. The innovation ability of enterprises needs to be supported by the government, and tax incentives can better promote enterprises to invest in R&D, to improve their innovative ability and thus enhance their development competitiveness.

Second, different policies should be formulated for enterprises with different property rights and different levels of R&D investment. While increasing the tax incentives for private enterprises, it is also necessary to pay attention to the degree of tax incentives for state-owned enterprises and other

enterprises. For enterprises in Beijing, the government should continuously strengthen tax incentives to stimulate the development of regional digital economy enterprises and improve their innovation capacity.

Finally, it is important to stimulate the flourishing of more large-format enterprises through tax incentives. Since there is a large gap between the development of digital economy enterprises in Tianjin, Hebei and Beijing, the Beijing-Tianjin-Hebei region should pay more attention to the coordinated development of the region while promoting the development of its own digital economy enterprises, closely following the integrated development of Beijing-Tianjin-Hebei digital economy, giving play to the demonstration and pulling role of the Beijing region, thus driving the quantity and quality of digital economy enterprises in Tianjin and Hebei, and continuously injecting vitality into the market.

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