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An empirical analysis of the impact of tax incentive policies on digital economy—The data of listed companies in Jiangsu Province are taken as samples

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Abstract: Using the fixed effect model as an empirical analysis model, this paper selected 246 listed companies in Jiangsu Province from 2019 to 2022 as samples to analyze the impact of tax incentives on digital economy enterprises. The results show that expanding the benefit range of tax incentives and implementing differentiated tax incentives are the intermediary channels affecting the development of digital economy enterprises.

1. Introduction

The digital economy is a new variable for improving the quality and efficiency of the economy, and has played an important role in reorganizing factor resources, optimizing the economic development structure, and promoting high-quality economic development. [1]The report of the 19th National Congress of the Communist Party of China put forward the digital China strategy, and the 14th Five-Year Plan emphasizes the activation of the potential of data elements, the creation of new advantages of the digital economy, the acceleration of digital development, and the construction of digital China. In the Government Work Report of The State Council in 2024, it is proposed to further promote the innovation and development of the digital economy, deepen the research and development and application of big data and artificial intelligence, and empower economic development, enrich people's lives, and improve the modernization of social governance through extensive and profound digital changes.

2. Research design

2.1. Model Construction

In order to study the impact of tax incentive policies on digital economy enterprises in Jiangsu Province, a model (1) is constructed and tested:

$$DIG_{it} = \alpha_0 + \alpha_1 X_{it} + \gamma \sum CONTROLS_{it} + \sum YEAR_t + \sum INDUSTRY_k + \varepsilon_{it1} \quad (1)$$

Among them, enterprise digitization level (DIG) is the explained variable;X is the core

explanatory variable - tax incentives(TAX), γ is the regression coefficient of the explanatory variable,If it is positive, it indicates that tax incentives have a significant promoting effect on the development of digital economy enterprises.CONTROLS is the control variable, ε it's a random error term.In addition, considering the impact of unobservable macro and industry factors on businesses in the digital economy. This paper also adds the fixed effect of YEAR and INDUSTRY to model (1).

2.2. Primary variable definition

(1) Explained variables. In this paper, digitization level of enterprises (DIG) is used as an indicator to measure the development level of digital economy enterprises.

(2) Core explanatory variables. The specific variable Settings are shown in Table 1:

Table 1: Variable explanation

Variable type	Variable name	Variable symbol	Intermediate variable
Explained variable	Enterprise digitization level	DIG	The natural logarithm of the sum of word frequencies of keywords related to enterprise digitalization
Explanatory variable	Tax incentives	TAX	(Corporate income tax statutory tax rate - effective tax rate) x EBIT, and then logarithm
Control variable	Enterprise scale	SCALE	The natural logarithm of a firm's operating income for the year
	Financial leverage	LEV	Total liabilities /(Total liabilities + Total Assets)
	Return on equity	ROE	Net profit/average owner's equity balance
	Fixed assets ratio	FAR	Net fixed assets/total assets
	Inventory level	IR	Net inventory/total assets
	Investment opportunity	TQ	Market capitalization/total assets
	Ownership concentration	TOP	Shareholding shares of the largest shareholder/total shares
Intermediate variable	Innovation input	R&D	R&d investment/operating income
	Financing constraint	FC	
	Digital human capital investment	HC	Total number of technicians/employees

2.3. Data source

This paper selects the data of digital economy enterprises in Jiangsu Province from 2009 to 2022 as the target sample. The original data comes from the CSMAR database and the Great Tide Information network. According to the research practice, the data are processed as follows: First, the sample enterprises that are specially treated by ST, *ST, PT, etc. are excluded; The second is to retain only the main variable in at least 5 consecutive years without missing values of the enterprise; Third, in order to reduce the impact of outliers on regression, the continuous variables were indentation at the level of 1% above or below, and the sample data of 246 enterprises were finally obtained after processing.

