Analysis of the Impact of Tax Incentive Policies on the High-Quality Development of Digital Agriculture

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Abstract: This paper adopts the difference-in-differences model as the empirical analysis model, selects the data of agricultural listed companies from 2014 to 2024 as the research sample, and takes the tax reduction effect and the promotion of digital transformation effect of agricultural tax policies as the starting point. It proposes hypotheses, establishes models, and selects multiple related variables for research based on the current agricultural enterprise VAT carry-forward tax refund policy, the additional deduction policy for R&D expenses of technology-based enterprises, and the tax deduction policy for equipment and tools before tax for high-tech enterprises. The results show that tax burden has a significant incentive effect on the development of digital agriculture.

Keywords: Digital Agriculture; High-Quality Development; Tax Incentive Policies

1. Introduction

Casting "new quality productive forces in agriculture" and "accelerating the construction of an agricultural power", leading the accumulation of advanced production factors scientific and technological innovation, and promoting the development of information technology in rural areas and agriculture through innovation, is the only way for China to move from an agricultural country to an agricultural power At present, the whole country mainly promotes agricultural digital innovation by increasing the additional deduction of digital R&D expenses, and then speeds up the process of transforming traditional agriculture into digital. However, the effect of the current tax preferential policy is not obvious, and the input, expenditure and the number of R&D personnel of agricultural enterprises' digital R& are still at a low level. Therefore, reducing tax burden, encouraging agricultural enterprises to purchase R&D equipment and technology, and formulating tax policies that attach importance to the application agricultural scientific and technological achievements are conducive to promoting the high-quality development of digital agriculture.

2. Research Design

2.1 Research Sample and Data Source

Using the double difference method, agricultural enterprises are set as the treatment group, aiming to analyze impact of preferential tax policies on the comprehensive tax burden rate of agricultural enterprises. This article selects the data of listed agricultural companies from 2014 to 2022 as the research sample, and the data of various variables in the sample are all from the annual reports of listed companies. In addition, in order to ensure the accuracy of the data some problem data have been removed.

2.2 Variable Setting

The setting explained variables, explanatory variables, mediator variables and control variables is shown in Table 1.

Table 1. Setting of Research Variables

Variable Category	Variable Name	Variable Code	Variable Description
Dependent variable	Degree of digitization	DX	Artificial intelligence technology; Blockchain technology; Cloud computing technology; Big data technology; Digital application technology total
Explanatory variables	Corporate tax burden	Tax	(Income tax expense Taxes and surcharges) / Operating income
	Turnover tax burden	Income tax	Taxes and surcharges / Operating income
	Income tax burden	Turnover tax	Income tax expense / Total

Mediating variable	R&D investment	RD	Ln(1+R&D investment/revenue)
Control variable	debt-to-asset ratio	LEV	Total liabilities/Total assets
	Enterprise scale	Size	Ln Total assets
	Profitability	Roe	Net profit/year-end total assets
	Fixed asset density	FIXED	Net value of fixed assets/total assets

2.3 Research Hypothesis and Model Design

The hypothesis of this article is that the tax burden of agricultural enterprises has a negative effect on the degree of digital of enterprises; reducing the tax burden of enterprises can increase the investment in R&D of enterprises, thereby promoting the improvement of the degree of digitalization of enterprises; under the condition other situations remain unchanged, the reduction of the tax burden of enterprises has a better effect on the improvement of the degree of digitalization of large agricultural enterprises.

To verify the above hypothesis, a model is constructed:

$$Y_{it} = \beta_0 + \beta_1 DID + \beta_2 CONL + \varepsilon_{it}$$

where, DID is the interaction term of the policy dummy variable with the time dummy variable, CONL represents the control variables. β_0 is the constant term, ε_{it} is the random disturbance term, β_i is the regression coefficient, where the DID coefficient β_1 captures the effect of the selected policy on agricultural market enterprises.

3. Empirical Analysis

3.1 Analysis Process

(1)Stationarity Test and Descriptive Statistical Analysis.Before the model regression, to the accuracy of the experimental results, each model has been tested for stationarity and problematic data has been removed. The results of the descriptive statistical analysis are shown in Table 2.

