

Digitalization of Tax Administration and Corporate Innovation: Evidence from a Quasi-Natural Experiment based on the Golden Tax Phase III

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Abstract

The Golden Tax Phase III is a significant initiative in China's digital tax administration reform. To thoroughly investigate its impact on the innovation activities of Chinese enterprises, particularly the heterogeneous effects across different ownership structures, this study relies on a quasi-natural experiment based on the phased implementation of the Golden Tax Phase III. It employs a sample of A-share listed companies from 2007 to 2019 to examine the direct effects of digitalized tax administration on corporate innovation investment, supplemented by a series of robustness tests to ensure the reliability of the conclusions. The results indicate that digitalized tax administration generally suppresses the innovation investment of Chinese enterprises, with the inhibiting effect being more pronounced in non-state-owned enterprises. This finding provides important empirical references and decision-making basis for government departments to optimize regulatory strategies and balance tax administration with corporate innovation vitality in the era of digital economy.

Keywords

Digitalization of Tax Administration; Corporate Innovation; Golden Tax Phase III.

1. Introduction

General Secretary Xi Jinping has emphasized that "innovation must be regarded as the primary driving force for leading development." As the main body of innovation, enterprises are critical drivers of sustained and healthy economic and social development, serving as important levers for the advancement of new productive forces. The level of innovation within enterprises not only determines their competitiveness but also influences the technological progress of the entire industrial chain and the overall innovation capacity of the nation. Financial resources are one of the essential conditions supporting corporate innovation activities, as enterprises need to invest substantial amounts of capital in technological research and development (R&D), product development, and other innovation-related endeavors. Consequently, companies must actively seek various funding sources, where tax burdens directly impact the internal funds available for innovation.

A thorough investigation of the effects of tax administration on corporate innovation activities, particularly its potential suppressive impact on innovation investment, is crucial for accurately identifying these obstructive factors, designing effective alleviation strategies, and ultimately fostering enterprises' willingness and capacity to increase their innovation inputs, thereby strengthening their core competitiveness. This is not only vital for the sustainable development of the enterprises themselves but also represents a key element in driving the transformation and upgrading of the entire socio-economic landscape and in achieving an innovation-driven development strategy.

On December 13, 2023, the expanded meeting of the Party Committee convened by the State Administration of Taxation proposed to "conduct in-depth research on advancing key reforms in tax system and tax administration, enhancing tax support for high-quality development." The digitalization of tax administration is a significant initiative within the realm of tax administration reform, and the Golden Tax Phase III project stands as a major achievement in this regard. This initiative integrates tax administration with technological innovation, marking a substantial breakthrough from "ticket-based tax management" to "information-based tax management." The Golden Tax Phase III system employs cutting-edge information technology tools and big data analysis strategies to achieve precise comparisons, in-depth analyses, and cross-verification of corporate tax responsibilities. This initiative has not only greatly enhanced the standardization and refinement of corporate tax management processes but also significantly reduced the risks of tax evasion and underreporting, ensuring the comprehensiveness and compliance of tax payments. This policy possesses significant externality characteristics, providing an ideal "natural experiment" context that offers a valuable opportunity for scientifically assessing the impact of digitalized tax administration on corporate innovation.

Given this background, the present study focuses on a sample of A-share listed companies in China from 2007 to 2019, aiming to explore the effects of digitalized tax administration on corporate innovation. The core marginal contributions of this paper are reflected in several aspects: First, leveraging the "Golden Tax Phase III" as an exogenous shock effectively mitigates potential endogeneity concerns during the evaluation process[1]. Second, selecting listed companies as the research sample ensures the timeliness and representativeness of the data resources, providing rich and cutting-edge information support for the analysis. Finally, this paper also considers the heterogeneous factors related to ownership structures, further enhancing the understanding of the role of digitalized tax administration in corporate innovation.