3. Empirical analysis

3.1. Descriptive statistics

Descriptive statistical analysis was carried out on the variables mentioned above from the aspects of sample size, average value, minimum value, median value, maximum value and standard deviation. The final statistical results are shown in Table 2:

Table 2: Descriptive statistics

variable	Sample size	Mean value	Minimum value	median	Maximum value	Standard deviation
DIG	1934	1.473	0	1.386	4.394	1.278
TAX	1934	16.75	12.74	16.69	20.09	1.397
SCALE	1934	21.29	18.95	21.21	24.39	1.197
LEV	1934	0.362	0.0710	0.342	0.760	0.177
ROE	1934	0.104	0.00300	0.0930	0.369	0.0670
FAR	1934	0.196	0.00800	0.175	0.569	0.119
IR	1934	0.123	0	0.109	0.425	0.0810
TQ	1934	2.028	0.913	1.677	6.686	1.080
TOP	1934	0.350	0.0800	0.345	0.687	0.133

As can be seen from Table 2, in terms of tax incentives, the maximum value is 20.09, the minimum value is 12.74, and the average value is 16.75, which indicates that there is still a certain gap in the tax incentives enjoyed by enterprises in different digital economy, which may be caused by the different ownership rights of enterprises or the different regions in which enterprises are located.

3.2. Correlation analysis

Prior to baseline regression, a preliminary Pearson correlation test was conducted for each variable involved in the model.

The results show: digitization level of enterprises (DIG) and tax incentives are significantly positively correlated at the 1% level and the correlation coefficient is 0.239, indicating that when the tax incentives enjoyed by enterprises increase by 1%, their digitization level increases by about 0.239%.

In order to exclude the possibility of multicollinearity between variables and ensure the reliability of subsequent empirical analysis results, this paper further tested the differential expansion factor (VIF) and tolerance (1/VIF). The results show that the variance inflation factor (VIF) of each variable is far less than the criterion 10, and the average VIF value is 1.560. Therefore, the possibility of multicollinearity between the variables is extremely low, and the next benchmark regression analysis can be carried out.

3.3. Baseline regression analysis

The impact of the implementation of tax incentive policies on the development of digital economy enterprises in Jiangsu Province is analyzed by benchmark regression. The results show:the regression coefficient of tax incentives on enterprise digitization level is 0.105, which is significant at 1% level, indicating that tax incentives can significantly promote enterprise digitization development.

3.4. Heterogeneity analysis

The samples are divided into two groups according to the regions of enterprises: Southern Jiangsu region and Central and Northern Jiangsu region, and further study whether the promotion effect of tax policy on digital economy enterprises will be affected by the regions of enterprises. The results show: The regression coefficient of tax incentives on the digitalization level of enterprises in southern Jiangsu is 0.076, which is significant at the 5% level, and the regression coefficient of tax incentives on the digitalization level of enterprises in Central and northern Jiangsu is 0.179, which is significant at the 1% level, which indicates that tax incentives in central and northern Jiangsu have a stronger incentive effect on the digitalization level of enterprises.

3.5. Mediation effect analysis

In order to study the mechanism of tax incentive policies affecting the digital development of enterprises, this paper further constructs the intermediary effect model:

$$DIG_{it} = \alpha_0 + \alpha_1 X_{it} + \gamma \sum CONTROLS_{it} + \sum YEAR_t + \sum INDUSTRY_k + \varepsilon_{it} \quad (2)$$

$$MV_{it} = \beta_0 + \beta_1 X_{it} + \zeta \sum CONTROLS_{it} + \sum YEAR_t + \sum INDUSTRY_k + \varepsilon_{it} \quad (3)$$

$$DIG_{it} = \phi_0 + \phi_1 X_{it} + \phi_2 MV_{it} + \eta \sum CONTROLS_{it} + \sum YEAR_t + \sum INDUSTRY_k + \varepsilon_{it} \quad (4)$$

Where MV represents the intermediate variable.

(1)Intermediary effect analysis based on innovation input. Referring to the practice of Cheng Qiongwen et al. (2022) [2],this paper uses the ratio of R&D input to operating income as an indicator to measure enterprise innovation input (R&D), and tests its intermediary effect. The results show: tax incentives and enterprise innovation input have a positive impact on enterprise digitalization level, and the regression coefficient of tax incentives is 0.077, lower than the standard deviation (0.105) under the baseline regression. After controlling innovation input, the marginal effect of tax incentives on enterprises' digitalization level is weakened.