Table 2. Descriptive Statistical Results

Variable	Obs	Mean	Std. Dev.	Min	Max
dx	143	3.441	3.299	0	16
tax	143	.004	.012	-.019	.113
incometax	143	.005	.004	0	.022
turnovertax	143	-.114	1.697	-20.098	.895
rd	143	3.168	4.29	0	35.68
lev	143	.437	.198	.059	.933
size	143	22.001	.88	20.32	24.248
roe	143	.015	.066	-.301	.136
fixed	143	.228	.144	.073	.67

As can be seen from Table 2, the maximum value of the digitalization degree of the explained variable DX is 16, the minimum value is0, the average value is 3.441, which is basically consistent with the description of the relevant literature, and the standard deviation is 3.299 indicating that the data has a certain degree of dispersion, indicating that there is a certain gap in the degree of digitalization among enterprises. The average value of the explanatory variable tax Tax is 0.004, the standard deviation is 0.012, indicating that the overall tax burden of enterprises is not high. The maximum value is0.113, the minimum value is -0.019, indicating that the tax burden gap of sample enterprises is large. According to the results of other variables the data dispersion between enterprises is small.

(3)Correlation analysis.The correlation test results between variables in the sample are shown in Table 3.

Table3. Correlation Test

Variables	(1) dx	(2) tax	(3)incometax	(4) turnovertax	(5) rd	(6) lev	(7) size	(8) roe	(9) fixed
(1) dx	1.000								
(2) tax	-0.028	1.000							
	(0.740)								
(3) incometax	0.103	0.238*	1.000						
	(0.219)	(0.004)							
(4) turnovertax	0.059	-0.232*	-0.083	1.000					
	(0.485)	(0.005)	(0.325)						
(5) rd	-0.044	0.115	0.123	-0.083	1.000				
	(0.606)	(0.171)	(0.142)	(0.322)					

(6) lev	0.047	-0.137	-0.018	0.118	-0.336*	1.000			
	(0.577)	(0.103)	(0.834)	(0.162)	(0.000)				
(7) size	0.281*	-0.012	-0.300*	0.009	-0.171*	0.085	1.000		
	(0.001)	(0.890)	(0.000)	(0.919)	(0.041)	(0.315)			
(8) roe	-0.089	0.017	-0.266*	0.038	0.004	-0.305*	0.078	1.000	
	(0.290)	(0.843)	(0.001)	(0.653)	(0.958)	(0.000)	(0.354)		
(9) fixed	-0.227*	-0.082	0.095	0.023	-0.276*	0.015	-0.036	0.021	1.000
	(0.006)	(0.328)	(0.257)	(0.786)	(0.001)	(0.857)	(0.671)	(0.803)	
*** p<0.01, ** p<0.05, * p<0.1									

The coefficient between the degree of digitalization of the explained variable DX and the explanatory variable Tax can be obtained from the correlation test, which is a negative, indicating that the corporate tax burden has a negative effect on the degree of digitalization, and hypothesis one is established. The coefficient between DX and income tax is positive, indicating that the higher the degree of digitalization, the more corporate income tax is paid, and the corporate income tax rate should be lowered. The coefficient between DX and turnover tax is positive, that the higher the degree of digitalization, the more turnover tax is paid, and the turnover tax rate should be lowered. At the same time, the coefficient between the explained variable the control variable is below 0.5, indicating that the control variable will not produce a problem of multiple collinearity affecting the empirical results.

(3)Regression Analysis.According to the F-test results, F(17,117) equal to 3.38 Prob>F=0.0000, thus the model passed the F-test.

Based on the above research on the impact of corporate tax burden on the degree of digitalization of enterprises, this paper establishes a fixed effect model with the degree digitalization as the explained variable and corporate tax burden as the explanatory variable. The research model demonstrates the relationship between corporate tax burden and the degree of digitalization of enterprises and proposes hypothesis. The empirical part of the model includes two results, (1) and (2). Among them, (1) is the regression result of the impact of corporate tax on the degree of digitalization without control variables, and (2) is the regression result after adding control variables, see Table 4.