2. Policy Background and Theoretical Analysis

2.1. Policy Background

In the context of the development of the digital economy, leveraging digitalization to enhance the national governance system and improve governance capabilities is an inevitable choice for advancing the modernization of national governance[2]. In March 2021, the Central Committee of the Communist Party of China and the State Council issued the "Opinions on Further Deepening Tax Administration Reform," positioning "smart taxation" as the primary focus for advancing tax administration reform in the new stage of development[3]. The construction of tax information systems in China began in the early 1980s, evolving through the first, second, and third phases of the Golden Tax Project—from inception to comprehensive coverage and from limited functionality to extensive applicability. It has now entered a new phase with the Golden Tax Phase IV, embarking on a new journey toward the modernization of tax governance. The Golden Tax Phase III project represents a significant exploration of the integration of big data technology with tax administration. In 2013, the Golden Tax Phase III was piloted in Chongqing, Shandong, and Shanxi provinces. In 2014, it was launched in Guangdong, Henan, and Inner Mongolia, and subsequently expanded nationwide, achieving comprehensive coverage across 31 provinces (autonomous regions and municipalities) by the end of 2016, excluding Hong Kong, Macao, and Taiwan. The Golden Tax Phase III successfully applied digital technology to the tax administration system, establishing a unified tax platform that enabled the centralized processing of national tax data, thereby significantly enhancing the efficiency and capability of national tax administration.

Compared to the first two phases of the Golden Tax Project, the Golden Tax Phase III system achieved a qualitative leap, comprehensively covering all tax types and deeply integrating into key aspects of tax management. This system promotes inter-departmental data connectivity, facilitating extensive sharing of data resources, which greatly aids tax authorities in conducting in-depth comparative analyses and cross-verifications of taxpayers' liabilities, effectively curbing the motives for tax evasion. Overall, the Golden Tax Phase III project, through the deep integration of internet technology, has significantly improved tax administration efficiency. However, this transformation has also been accompanied by an increase in the actual tax burden perceived by enterprises, reflecting a dual effect of enhanced tax regulation and improved compliance. Compared to other tax administration reform measures, the Golden Tax Phase III has played a significant role in improving the tax administration environment, and its phased piloting and gradual implementation characteristics provide a favorable research context for exploring the policy effects of digitalized tax administration.

2.2. Theoretical Analysis

Corporate innovation activities are characterized by their long-term nature, high risk, and potential for high failure rates, necessitating that enterprises maintain a solid financial and material foundation to support uninterrupted research and development (R&D) and innovation processes. However, the gap between private returns and social benefits from R&D investments means that adjustments to tax policies-whether through tax reductions or increases-can have dual effects on corporate R&D.

In addition to funding, the effectiveness of corporate innovation is significantly influenced by various internal and external factors, including the characteristics of senior management, ownership structure, organizational culture, human resources, technological environment, market conditions, legal frameworks, and financing environments[3]. Among these, R&D investment serves as a cornerstone, and its sustainability is a prerequisite for enhancing a company's innovation capabilities. A high tax burden not only compresses profit margins and investment efficiency, increasing operational risk, but may also reduce R&D spending. Moreover, indirect taxes, such as value-added tax (VAT), can shift the tax burden through pricing mechanisms, potentially impacting resource allocation efficiency and causing marginal outputs to deviate from the social optimum. In summary, tax burden levels and their adjustments tend to suppress corporate innovation incentives and inputs, further highlighting the central role of resources in the development of corporate innovation.

China's implementation of tax incentives for high-tech industries has significantly reduced the R&D burdens on enterprises, effectively promoting dual growth in R&D efficiency and output, thereby facilitating the expansion of high-tech industries. Conversely, excessively high tax rates can inhibit the liquidity of free funds for enterprises constrained by financing, weaken their capacity to allocate resources for industrial upgrading, and suppress the generation of innovative outcomes. Additionally, high tax burdens can create barriers to market entry, reducing market competitiveness and innovation potential.

Tax policy, as an important incentive mechanism, such as the "Business Tax to VAT" reform, has alleviated the tax burden on enterprises and enhanced total factor productivity. However, measures like the "Golden Tax Project," which strengthen tax administration, while increasing the efficiency of government fiscal revenue, have also raised compliance costs for enterprises, indirectly exacerbating the tax burden and exerting dual pressure on corporate innovation inputs and outputs, which is detrimental to sustained innovation and development.

Taxation is a significant means by which the government participates in the sharing of corporate revenue resources. With the establishment of intelligent tax systems, the government has a more comprehensive grasp of tax-related information concerning enterprises, and the capacity of tax authorities to collect taxes has improved. The design of the tax system allows for

substantial flexibility, and the launch of digitalized tax administration has enhanced tax authorities' ability to manage information. If local governments face fiscal pressure, they may intensify tax inspections and strengthen tax administration efforts to alleviate financial strain and meet revenue targets[4], leading to a significant increase in the tax burden on enterprises. In practice, local governments tend to increase the intensity of tax administration to meet revenue targets, resulting in higher actual tax payments by enterprises.