(2)Analysis of intermediary effects based on financing constraints. Using the practice of Zhang Jianwei (2023) for reference, FC index is used to measure the degree of financing constraints of enterprises. The larger the FC index is, the higher the degree of financing constraint is. The results show: the estimated coefficient of tax incentives on financing constraints is -0.034, indicating that tax incentive policies increase the cash flow of enterprises and alleviate the financing constraints of enterprises.

(3)Intermediary effect analysis based on digital human capital investment. With reference to the practice of Yu Xiuxiang et al. (2022), [3]the proportion of technical personnel in the employees of listed companies is selected as an indicator to measure the digital human capital input (HC) of enterprises, and its intermediary effect is tested. The results show: the estimated coefficient of tax incentives on digital human capital investment is 0.055, indicating that tax incentive policies have a positive promoting effect on enterprises' digital human capital investment.

3.6. Robustness test

(1)Endogeneity test. In order to further control the influence of endogenous problems on the relationship between tax incentives and the development level of digital economy enterprises, this paper adopts the two-stage least squares (2SLS) regression method for analysis. With reference to the practice of Ding Fangfei (2021)[4] et al., the data of tax incentives lagging one period are respectively taken as their instrumental variables. The results show: there is still a significant

positive relationship between tax incentives and enterprise digitization level, and the 1% significance level test is consistent with the benchmark regression result. Therefore, the conclusion of baseline regression is robust.

(2) Substitute the interpreted variable with a proxy variable. In order to ensure the reliability of the empirical analysis, the robustness test is also carried out by replacing the explained variables. With reference to the practice of Zhao Chenyu (2021), the keyword frequency is counted from the four perspectives of Internet business model, modern information system, intelligent manufacturing and digital technology application, and the counting sum and logarithmic processing are carried out to finally obtain the proxy variable of the explained variable. The results show: tax incentives have a positive incentive effect on the digitalization level of enterprises at the significance level of 1%, which is consistent with the benchmark regression analysis. Therefore, the empirical analysis in this paper is robust.

4. Relevant policy suggestions

4.1. Expand the scope of tax incentives

The first is to change the traditional tax incentive model based on standard recognition and adopt the deduction model. Regardless of the industry field or nature of the enterprise, as long as its business involves digital industrialization or industrial digitalization, it can enjoy tax preferential policies such as preferential tax rates, tax deductions and expense deductions. This kind of policy design can effectively expand the benefit scope of tax preferential policies, so that more digital economy enterprises can enjoy policy dividends. The second is to consider the establishment of "digital economy enterprises" identification standards, set digital mode proportion, digital technology capital investment, digital technology application degree and other assessment indicators, and implement specific tax incentives for digital economy enterprises that meet the identification standards, such as allowing them to enjoy a preferential corporate income tax rate of 15%. The third is to expand the Preferential Catalogue of Enterprise Income Tax for Public Infrastructure Projects, adding digital economy infrastructure as a public infrastructure project to the catalogue, so that enterprises engaged in digital economy infrastructure projects can also enjoy the corresponding preferential policies of enterprise income tax, and promote the construction of digital economy infrastructure.

4.2. Implement differentiated preferential tax policies

First, the government has increased policy support for small and medium-sized enterprises in the digital economy, such as appropriately relaxing the scope of application of the tax credit policy for small and medium-sized enterprises, extending the period of loss compensation carry-over for small and medium-sized digital economy enterprises. The second is to pay attention to the differences in the development of digital economy between regions, so that the preferential tax policies are moderately inclined to the relatively low level of digital economy development in Central and northern Jiangsu, promote the balanced development of digital economy in Jiangsu Province, and bridge the "digital divide". Third, on the basis of detailed policy objectives, tax preferential policies are formulated according to the phased characteristics of each life cycle of digital economy enterprises, such as the gradient equity incentive pre-tax deduction policy based on the life cycle. The fourth is to combine the development stage of digital economy enterprises and the different periods of digital technology research and development, comprehensively consider the size of enterprises, capital investment, human resources and other multi-dimensional factors, and reasonably design the combination of direct tax and indirect tax preferential tax policies to ensure

that all participants in digital technology research and development activities can benefit from tax policies, and improve the enthusiasm of digital economy enterprises to research and innovation.

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