Table 4. Regression Analysis

	(1)	(2)
	dx	dx
tax	4,591	1,679
	(0,223)	(0,078)
lev	-2,219	-2,044
	(-0,665)	(-0,607)
size	-0,739	-0,647
	(-0,756)	(-0,655)
roe	-7,819*	-7,186
	(-1,666)	(-1,476)
fixed	-9,176*	-8,886
	(-1,671)	(-1,607)
incometax		67,839
		(0,878)
turnovertax		0,043
		(0,302)
_cons	22,857	20,380
	(1,077)	(0,947)
N	143	143
F	1.120	0.912
***p<0.01,**p<0.05,*p<0.10		

The regression results of the effect of the tax burden of enterprises on the degree of digitalization of enterprises can be obtained from the results of Table 4. can be concluded from the results that the higher the degree of digitalization of enterprises, the more tax is paid, indicating that the tax payment in the process of digitalization is more.

3.2 Mediation Effect Analysis

The independent variable of tax burden is analyzed and calculated for the mediator variables and the mediator variables and the dependent variables respectively. According the data in Table 5, it can be concluded that the mediation effect of R & D investment is established and the mediation effect analysis model is passed.

Table 5. Med Effect Analysis

	(1)	(2)
	rd	dx
tax	-6,738	6,866
	(-0,295)	(0,201)
incometax	-119,651	70,674
	(-1,460)	(0,572)
turnovertax	-0,120	0,089
	(-0,792)	(0,392)
lev	-7,861**	-3,733
	(-2,208)	(-0,688)
size	0,907	1,093

	(0,939)	(0,755)
roe	-1,971	2,645
	(-0,387)	(0,348)
rd		0,009
		(0,065)
_cons	-12,738	7,151
	(-0,624)	(0,234)
N	143	143
R^2	0.058	0.012
F	1.230	0.211

***p<0.01,**p<0.05,*p<0.10

3.3 Robustness Check

We adopted the trimming method to delete the abnormal value, re-do the empirical result analysis to test the stability of model. If the data after the trimming method deleting the abnormal value is still significant, it proves that the model has passed the stability test. The results are shown in Table 6:

Table 6. Robustness Check

Variable	Obs	Mean	Std. Dev.	Min	Max
year	143	2018.916	2.877	2014	2023
symbol	143	415622.69	239892.67	998	831087
dx	143	29.994	6.082	0	41.577
tax	143	.004	.012	-.019	.113
incometax	143	.005	.004	0	.022
turnovertax	143	-.114	1.697	-20.098	.895
rd	143	3.168	4.29	0	35.68
lev	143	.437	.198	.059	.933
size	143	22.001	.88	20.32	24.248
roe	143	.015	.066	-.301	.136
fixed	143	.228	.144	.073	.67
est m1	143	1	0	1	1
est m2	143	1	0	1	1
dx w	143	30.14	5.579	21.22	41.271
tax w	143	.004	.009	-.017	.04
incometax w	143	.005	.004	0	.02
turnovertax w	143	.013	.261	-1.787	.653
lev w	143	.436	.197	.069	.823
size w	143	22.001	.875	20.431	24.046
roe w	143	.015	.066	-.284	.125

4. Conclusion

The analysis show that the tax burden reduction policy can promote the digital transformation process of enterprises. According to hypothesis 1, it shows that the tax burden of agricultural enterprises has a negative effect on degree of digitalization of enterprises; reducing the tax burden of enterprises can increase the investment intensity of enterprise R&D. According to hypothesis 2, it shows that the reduction of tax burden can increase the investment intensity of enterprise R&D, and thus promote the improvement of the degree of digitalization of enterprises; the reduction of enterprise tax burden is more in improving the degree of digitalization of large agricultural enterprises. According to hypothesis 3, it shows that large agricultural enterprises have more advantages than small and medium-sized enterprises, and can play a certain demonstration role in the promotion of local economy and industrial clustering, and their changes under the influence of policy are also more obvious.

Acknowledgment

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