In conclusion, corporate innovation activities rely on sustained resource inputs. In the context of digitalized tax administration, tax authorities have a more comprehensive understanding of corporate operational information, which suppresses tax avoidance behaviors and reduces the cash flow available for innovation, thereby inhibiting corporate innovation. Therefore, the following hypothesis is proposed: Digitalized tax administration suppresses corporate innovation.

3. Research Design

3.1. Model Design

To capture the impact of digitalized tax administration on the innovation behaviors of A-share listed companies, this study constructs the following multi-period difference-in-differences (DID) model for testing, based on the phased implementation characteristics of the Golden Tax Phase III project. The model simultaneously controls for firm-level (Firm) and year-level (Year) fixed effects[5].

$$RD = \beta_0 + \beta_1 GTP + \sum \beta_i Controls + \sum Firm + \sum Year + \varepsilon$$

In this model, the level of corporate innovation investment serves as the dependent variable, quantified by the ratio of R&D expenditure to total assets (RD), where an increasing value indicates an enhancement in corporate innovation investment.

To assess the impact of the Golden Tax Phase III project, the variable GTP is introduced as a key explanatory variable, assigned a value of 1 for sample firms in the years following the implementation of the project, and 0 otherwise. This allows for the capture of the tax impact of the Golden Tax Phase III policy on the sample firms.

Table 1. Variable Definitions

Variable Type	Variable	Variable Name	Indicator Description
Dependent Variable	RD	Corporate Innovation	Ratio of corporate R&D expenditures to total assets
Independent Variable	GTP	Tax Digitization	For companies located in regions implementing the third phase of the tax reform, value is 1; otherwise, 0
Control variable	Size	Firm Size	Natural logarithm of total assets
	Lev	Financial Leverage	Ratio of total liabilities to total assets
	Age	Firm Age	Natural logarithm of the number of years since establishment in the observation year
	Roe	Return on Assets	Ratio of net profit to total assets
	Cf	Operating Cash Flow	Net cash flow from operating activities as a proportion of total assets
	First	Ownership Concentration	Shareholding proportion of the largest shareholder
	Growth	Firm Growth	Revenue growth rate
	Dual	CEO Duality	If the chairman also serves as the CEO, value is 1; otherwise, 0

In constructing the control variables (Controls), a comprehensive consideration of multiple factors from both the financial and corporate governance dimensions is undertaken[6], including but not limited to firm size, financial leverage, operational performance, ownership concentration, and CEO duality (see Table 1).

3.2. Sample Selection

The Golden Tax Phase III was first launched in 2013. This study uses data from A-share listed companies from 2007 to 2019 as the sample and applies the following processing steps: (1) excluding company samples from the financial and insurance sectors; (2) removing samples with abnormal financial data, such as ST companies; (3) eliminating samples with a debt-to-asset ratio greater than 1; (4) deleting samples with missing variables; and (5) applying 1% winsorization to the required variables. The final sample consists of 30,068 observations, with data sourced from the China Stock Market and Accounting Research (CSMAR) database, while the implementation dates of the Golden Tax Phase III are manually compiled from the State Taxation Administration.

3.3. Descriptive Statistics of Variables

Table 2. Descriptive Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
RD	30,068	0.0159	0.0180	0	0.0889
GTP	30,068	0.393	0.488	0	1
Size	30,068	22.04	1.280	19.41	26.40
Lev	30,068	0.428	0.208	0.0274	0.927
Age	30,068	2.001	0.915	0	3.332
ROE	30,068	0.0719	0.125	-0.962	0.446
CF	30,068	0.0454	0.0720	-0.224	0.283
First	30,068	0.353	0.150	0.0838	0.758
Growth	30,068	0.188	0.428	-0.636	3.894
Dual	30,068	0.260	0.439	0	1

Descriptive statistics reveal that the average R&D investment intensity of firms is 1.59%, indicating a relatively low level of R&D investment among Chinese enterprises. The low standard error further suggests that the levels of R&D investment are relatively concentrated, with minimal variation among firms. The means and standard errors of the other control variables are moderate and fall within a reasonable range, with no outliers detected, allowing for the derivation of more generalizable conclusions.

4. Empirical Results

4.1. Correlation Analysis

Table 3 presents the results of the correlation analysis of the variables. Through this analysis, preliminary insights into the basic information regarding the impact of digitalized tax administration on corporate innovation can be obtained. The correlation coefficients of the explanatory variables are generally below 0.5, indicating that the model does not exhibit significant multicollinearity issues. Furthermore, the correlation coefficients among the variables are relatively small, which meets the requirements for model construction.

Table 3. Variable Correlation Analysis

	RD	GTP	Size	Lev	Age	ROE	CF	First	Growth	Dual
RD	1									
GTP	0.193***	1								
Size	-0.184***	0.138***	1							
Lev	-0.282***	-0.051***	0.493***	1						
Age	-0.270***	0.054***	0.392***	0.404***	1					
ROE	0.065***	-0.064***	0.088***	-0.179***	-0.170***	1				
CF	0.067***	0.032***	0.048***	-0.147***	0	0.269***	1			
First	-0.113***	-0.084***	0.197***	0.059***	-0.089***	0.138***	0.084***	1		
Growth	0.00700	-0.016***	0.048***	0.040***	-0.042***	0.236***	0.012**	0.017***	1	
Dual	0.169***	0.067***	-0.162***	-0.163***	-0.239***	0.017***	-0.022***	-0.049***	0.018***	1

Note: In this table, *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

4.2. Baseline Regression Analysis

Table 4 presents the results of the baseline regression analysis based on Equation (1). In column (1), without including firm-level control variables, the coefficient of GTP is negative and significant at the 1% level, indicating that digitalized tax administration suppresses corporate R&D investment, meaning that higher tax burdens hinder corporate innovation. In column (2), after incorporating firm-level control variables, the model's goodness of fit improves, and the GTP coefficient remains significantly negative.

Table 4. Baseline Regression Results

	Regression result (1)	Regression result (2)
	RD	RD
GTP	-0.003*** (-4.251)	-0.002*** (-3.743)
Size		-0.001*** (-5.994)
Lev		-0.009*** (-7.171)
Age		-0.004*** (-15.712)
ROE		0.007*** (4.903)
CF		0.012*** (5.620)
First		-0.011*** (-6.843)
Growth		0.001*** (3.058)
Dual		0.002*** (4.043)
_cons	0.001 (1.481)	0.043*** (10.100)
Year fe	Yes	Yes
Ind fe	Yes	Yes
N	30068	30068
r2_a	0.094	0.219

From the perspective of control variables, return on assets, cash flow, growth potential, and CEO duality all significantly promote corporate innovation investment, while increases in firm age, size, and debt-to-asset ratio inhibit innovation investment.

In summary, from an overall perspective, digitalized tax administration suppresses corporate innovation.

4.3. Robustness Test

4.3.1. Lagged Period Test

Table 5 primarily investigates the impact of lagged digitalized tax administration on corporate R&D investment. The results indicate that the coefficient for lagged digitalized tax administration is 0.002, which is significant at the 1% level, demonstrating a clear negative correlation consistent with the hypothesis. When firm-level control variables are included, the model's goodness of fit improves from 0.079 to 0.212, and the GTP coefficient remains significantly negative, also at the 1% significance level. This result aligns with the direction of the previous analysis.

In summary, by introducing the lagged explanatory variable, the hypothesis is successfully validated, indicating that the baseline regression results of this study are robust.

Table 5. Robustness Test Results for Lagged Explanatory Variables

	Regression result (1)	Regression result (2)
	RD	RD
L.GTP	-0.002*** (-3.644)	-0.002*** (-3.423)
Size		-0.001*** (-5.418)
Lev		-0.009*** (-6.743)
Age		-0.006*** (-16.581)
ROE		0.008*** (5.285)
CF		0.012*** (5.185)
First		-0.011*** (-6.661)
Growth		0.000* (1.866)
Dual		0.002*** (3.625)
_cons	0.020*** (13.434)	0.065*** (13.363)
Year fe	Yes	Yes
Ind fe	Yes	Yes
N	26194	26194
r2_a	0.079	0.212

4.3.2. Substitution Variable Method

Furthermore, to enhance the robustness of the analysis, this study adopts the ratio of corporate R&D expenditure to operating revenue, as proposed by Yang Guochao[6], as an alternative

measure of corporate innovation investment for regression analysis. This approach ensures the reliability and comprehensiveness of the research findings.

Table 6 presents the regression results after replacing the dependent variable. In column (1), the ratio of R&D expenditure to operating revenue is used as the new dependent variable. After excluding the interference of control variables, the negative correlation between digitalized tax administration and corporate innovation investment remains significant, indicating that the launch of the Golden Tax Phase III has suppressed corporate R&D investment. In column (2), after incorporating firm-level control variables, the results are consistent with the previous baseline regression, further demonstrating that digitalized tax administration inhibits corporate innovation.

Table 6. Robustness Test Results for Replaced Dependent Variables

	Regression result (1)	Regression result (2)
	RD1	RD1
GTP	-0.008*** (-5.289)	-0.007*** (-5.209)
Size		-0.000 (-0.808)
Lev		-0.052*** (-13.660)
Age		-0.009*** (-14.677)
ROE		-0.027*** (-5.465)
CF		-0.014** (-2.388)
First		-0.038*** (-9.083)
Growth		0.001 (0.912)
Dual		0.006*** (4.381)
_cons	0.003* (1.663)	0.070*** (7.764)
Year fe	Yes	Yes
Ind fe	Yes	Yes
N	30068	30068
r2_a	0.065	0.188

4.4. Heterogeneity Analysis

The impact of the Golden Tax Phase III project varies among enterprises with different ownership structures. Therefore, this study further explores the heterogeneous effects of digitalized tax administration on corporate innovation. State-owned enterprises (SOEs), due to their long-term monopoly on substantial market profits, exhibit strong market competitiveness but often lack a sufficient incentive for technological innovation. Additionally, when raising funds, financial institutions and investors treat companies differently based on their ownership structure. SOEs are better positioned to secure external financing and do not rely on tax avoidance to generate additional cash flow. Consequently, the suppressive effect of digitalized tax administration on innovation is more pronounced among non-state-owned enterprises.

Table 7. Heterogeneity Analysis Results by Ownership Structure

	state-owned enterprise	Non state-owned enterprises
	RD	RD
GTP	-0.000 (-0.073)	-0.003*** (-4.535)
Size	-0.001*** (-4.255)	-0.001*** (-3.367)
Lev	-0.005*** (-2.648)	-0.011*** (-7.229)
Age	-0.003*** (-5.664)	-0.004*** (-11.415)
ROE	0.007*** (3.641)	0.007*** (3.762)
CF	-0.003 (-0.987)	0.021*** (7.314)
First	-0.005** (-2.275)	-0.013*** (-5.942)
Growth	0.001** (2.104)	0.001* (1.938)
Dual	0.000 (0.237)	0.002*** (3.660)
_cons	0.038*** (6.363)	0.039*** (5.728)
Year fe	Yes	Yes
Ind fe	Yes	Yes
N	11632	18436
r2_a	0.114	0.186

5. Conclusion and Recommendations

This study uses a sample of A-share listed companies from 2007 to 2019 and applies the difference-in-differences (DID) method to compare changes in corporate R&D investment before and after the launch of the Golden Tax Phase III. The results show a significant decline in R&D investment, which remains significant even after replacing the variables. Additionally, non-state-owned enterprises experience a greater impact from digitalized tax administration, with a more pronounced reduction in R&D investment. Based on these findings, this paper proposes relevant policy recommendations from both government and corporate perspectives. The intensity and enforcement of tax administration can suppress the innovation vitality of Chinese enterprises in the market economy, thereby harming their business performance and economic interests, which is detrimental to their sustainable and healthy development. Digitalized tax administration is a necessary response to the demands of economic development and tax system reform, which helps further strengthen "law-based taxation," improve the accuracy of tax law enforcement by tax authorities, and standardize the market environment. Additionally, digitalized tax administration enhances the government's ability to gather market information, facilitating tax revenue analysis and forecasting. Therefore, based on reasonable predictions, it is essential to reduce the tax burden on enterprises, strengthen market guidance, and promote corporate innovation, development, and industrial upgrading. Efficient tax administration not only reflects the government's regulatory capabilities but also provides enterprises with a clear financial and tax planning environment. Enterprises should

integrate local tax administration levels with internal governance and resource utilization perspectives. This can be achieved through flexible organizational adjustments, clear delineation of responsibilities, implementation of innovation incentive mechanisms, and the establishment of robust internal control and risk management systems to optimize governance structures. Furthermore, firms need to allocate resources precisely, promote cross-departmental resource sharing, increase R&D investment and technology introduction, and enhance talent cultivation and the recruitment of high-level professionals to improve resource utilization efficiency. These measures will effectively drive corporate innovation and development, ensuring competitiveness in the market and achieving sustainable growth.

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